Chapter 5

STRUCTURAL CHANGE AND THE POSSIBILITIES FOR FUTURE GROWTH IN NIGERIA

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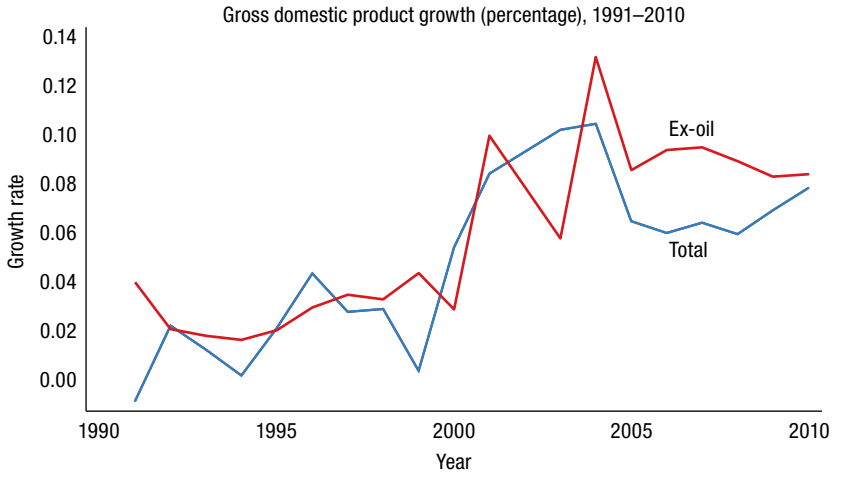
Since the turn of the century, overall economic growth in Nigeria has been consistently strong—averaging around 5.4 percent per year, up substantially from about 2.0 percent during 1990–2000. Moreover, overall GDP growth in the past decade is even higher if the oil sector—which accounts for 20–30 percent of GDP—is excluded, averaging around 8.4 percent per year, up sharply from 2.0 percent per year (Figure 5.1). This growth pickup has occurred alongside shifts in the composition of employment, mainly out of agriculture and into sectors such as manufacturing and finance and business services.

The Nigeria of today has the highest GDP in Africa south of the Sahara—even higher than South Africa, although South Africa has a much higher GDP per capita rate. Nigeria's *Vision 20:2020* (adopted in 2010) is centered on positioning Nigeria to become one of the top-20 economies in the world by 2020 (FRN/NPC 2010). Yet GDP per capita is still quite low, along with living standards (54 percent of the population lives on less than US$1.25 a day).[1,2] The latest United Nations Development Programme Human Development Index places Nigeria in the low human development category, with a ranking of 152 out of 186 countries and territories. The World Bank's recent Doing Business database ranks Nigeria 169th out of 189 economies on "ease of doing business" and 182nd on "getting electricity," underscoring concerns about reliable power and good governance. And unemployment and underemployment, especially for youths, pose serious challenges. On the demographic side, Nigeria, already the continent's most populous country with 170 million people, is expected to see enormous population growth in the decades ahead. In fact, the United Nations

1 In April 2014, Nigeria rebased its GDP data for 2010–2013, using 2010 as a base year for prices. In this chapter, we use the older GDP figures with a base year of 1990, as this provides sector-level breakdowns of GDP from 1990 to 2010. It is not immediately clear what effect rebasing the year would have on our results, as some sectors have been scaled up (telecommunications and information technology), while others have been scaled down (wholesale and retail trade).

2 All currency in this chapter is in US dollars unless otherwise specified.

FIGURE 5.1 Slow growth in the 1990s turns into rapid growth in the 2000s



Source: Authors' calculations using data from the Nigerian National Bureau of Statistics (FRN/NBS, various years).
Note: The figure shows the growth rate of aggregate GDP in Nigeria, on a year-by-year basis. The year 2003 is excluded because of a one-time change in reporting that falsely inflated growth.

forecasts that by 2050, Nigeria's population will surpass that of the United States (UN 2013).

Fortunately, Nigeria is rich in human capital and natural resources (especially oil and gas, but also mineral deposits). So the big question is how best to use its enormous resources to stimulate growth and place the country on a path of sustained and rapid socioeconomic development. Clearly, policies will need to reflect the lessons learned from past efforts on the growth front. This chapter hopes to add to this knowledge base by dissecting Nigeria's growth between 1996 and 2009—in particular, assessing how much of the growth in labor productivity has come from its two key components: (1) structural change (impacts on productivity from sectoral rearrangements of the labor force), and (2) within-sector change (impacts on productivity from overall increases within sectors). We also examine what has been occurring at the sector level, the potential gains for Nigeria if it removes obstacles to greater structural change, and the key levers of structural change. Mostly, we focus on the nonpetroleum portion of the economy, which despite being only 70 percent of GDP accounts for nearly 100 percent of employment.

Our findings show that growth in labor productivity between 1996 and 2009 was about 4.5 percent per year in the nonpetroleum economy. Of this,

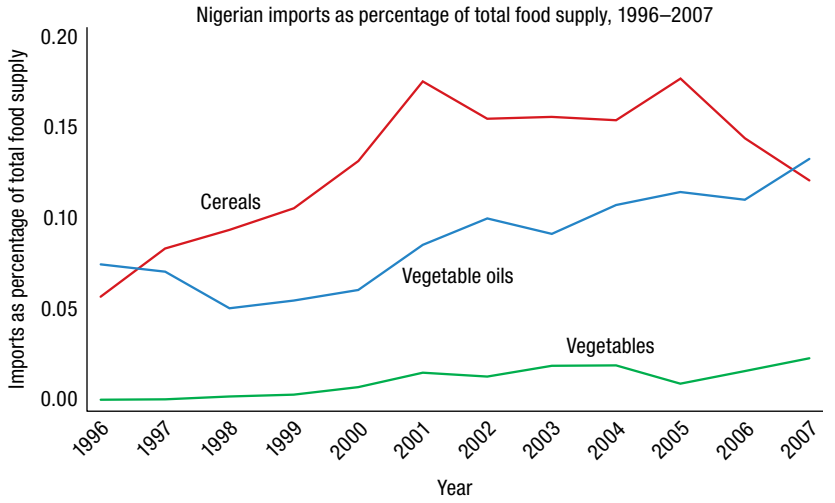
about 1.0 percentage point of labor productivity growth was the result of structural shifts of labor from low-productivity to high-productivity sectors, with the remaining 3.5 percentage points coming from within-sector productivity improvements. If we include the petroleum sector, growth in labor productivity in the same period dips to roughly 2.9 percent per year—with 2.2 percentage points stemming from structural change and a 0.7 percentage point from within-sector productivity.

Despite the positive role of structural change in this period, we also find that it could have contributed much more to growth. In fact, labor productivity could have jumped by roughly 50 percent between 1996 and 2009 under a better economic environment and, had that occurred, growth in labor productivity in the nonpetroleum economy would have been 3.2 percentage points higher. The challenge now is for Nigeria to tackle a range of economic barriers, including (1) policies that restrict agricultural productivity (like an inadequate supply of fertilizers and the lack of appropriate infrastructure to bring agricultural products to market); (2) a lack of infrastructure to allow the manufacturing and business services sectors to expand and meet demands; and (3) a lack of quality education, which limits the supply of appropriately trained workers.

Evolution of the Nigerian Economy

When Nigeria gained independence in 1960, it was largely an agrarian economy, securing most of its export earnings and government revenues from agriculture. But today, oil accounts for 96 percent of export earnings and 70 percent of government revenues, and the country has gone from being self-sufficient in food to a major food importer, especially in cereals and vegetable oils (Figure 5.2). Over much of this period, there was little net economic growth, although the growth rate was quite volatile—reflecting an oil boom (and soaring revenues) in the 1970s and a sharp fall in oil prices (and collapsing revenues) in the 1980s. Per capita income went through similar swings, even falling by the early 2000s to one-quarter of its mid-1970s high, below the level at independence. Since the mid-2000s, when Nigeria secured multilateral debt relief, the civilian government has focused on economic reforms, most recently laid out in the 2010 *Nigeria Roadmap for Power Sector Reform* (PTFP 2013) and *Vision 20:2020* (FRN/NPC 2010). The emphasis is on building up and further diversifying the nonpetroleum economy to boost growth and development. At the same time, Nigeria continues to be Africa's largest oil exporter (despite large cutbacks in production over the past two years, amidst

FIGURE 5.2 From net food exporter to net importer



Source: Authors' calculations using data from the FAOSTAT database (FAO, various years).

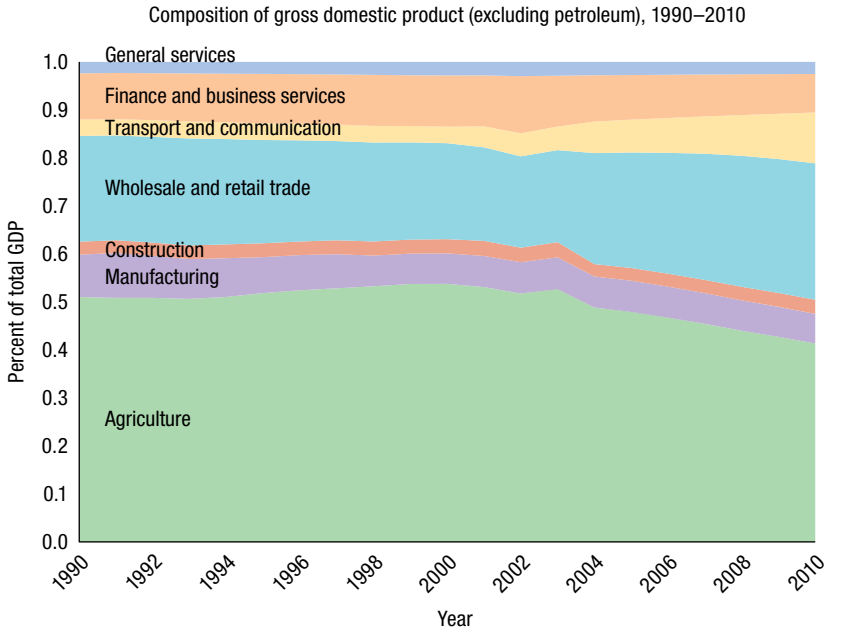
Note: Food supply is the total amount of food available for consumption in Nigeria, roughly equal to production plus imports minus exports, with modifications for use as feed and seed in agricultural production. Both the supply and the imports are originally measured in metric tons.

allegations of corruption and rent seeking) and a major supplier of liquefied natural gas to European buyers.

The current GDP breakdown at the sectoral level—in terms of the nonpetroleum part of the economy—is typical of developing countries in Africa. Agriculture accounts for a dominant portion of GDP, at around 50 percent of the nonpetroleum economy (or about one-third of total GDP) (Figure 5.3). The second major sector is wholesale and retail trade, which makes up 20 percent of nonpetroleum GDP (or about 15 percent of total GDP). This structure is not static, however, and over the two decades from 1990 to 2010, Nigeria experienced a slow process of structural change away from agriculture—now closer to 40 percent—and into new sectors such as transport and communications.

What has happened to labor productivity? We find that, not surprisingly, agriculture makes up the greatest portion of employment, with nearly 60 percent, and has a relatively low level of labor productivity—at only about two-thirds of the aggregate level (Figure 5.4). However, services, which includes not only public employees but also many informal workers, actually has even lower productivity, at only about 30 percent of the aggregate. Note that the oil and gas sector is excluded from this figure because labor productivity is so large in that sector (roughly 10,000 percent higher than average),

FIGURE 5.3 Agriculture, although losing ground, still dominates



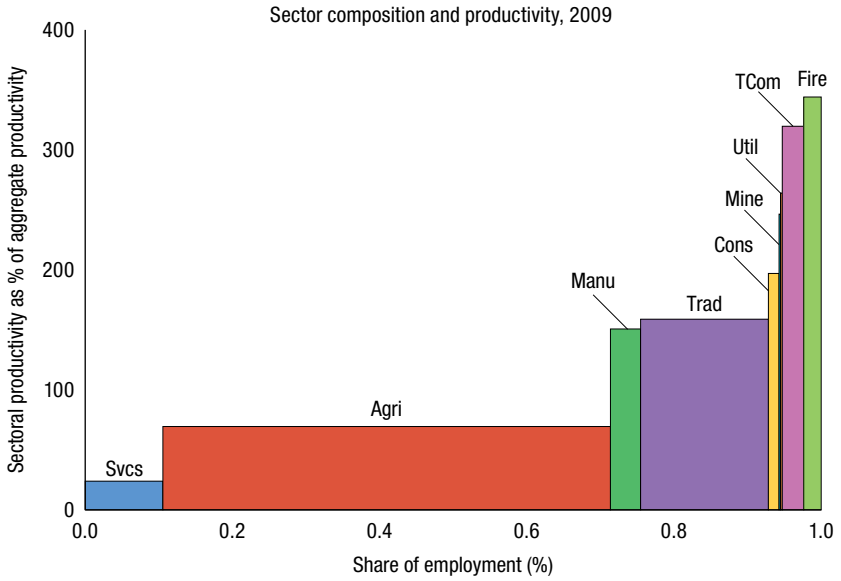
Source: Authors' calculations from National Bureau of Statistics data on the composition of gross domestic product (GDP), in constant 1990 prices (FRN/NBS, various years).

Note: The figure shows the fractions of GDP coming from the seven largest sectors—excluding petroleum, which typically accounted for 20–30 percent of GDP. Other excluded sectors, because of their negligible size, are electricity, gas, and water; mining and quarry; and undefined activities. The breakdown is based on data on crop production, and electricity value-added is adjusted for discrepancies, as described in the text.

and employment in that sector is so small (less than one-fifth of 1 percent), that the figure would lose all meaning.

Using household survey data for 1996–2009, we can see how the labor shares have changed over time (Table 5.1a). Agriculture, comprising 66.5 percent of workers in 1996, dipped to 60.8 percent by 2009. The next-largest sectors, but still only a fraction of agriculture, are wholesale and retail trade (employing 19.4 percent of workers in 1996 before falling slightly to 17.4 percent by 2009) and general services (averaging 10.0 percent of workers, with a temporary spike in 2005 that appears to be an anomaly). Over these 13 years, as we see in Table 5.1b, agriculture and wholesale and retail trade were the sectors losing employment share, which 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.

FIGURE 5.4 Agriculture and services have the lowest levels of productivity



Source: Authors' calculations using data from the Nigerian National Bureau of Statistics (FRN/NBS, various years).

Note: The figure shows the relative labor productivity of a sector (the height of the box) against the share of employment (the width of the box) for all sectors in Nigeria, excluding oil and gas. agri = agriculture; cons = construction; fire = finance, insurance, real estate, and business services; manu = manufacturing; mine = mining activity, excluding oil and gas; svcs = services; tcom = transport and communications; trad = wholesale and retail trade; util = utilities.

Here, we should note that data from the General Household Surveys (GHS) conducted by the National Bureau of Statistics in Nigeria for the periods 1996–1999 and 2005–2009 (see Appendix 5B) paint a picture of a labor force that is poorly paid and not sufficiently using both women and youths.

- The fraction of the employed working for wages is extremely low, averaging around 10 percent over all the surveys, and only rising to 13 percent by 2010. The vast majority of workers are engaged in relatively informal arrangements, working either for themselves or within the family.
- Women make up slightly more than one-third of employment in the 1990s, before rising slightly to average around 40 percent of employment in the 2000s. (It seems likely that women who are not employed in our calculations are concentrated in the agriculture sector, which likely understates total agricultural employment in our calculations.)

TABLE 5.1a Agriculture still employs the most labor . . .

Share of employment in major sectors (percentage), 1996–2009				
	Time periods			
Sector	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 communications	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

Source: Authors' calculations using the Nigerian General Household Surveys (FRN/NBS 2013).

Note: Sectors are defined as in the ISIC revision 2 classification to facilitate comparison across years. See Appendix 5A for specifics on how sectors are assigned in later years.

TABLE 5.1b . . . even though it has seen the biggest labor falls, followed by trade

Change in share of employment in major sectors (percentage points), 1996–2009				
	Time periods			
Sector	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 communications	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

Source: Authors' calculations using the Nigerian General Household Surveys (FRN/NBS 2013).

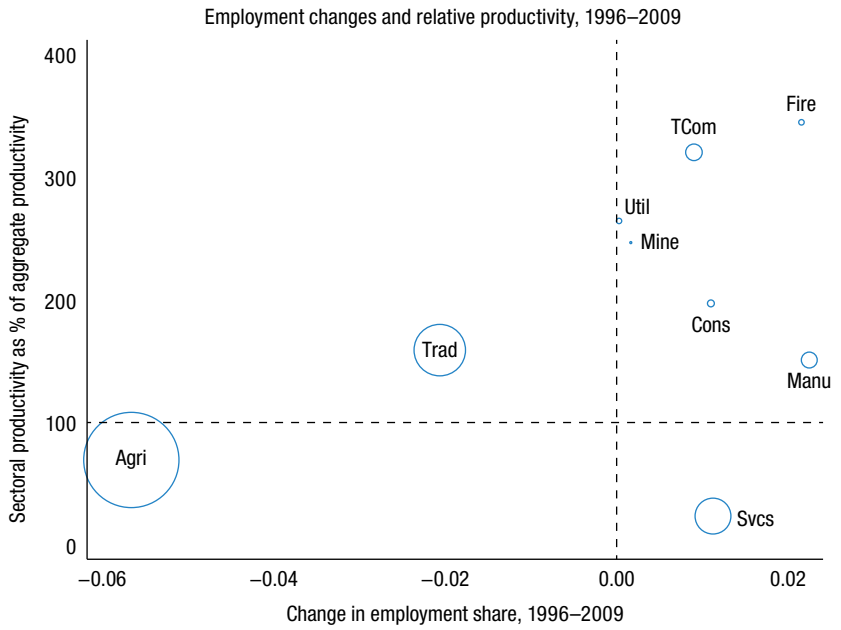
Note: Changes are percentage point differences between values reported in Table 5.1a.

- Only 25–30 percent of the population age 15–25 is employed, with another 40–49 percent in school, which leaves 25–30 percent as neither in school nor employed—the possible result of a skills mismatch.

A Growing Role for Structural Change

How large were these movements of employment between sectors? To provide a rough guide to the scale of the movements and their relationship to labor productivity, Figure 5.5 shows the changes in employment shares between 1996 and 2009 against the log of relative productivity in each sector. The sizes of the circles denoting each sector reflect their employment share in 1996.

FIGURE 5.5 A picture of positive structural change



Source: Authors' calculations using data from the Nigerian National Bureau of Statistics (FRN/NBS, various years).

Note: The figure shows the productivity of a sector in 2009 relative to aggregate productivity against the change in the share (percentage) of employment in that sector from 1996 to 2009. agri = agriculture; cons = construction; fire = finance, insurance, real estate, and business services; manu = manufacturing; mine = mining activity, excluding oil and gas; svcs = services; tcom = transport and communications; trad = wholesale and retail trade; util = utilities.

Agriculture—the largest sector, but with low productivity—saw the largest drop in employment share during this period. Wholesale and resale trade also witnessed a decline in employment share, despite being slightly above average in labor productivity. Services actually grew but remained a low-productivity sector. The remaining sectors—including manufacturing—witnessed growth in their share of employment and had relatively high productivity.

Looking across sectors, the general relationship is positive, indicating that growth in employment was occurring in sectors that were highly productive—thus raising overall productivity between 1996 and 2009. Here, again, the oil and gas sector is excluded, because its relative labor productivity is so large that it would make the figure unreadable. In addition, its share of labor grew from only 0.03 percent in 1996 to 0.2 percent in 2009. That said, our analysis of the role of structural change covers the differences that arise whether the oil and gas sector is included or excluded.

What is of special interest is that this positive correlation between relative productivity and shifts in labor is consistent with the findings of a study by McMillan and Harttgen (2014), which looks at Africa south of the Sahara. In the case of Nigeria, it also found a positive correlation using the period 1999–2009. However, our finding contradicts the negative correlation found by McMillan and Rodrik (2011), who looked at 38 countries (29 developing and 9 high-income), including Nigeria, for the period 1990–2005. We believe that the likely reason for the discrepancy is the specific time frame that McMillan and Rodrik (2011) use. The years prior to both 1996 and 2005 appear to have several anomalous features when compared with the rest of the 2000s. Using a consistent set of data (as we do here and McMillan and Harttgen (2014) do) results in a positive correlation.

Did the movement of employment between sectors actually contribute meaningfully to growth in labor productivity in Nigeria? To address this, we follow McMillan and Rodrik (2011) and decompose the overall percentage change in labor productivity in Nigeria from 1996 to 2009 into a "within-sector" component representing only increases in sector-level productivity and a "structural change" component representing the reallocation of employment between sectors (see the Overview in this book for details on the methodology).[3] The data on value-added are available from 1990 to 2010 and are reported in constant 1990 US dollars, calculated using sector-specific deflators applied to sector-specific nominal value-added (Appendix 5C).

Let us start by dividing the 1996–2009 period into three subperiods (excluding oil and gas). As panel A in Table 5.2 shows, labor productivity undergoes major swings, beginning with overall growth of only 0.8 percent per year in the first subperiod (1996–1999), then jumping to 4.8 percent in the second subperiod (1999–2005), and rising again to 7 percent in the final subperiod (2005–2009). For the period as a whole, labor productivity grew at 4.5 percent per year.

At the same time, structural change experienced major swings. In the first subperiod (1996–1999), it was the only factor contributing positively

3 Algebraically, the decomposition is:

$$\Delta P_t = \sum_{i=1}^{N} \theta_{i,t-k} \Delta p_{i,t} + \sum_{i=1}^{N} p_{i,t} \Delta \theta_{i,t}$$

where ΔP_t is the change in aggregate labor productivity between period $t-k$ and t. The first term is the "within-sector" 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 5.2 Structural change starts to take on a bigger role in the mid-2000s

Structural components of labor productivity change, 1996–2009				
	Time periods			
Structural components	1996–1999	1999–2005	2005–2009	1996–2009
Panel A: Excluding oil and gas				
% annual growth productivity	0.8	4.8	7.0	4.5
of which:				
% "within-sector" productivity	–2.0	9.4	2.6	3.5
% "structural change"	2.8	–4.6	4.4	1.0
Panel B: Including oil and gas				
% annual growth productivity	–0.8	4.4	4.1	2.9
of which:				
% "within-sector" productivity	–7.1	6.2	–1.6	0.7
% "structural change"	6.3	–1.8	5.7	2.2

Source: Authors' calculations. Data on output by industry are from Nigerian National Bureau of Statistics (FRN/NBS, various years), and workers engaged in each industry are calculated from the Nigerian General Household Surveys (FRN/NBS 1996–2009).

Note: See Appendix 5A for a translation of industries reported by NBS into standard International Standard Industrial Classification revision 2 codes. See Appendix 5B for a description of labor force data.

(2.8 percent per year) to overall productivity growth, as within-sector productivity actually fell by 2 percent per year, although the transfer of labor from low-productivity sectors to high-productivity sectors was able to turn overall labor productivity positive.

In the next two subperiods, we 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, reflecting the anomalous increase in services. Then from 2005 to 2009, the reversion to the typical level of services employment shows up as a very large contribution of structural change to labor productivity growth.

Given the service spike anomaly, a look at the decomposition of the full time span (1996–2009) is likely the most informative of all. We find that during the robust growth in labor productivity (4.5 percent per year), the big driver was within-sector growth (with 3.5 percentage points), while structural change accounted for the remaining 1.0 percentage point (about 21 percent of the total). On net, labor moved away from agriculture and wholesale and retail trade, with relatively low productivity, and into finance and business services, manufacturing, services, and transport, which as a group had relatively high productivity—although this effect was small relative to the overall increase in labor productivity within sectors.

What happens if we include the oil and gas sector? As panel B in Table 5.2 shows, several of the patterns remain intact, but the role of structural change becomes exaggerated. In particular, if we take the whole period (1996–2009), growth is lower—just 2.9 percent per year, as opposed to 4.5 percent when the oil and gas sector is excluded. Of this gain, the main factor is structural shifts, at 2.2 percentage points, unlike when the oil and gas sector is excluded (then "within" is the main factor). This exaggeration arises because there is a minute change in the fraction of workers in the mining industry (which includes oil and gas), rising from 0.03 percent of the workforce in 1996 to 0.2 percent of the workforce by 2009. In addition, labor productivity in the oil and gas sector is so high that this small shift in labor implies an enormous gain in overall labor productivity.

Which non-oil sectors pulled in the most labor from agriculture and wholesale and retail trade, and what were their relative labor productivities? Table 5.3 shows the labor productivity in 2009 of each major sector relative to agriculture, as well as the change in employment share in each sector. We can see that while wholesale and retail trade is relatively productive, it lost 2.1 percentage points of employment in this period. Moreover, employment shifting out of agriculture and trade into general services was actually bad for productivity, as general services had a productivity of only one-third of agriculture's level.

The biggest sources of the positive structural change were the movements of employment into transportation and communications and the finance industries. Each of these sectors has labor productivity more than four times

TABLE 5.3 Transportation and communications sector outperforms other sectors

Sector productivity levels relative to agriculture and employment changes, 1996–2009			
Sector	Change in employment, 1995–2009 (percentage points)	Relative labor productivity, 2009	Change in labor productivity 1996–2009 (percentage)
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
Finance and business services	2.2	4.95	–86.7

Source: Authors' calculations using output data from the Nigerian National Bureau of Statistics (FRN/NBS, various years) and labor force in each industry from the Nigerian General Household Surveys (FRN/NBS 1996–2009). Changes in employment are taken from Table 5.1.

Note: Labor productivity is reported relative to agriculture for each sector.

higher than agriculture. By together adding about 3 percentage points to their share of employment, these two sectors contributed 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 in agriculture and trade. However, growth in productivity in those three sectors was not necessarily positive. As can be seen in Table 5.3, in manufacturing and finance and business services, productivity growth was actually negative during 1996–2009, consistent with declining marginal returns to labor in those sectors.

Contrast this performance to that of the transportation and communications industry, which had both productivity growth and levels of productivity that were higher than those of any other major sector. The combination of high productivity growth and an inflow of employment 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 employment off to more productive uses; and second, through their own labor productivity growth.

Gradual Move into New Economic Areas

Drilling down into the subsectors, we gain more insights into Nigeria's economic evolution, especially a gradual broadening of economic activities. One caveat here is that the data are fragile, given that we are using the GHS and the absolute numbers of people reporting activity in any given subsector can be quite small.

Manufacturing. In 1996, nearly two-thirds of the manufacturing employees in Nigeria were reported to be in the textile, apparel, and leather goods subsector. However, by 2009, the distribution of manufacturing work had shifted substantially, with this subsector employing less than 30 percent of manufacturing labor. The main beneficiary of this drop was the manufacture of food, beverages, and tobacco, which employed 36 percent of manufacturing labor, as opposed to only 4 percent in 1996. Given the absolute growth in manufacturing workers from 1996 to 2009, the food and beverage subsector grew by a factor of nearly 27 in absolute terms, absorbing most of the additional manufacturing labor.

Finance and business services. This sector grew by roughly the same number of workers as manufacturing between 1996 and 2009. By using the more detailed ISIC revision 4 classifications available in 2009, we can see that much of the labor engaged in this industry appears to have come from the expansion of office administration and security services activities.

Transportation and communications. This sector is dominated by transportation activities. In 2009, 84 percent of the sector worked in the transportation subsector, while in 1996 the comparable number was 94 percent. The three largest nontransportation subsectors in 2009 were information services, telecommunications, and computer programming. Together these three accounted for about 14.5 percent of the entire sector employment. The relatively high-tech subsectors of information services, telecommunications, and computer programming contributed significantly to overall labor productivity growth.

General services. Unlike the others, this sector has a relatively small labor productivity level, and so the shift of employment into this industry was actually a net drag on aggregate labor productivity. This shift into the services industry was almost exclusively the result of the addition of employment in education and personal and household services (mostly "other personal services," which likely is a catch-all for domestic service and similar work, and may reflect part of the reason why the general services sector had such low levels of measured labor productivity).

Thus, between 1996 and 2009, Nigeria saw a broad shift of employment out of agriculture and trade into a few particular subsectors: 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. This movement appears to reflect a general broadening of the types of economic activities Nigerians engage in as they move out of the agricultural and trade activities that still dominate employment (Table 5.4).

Using Human Capital to Measure Labor Effort

But before we move on, it is important to ask whether this decomposition of growth may misstate the role of structural change, given that we have used productivity per worker, rather than a more refined measure that accounts for human capital and time spent working by those workers. Here we ask whether accounting for human capital levels and/or hours worked changes our prior decomposition significantly. We do this by decomposing value-added

TABLE 5.4 Agriculture and trade still dominate employment

ISIC revision 4 subsector employment shares, 2009	
ISIC-4 subsector	**Percentage of employment**
Crop and animal production	59.43
Retail trade, excluding motor vehicles	13.44
Education	3.27
Other personal services	3.17
Public administration and defense	2.32
Land transport and transport via pipeline	2.28
Food and beverage service activities	1.51
Wholesale, retail, and repair of motor vehicles	1.50
Manufacture of food products	1.38
Construction of buildings	1.03
Human health activities	0.92
Fishing and aquaculture	0.90
Manufacture of wearing apparel	0.89
Office administration, support	0.84
Wholesale trade, excluding motor vehicles	0.82
Security and investigation	0.48
Manufacture of furniture	0.36

Source: Authors' calculations using the 2009 Nigerian General Household Survey (FRN/NBS 2010).
Note: The subsectors are International Standard Industrial Classification (ISIC) revision 4 categories, as reported in the GHS.

per unit of human capital, value-added per hour worked, and value-added per hour worked by each unit of human capital (see Appendix 5D for details). We report the results excluding the oil and gas sector, but the adjustment to the results of including that sector are similar to what was seen in Table 5.2, where overall growth in labor productivity is slower, but structural change accounts for a larger fraction of that growth.

Our results show that from 1996 to 2009, human capital productivity grew by 2.3 percent per year—roughly half of what we saw for growth in labor productivity (Table 5.5, panel A). This implies that human capital per worker roughly doubled, accounting for a large portion of the raw labor productivity increase. Of this, the share attributable to the structural shift of human capital between sectors was about a 0.5 percentage point—which is a share proportionally similar to, if slightly higher than, that seen for labor productivity. The similar breakdown of growth into within-sector and structural change growth

TABLE 5.5 Structural change was broad based in terms of human capital

Components of productivity change using human capital, 1996–2009				
	Time periods			
Components	1996–1999	1999–2005	2005–2009	1996–2009
Panel A: Productivity per unit of human capital				
% change productivity	–1.9	1.2	7.4	2.3
of which:				
% "within-sector" productivity	–2.0	4.2	3.1	1.8
% "structural change"	0.1	–3.0	4.3	0.5
Panel B: Productivity per hour				
% change productivity	6.1	3.5	7.4	5.3
of which:				
% "within-sector" productivity	4.8	7.2	3.7	4.3
% "structural change"	1.3	–3.7	3.6	0.9
Panel C: Productivity per hour of human capital				
% change productivity	0.8	1.2	8.0	3.1
of which:				
% "within-sector" productivity	2.2	3.7	4.3	2.7
% "structural change"	–1.3	–2.5	3.7	0.5

Source: Authors' calculations using data described in Appendix 5D.

Note: The panels show the decomposition of productivity growth in the noted periods. For a comparison, see Table 5.2, which measures productivity in terms of output per worker.

implies that the shifts of human capital were broad based. That is, there is not any indication that only high-education or low-education workers were moving from and into sectors.

What about productivity per hour of work? Here, too, our results are quite similar to those for labor productivity (Table 5.5, panel B). 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 growth in hourly productivity of 5.3 percent per year from 1996 to 2009; of this, a 0.9 percentage point is the result of structural shifts from industries with low hourly productivity to high-productivity industries.

Finally, we can adjust for both hours and human capital, and measure hourly human capital productivity changes. Once again, the overall story remains similar to that of labor productivity (Table 5.5, panel C). From 1996 to 2009, structural shifts into industries with relatively high productivity per

human capital hour accounted for about 0.5 percentage points of the overall 3.1 percent growth rate in productivity. Thus, 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.

Potential Gains from Further Structural Change

The big question, though, is whether structural change could have been an even greater force for growth. Here, we ask the following question: If labor (or human capital) had been able to flow into the sectors where it was the most productive, how much higher would value-added per worker (or per unit of human capital) have been? Or taking a forward perspective, how much growth could we possibly still expect from structural change?

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). Essentially, we ask how much higher value-added per worker would be if we shifted workers among sectors until we reached the optimal allocation. Notably, we assume that each sector exhibits diminishing returns to labor. This means that moving workers from agriculture to transportation and communications will raise aggregate output per worker, but eventually per-worker productivity in transportation and communications will fall (and that in agriculture will rise), and there will no longer be any gain from moving workers. The optimal allocation is where all workers have the same value-added per worker, and there is no longer any gain from shifting a worker into another sector (see Appendix 5E for more details on the methodology).[4]

Using this method, we find a possible gain in value-added per worker of 54 percent. This gain comes primarily from moving workers out of agriculture. The fraction of workers who remain in agriculture in our counterfactual calculation is only 4.24 percent—a very low number that reflects the extremely low productivity in Nigerian agriculture. Maximizing output per worker would involve shifting a massive number of workers out of low-productivity

4 The implication is that the current allocation of labor across sectors in Nigeria is inefficient, in the sense that income is not maximized. This does not necessarily mean that the allocation is suboptimal from a welfare perspective. There may be costs to shifting labor between sectors that make the current allocations welfare maximizing from an individual perspective.

agriculture into other sectors. In comparison, the proportion in transportation and communications would be 33 percent, and that in finance and business services would be 34 percent. Unsurprisingly, the allocation that maximizes value-added per worker is heavily skewed toward those sectors with the highest actual value-added per worker. If these shifts had occurred over the period under study, 1996–2009, this would have raised labor productivity growth by approximately 3.2 percent per year.

What if we use the units of human capital instead of the number of workers? Now we find value-added could be 25 percent higher if human capital were rearranged among sectors to equalize the value-added per unit of human capital. If this shift had occurred between 1996 and 2009, it would have raised growth in labor productivity by about 1.7 percent per year.

An important caveat to these results is that they ignore the oil and gas industry. A collapse of oil prices or a slowdown of production would lead to a significant loss of GDP, but likely would have an impact on the structure of employment within Nigeria as well. While we cannot calculate a precise number, some of the structural change that has actually taken place to this point is likely driven by oil revenues, leading to greater demand for services—often urban services. If oil revenues were to collapse, then this demand would shrink, causing a shift of labor out of service sectors. Where precisely this labor would go is unclear, but a likely outcome is a flow of labor back into rural areas and possibly agricultural work. Moreover, if oil revenues were to disappear rapidly, the structural change that has occurred so far might come undone.

Levers of Structural Change

Clearly there appears to be great scope for growth through further structural change, but so far, little progress is being made. What are the key barriers that hinder further development? Let us start with the biggest non-oil sector, agriculture, where productivity is still very low.

Agricultural Production Needs to Be Stimulated

A number of constraints on agriculture prevent it from being a larger contributor to the process of structural change. One of the most important is the sector's limited use of fertilizer and improved varieties of crops. Nigeria uses about 10–15 kilograms per hectare (kg/ha) of fertilizer—far below the 100–200 kg/ha used in most developed nations. In the early 2000s, the National Fertilizer Company of Nigeria (NAFCON) was shuttered, and ever

since all the fertilizer used in Nigeria has been imported.[5] Increases in international fertilizer prices have kept imports low, despite the presence of subsidies of 25 percent since 2001 (Phillip et al. 2009).

An additional issue is that the fertilizer that is imported often fails to make it to the smallholders who dominate the agriculture sector. Several barriers prevent an efficient distribution to those who might benefit most, such as poor transportation links from ports to inland destinations and a lack of any meaningful distribution network (Phillip et al. 2009). The World Bank (2007) notes that the density of roads in the rural areas is extremely low, with only 0.06 kilometers (km) of road per 10 hectares of cultivable land, compared with rates of 0.18 km in Tanzania and 0.19 km in India. This leaves 30 million rural inhabitants more than 2 km from the nearest road.

Several 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 (World Bank 2008, Annex 6; Taiwo 2007). Moreover, the limited infrastructure to deliver needed inputs to agriculture is mirrored in a lack of infrastructure to get agricultural products to market, with transportation costs between one-third and one-half of the cost of bringing agricultural crops to market (Fade-Aluko 2007).

Another major hurdle, especially for smallholders, is securing financing for improving productivity. One study reports that none of the farmers in its sample in Oyo and Ogun states was able to access conventional bank loans to finance projects, relying instead on cooperatives or friends and family (Phillip and Adetimir 2001). At a national level, the loan picture is getting even worse. The Central Bank of Nigeria reports that in 1993, 16.4 percent of all loans were made to the agriculture sector, while by 2009 that percentage was down to 1.5 percent (CBN 2010). In terms of total value-added from agriculture, loans were equal to 12 percent of the total in 1993 and only 3 percent by 2009.

Three parastatal entities are supposed to deliver credit services to the agriculture sector. The Nigerian Agricultural, Cooperative, and Rural Development Bank was created in 2000 to provide credit directly as well as

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

loan guarantees. The Agricultural Credit Guarantee Scheme Fund has existed for more than 30 years, guaranteeing credit on behalf of farmers. And the Agricultural Credit Support Scheme was established in 2006 to subsidize commercial bank loans to the agriculture sector. But the extent to which these institutions have penetrated the rural market is quite limited.

Over the past decade, there have been several major policy initiatives to improve the situation, although all of them have fallen short. The Presidential Initiative on Cassava—launched in 2002 to increase the production of starch, chips, and flour, and raise exports of cassava products by $5 billion by 2007—has received only a fraction of the 65.6 billion naira budgeted (FAO). Major constraints to exporting cassava include 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.

Similar issues plague the Presidential Initiative on Rice and the Presidential Initiative on Vegetable Oil Development. Promised funds have not been released, and output and the ability to process the output have not grown appreciably. In fact, neither rice nor cassava production has grown any faster than maize, a crop that was not subject to a specific initiative (Phillip et al. 2009).

The bottom line is that the shifts of labor out of agriculture are a positive contributor to aggregate labor productivity growth. But 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 quite large, accelerating the structural changes that are now proceeding only very slowly.

Trade Policies Need to Be Further Liberalized

The specific patterns of tariff protection within certain sectors are closely correlated with the patterns of employment within those sectors, although the tariff protection itself does not appear to have a significant effect on the scale of structural change itself. This shows up most clearly within manufacturing.

Overall, manufacturing raised its share of employment from 1.9 percent in 1996 to 4.1 percent in 2009. Within that sector, tariffs on intermediate and final goods vary by subsector.

For four key subsectors (food and beverages, textiles, wood products, and paper and printing), there is a distinct degree of tariff escalation across stages of production (WTO 2005)—meaning low tariffs on imports involved in the initial stage of production (that is, raw materials) combined with high tariffs

on imports of the final goods. As a result, raw materials and necessary inputs can be purchased relatively cheaply, while their output is competitive because of the high end-product tariffs. The differences in tariff rates between the final and initial stages are quite large (20 percentage points for food and beverage, 25 for textiles, 30 for wood products, and 15 for paper and printing).

The protection accorded these subsectors shows up in sectoral allocations. In manufacturing, the subsectors with the largest shares of workers are food products (1.38 percent), wearing apparel (0.89 percent), and furniture (0.36 percent) (Table 5.4). While none of these shares is particularly large relative to the economy as a whole, these subsectors form the dominant proportion of all manufacturing work.

Textiles are a particularly interesting case, as they face not only a favorable tariff structure but also outright import bans on 70 percent of tariff lines—which continue to exist despite Nigeria's adoption of the Economic Community of West African States common external tariff in October 2005. Yet despite this degree of protection, the share of labor working in textiles has been falling, and a vibrant textile industry has yet to materialize. Moreover, these measures appear to have diverted resources into smuggling (Raballand and Mjekiqi 2010). One issue may be that after the Multi-Fibre Arrangement expired in 2005, a flood of low-cost producers from Southeast Asia and elsewhere entered the market. While Nigeria may have low-cost labor capable of supporting a larger textile sector, it becomes uncompetitive once nonlabor costs to trade are factored in.

Tariff structures for the remaining areas of manufacturing do not have a similar escalation across stages of production. For nonmetallic mineral products, tariffs on initial-stage products are nearly 10 percentage points higher than final-stage tariffs, meaning that producers face high input costs and limited output protection. Within the manufacturing sector 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 subsectors. But while the protection ensures that these sectors do not face intense international competition, it has not engendered any sustained expansion of these sectors.

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

75 percent. Additionally, several agricultural products are simply prohibited from being imported (like wheat flour, sorghum, cassava, and frozen poultry). Although numerous products were removed from the banned list in October 2008, the remaining bans cover many goods with significant trade possibilities. Similarly, imports of major construction goods (like cement, steel, and wood) are restricted. 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. The Export Expansion Grant (EEG) program makes grants of 15–30 percent of export value. A similar Manufacture-in-Bond (MIB) program involves the duty-free importation of raw materials for use in producing exportable products. Also, the Pioneer Tax program provides tax holidays for those who export at least half of their total production. And there are 17 free trade zones (FTZs), some of which target specific industries (particularly oil and gas).

How have these programs fared? One recent study finds a very limited impact, citing a low uptake of the programs (Mousley 2010). It says that only 94 firms accessed the Pioneer Tax program from 2006 to 2010, while almost all FTZs are related to oil and gas. Further, the EEG and MIB programs generated very few jobs, with firms stymied by daunting documentation requirements.

More broadly, policy and practice act to limit trade. Nigeria ranked 144th out of 181 countries in the World Bank's Doing Business 2009 rankings (World Bank). Hurdles include a large number of export documents required (10 for Nigeria, compared with 6 in Ghana and 4 in Singapore); high export container costs ($1,179, which is roughly twice that of the most efficient operators in the world); hefty import container costs ($1,306, which is between two and three times higher than the most efficient countries); and lengthy import clearance times (nearly 42 days, compared with 26 in Kenya, 29 in Ghana, and only 3 in Singapore).

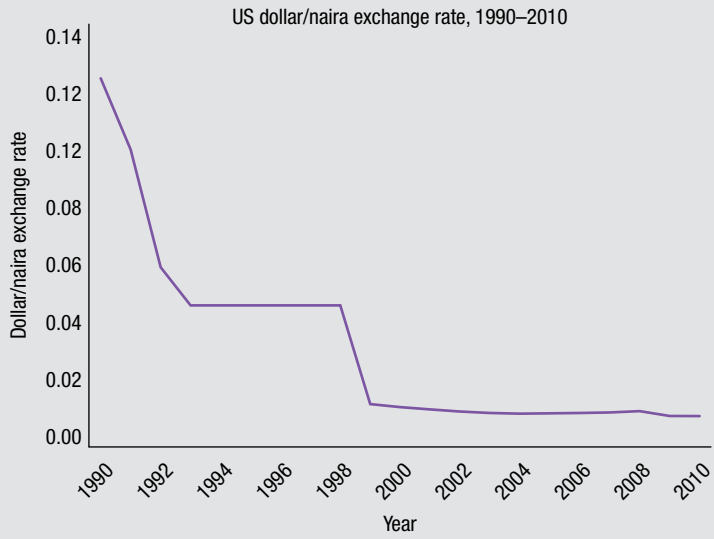
Complicating matters is the naira's exchange rate. Although the naira has maintained a stable exchange rate with the US dollar over the past 12 years, following a major depreciation in 1999 (Box 5.1), the dollar itself has been slowly depreciating over most of this time period versus other major currencies (especially the euro and pound sterling). Given that the United Kingdom 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. While the depreciated exchange rate should also make exports more competitive, restrictive tariff policies and

BOX 5.1 The naira's role in foreign trade

The sharp depreciation of the naira after 1999 (Figure B5.1)—part of the package of financial reforms that took place with the return to democracy—should have made exporting more lucrative and raised the prices of imports. Also, the more transparent foreign exchange management system has led to a much less volatile exchange rate, which has helped boost oil revenues.

However, the sectors that may have been expected to benefit through exports (like textiles) have not expanded appreciably because of the high costs of exporting. On the other hand, the depreciated naira—not only in nominal but also in real terms—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. An example is fertilizer, whose limited use stands as a major barrier to higher agricultural productivity. Still, an open question is whether a further depreciation will be needed in the absence of trade liberalization.

Figure B5.1 Stability after depreciation



Source: Authors' calculations from the World Development Indicators database (World Bank, various years).
Note: A lower dollar/naira exchange rate value means a depreciation of the naira.

the lack of infrastructure have likely prevented Nigerian exporters from taking full advantage.

In the end, the restrictive tariff policies and import bans have acted to freeze Nigeria's economic structure. Insulated from competition, there is little incentive for firms to improve their productivity, which would allow for either an expansion of output or a shift of resources away from the protected sectors. The tariff structure has managed to focus manufacturing on several specific subsectors, but it has not been able to significantly boost manufacturing employment overall. Import bans have not provided any incentive for domestic industries to expand, instead simply shifting trade into unofficial channels. The costs of necessary inputs that would contribute to productivity growth (like fertilizer and cement) are made more expensive by an exchange rate policy that favors a stable but devalued naira.

Moreover, regardless of the precise tariff policies in Nigeria, competition from numerous other developing countries producing similar entry-level manufactured goods (like textiles)—but operating with lower transportation costs—certainly hinders the ability of manufacturing to grow significantly. To the extent that there are economies of scale involved in manufacturing, then the developing industries in Southeast Asia will continue to be lower-cost producers than those in Nigeria. Overcoming that advantage and making manufacturing exports a driver of structural change will require a significant reduction in costs in Nigeria, either directly through lowering the logistical barriers to trade or indirectly by a significant devaluation of the naira.

Infrastructure Needs to Be More Widespread and Reliable

A commonly cited reason for low productivity in Nigerian industry is the lack of reliable power. As a result, 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 firms' productivity or for expansion and the creation of new wage positions. Take the following examples.

- Nigeria produces only around 4,000 megawatts (MW) of power—far below the 39,000 MW of South Africa, with only one-third of Nigeria's population (World Bank 2007).
- In the 2002 World Bank Regional Program on Enterprise Development survey, about 94 percent of firms reported power as being their number one problem—more than twice the percentage of any other individual constraint on growth—and more than 90 percent of them had some facility to generate their own power (World Bank 2002).

- A 2003 survey of firms in Abia and Anambra states found that 90 percent of firms named infrastructure as a constraint on their business, and 85 percent cited the high cost of utilities (World Bank 2007).
- Up to 15 percent of total payrolls for industrial firms in Nigeria goes toward maintaining self-generation facilities; 20 percent of the costs of new investment projects is for infrastructure investments (like power, water, and telecoms); and 22 percent of the value of equipment and machinery in business is for electricity generation (World Bank 2007).

Thus, it seems safe to assert that disruptions and limitations caused by the sporadic power supply are a significant constraint on Nigerian manufacturing and industry, leading to a constriction of the nonagriculture sectors. At this point, fewer firms are entering the manufacturing sector because of the high costs of start-up associated with providing one's own power, and firms are operating below capacity because of the lack of reliable power supplies.

Similarly, infrastructure related to transportation is a major problem for industry. While some roads are relatively well maintained (for example, Lagos-Kano), almost half (46 percent) of Nigeria's roads are classified as being in poor condition. More than 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. Locomotive availability at the Nigerian Railway Corporation is only 6 percent, compared with an average of 75 percent in the rest of Africa. Wagons and passenger coaches both have an availability of less than 30 percent (World Bank 2007). As a result, nearly all cargo is transported by road.

One notable contrast to these infrastructure problems is telecommunications. Following liberalization in 1999, this subsector has grown demonstrably, with four mobile operators and more than 20 fixed-line operators. The density of telephone subscriptions reached 16 percent by 2005 from a rate of less than 1 percent in 2000. We noted before the rapid growth of the telecommunications subsector as a part of the overall growth in the transportation and communications sector. It is worth recalling that this subsector also showed the most notable growth in labor productivity between 1996 and 2010. It is regulated by the Nigeria Communications Commission, which is independent of the national telecommunications company NITEL, in which the government is pursuing the sale of a large stake.

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 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, although at this point the verdict is still out.

Human Capital Needs to Be Further Developed

A final major barrier to structural change appears to be the lack of suitable human capital for formal sector, technical jobs. As a recent World Bank report notes, "...there are mismatches between skills being developed by present public policies and those required to support structural change and employment in the labor market" (Billetoft 2010). This is a problem for a nation with only 28 percent of young people (age 15–25) in the labor force, and only 63 percent of them age 25–35.

The first source of this mismatch can be traced to general education. Even in 2009, a large portion of the workforce (including most agricultural workers) consisted of individuals with only a primary education. The actual breakdown was: about 37.0 percent of all individuals over the age of 20 had completed only primary school or less; 6.0 percent had completed junior secondary school; 34.0 percent had completed senior secondary school; 8.0 percent had the equivalent of a baccalaureate degree (which includes the Higher National Diploma); 2.1 percent had a postbaccalaureate degree; another 10.0 percent obtained the National Diploma, the Nigerian Certificate in Education, or nursing degrees (all technical or vocational tertiary degrees); and less than 0.1 percent had completed a degree at a vocational or 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 for the developing manufacturing and construction sectors.

A reason for the limited supply of workers who 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 train 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.

In an effort to improve the education picture, two types of new institutions were introduced by the Federal Ministry of Education in 2007—the Vocational Enterprise Institutions (VEIs) and Innovation Enterprise Institutions (IEIs). These privately run institutions serve secondary school leavers (VEIs) and those with some postsecondary education (IEIs). They were designed to equip the students with the technical skills demanded by industry, enabling 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 a total of 138 program areas were being offered in 2 VEIs and 22 IEIs (Billetoft 2010). It is too early to evaluate whether these institutions will have a material impact on structural change within Nigeria, as their first graduates only entered the job market in 2010.[6]

Several tertiary institutions (including the polytechnics and monotechnics) ostensibly already provide some of this kind of training, although their poor funding and low status serve as roadblocks to increasing their enrollment (Billetoft 2010). In 2000, the Ministry of Education formulated a Master Plan for Technical and Vocational Development, with proposed actions to take in the following decade (Billetoft 2010). One of the main tools called for was the creation of a National Vocational Qualifications Framework, which would standardize the certification of programs, thereby allowing the private sector to step in and take on a more active role in providing skills training. However, to date, this idea, too, has yet to be fully realized.

Focusing on Barriers to Growth

As policy makers debate the road ahead for Nigeria, it is encouraging to know that growth-enhancing structural change is occurring in Nigeria, with employment tending to shift from agriculture and trade activities into manufacturing, transportation, and services. We find that between 1996 and 2009, structural change accounted for about one-quarter of the overall growth in labor productivity (4.5 percent), excluding the oil and gas sector, with the remainder accounted for by within-sector productivity growth. Moreover, if

6 There are not enough observations of individuals in the GHS with vocational schooling to make any concrete statements about their unemployment rates versus those with higher degrees.

we include oil and gas, the structural change share rises to three-quarters of overall labor productivity growth (2.2 percent). This transition fits within a typical model of structural transition, with labor leaving agriculture and basic trade activities and moving to higher-productivity activities. Looking more closely, the main beneficiaries of this shift were the food products, textile, and wood products subsectors of manufacturing, as well as education, office services, security services, and telecommunications.

This push-out of agriculture has occurred despite the lack of appreciable gains in total agricultural output in this period—likely constrained by a lack of fertilizer and poor infrastructure. Without those constraints, the transition out of agriculture to higher-productivity sectors may well have been higher. Moreover, we hypothesize that removing those constraints could induce a larger structural shift in the future.

For the manufacturing sector, the lack of sufficient infrastructure to support high-productivity activities has likely led to its relatively slow growth. This includes not only utility provision but also the availability of efficient transport and port facilities, which 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.

Complicating matters 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 being adequately supplied by the technical education system—as manifested in the 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 among sectors would raise value-added in Nigeria by about 25 percent. In other words, these barriers are holding back a potentially significant source of growth in labor productivity in Nigeria.

Appendix 5A: Translation of ISIC Revision 4 to ISIC Revision 2

Data from later years of the Nigerian GHS (2006 through 2009) use ISIC revision 4, while the earlier data use revision 2. To make data comparable, we translated the revision 4 codes into revision 2 categories, 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 sale and retail trade, hotels, 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, and business services
- 9 (Community, Social, and Personal Services): public administration, education, health, private nonprofits, and other services

Two economic activities listed in the Nigerian national accounts data are not included in our calculations. The first is the oil and gas sector, which is excluded because of its large size and relatively small local labor force. The second is the electricity sector, which in the national accounts data experienced an unexplained increase in GDP of approximately 1,000 percent in 2003.

Appendix 5B: Employment Data

To define who is included in our measures of employment, we use a common question across all the GHS: "What was your main job in the last week?" The possible answering options are: (1) worked for pay, (2) got job but did not work, (3) worked for profit, (4) attached but did not work, (5) got an apprenticeship, (6) stayed home, (7) went to school, and (8) did nothing.

We count anyone under the first five categories as being employed. 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 employed workers, and these job seekers have none listed. Table 5B.1 shows that employed workers were approximately one-third of the entire sample over all years.

We can describe several features of employment that conform to common findings regarding the Nigerian labor market. First we identify individuals involved in wage work as those who responded "worked for pay" to the question regarding their main job. We also count as wage workers those who reported "got job but did not work," "attached but did not work," or "apprenticeship"—along with reporting their employment status on a separate question as "employee."[7]

While we have 10 different surveys available, several irregularities in the data confine our analysis to a limited number of years. By focusing specifically on 1996, 1999, 2005, and 2009, we can track changes over the longest possible time period, while still providing some information on intermediate

7 The other alternatives for this separate questionnaire are "Employer," "Own account worker," "Member of cooperative," "Unpaid family worker," and "Other."

Table 5B.1 Summary data from Nigerian General Household Surveys, 1996–2009

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

Source: Authors' calculations using the Nigerian General Household Surveys (FRN/NBS 1996–2009).
Note: Definitions of the different percentage breakdowns are described throughout the chapter.

years. The problems relate to the nature of the data on industry of employment, notably in 2006 and 2007, when there is an aberration—17 percent of the labor force is coded as working in coal mining (compared with essentially 0 percent in the prior and following years). We believe that these individuals may have been miscoded as "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 employment into manufacturing (roughly an additional 6 percent of the labor force) that appears anomalous compared with the movements into manufacturing over the rest of the years. Again, as we have a relatively long time frame by summarizing data from 1996 to 2009, dropping the years with suspicious outcomes does not severely limit our ability to measure the role of structural change.

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.[8]

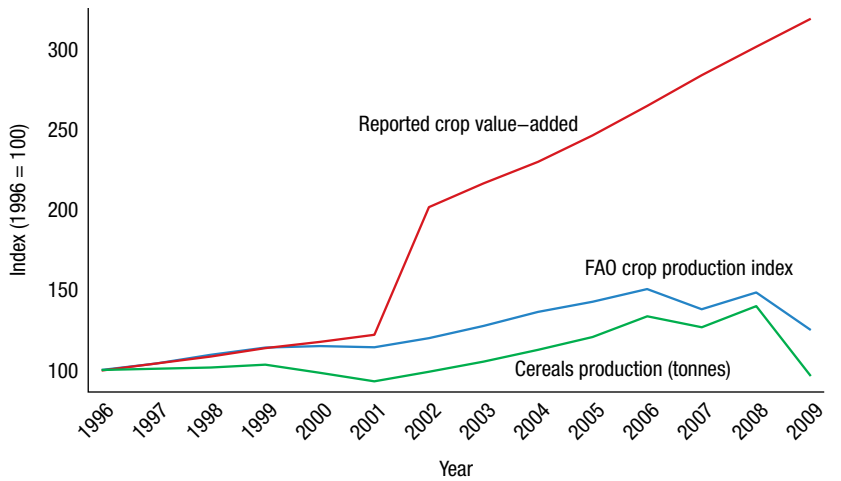
8 The other sectors are mining and quarrying; electricity, gas and water; and construction. These three account for very small fractions of the labor force and do not reveal large changes in those fractions over time.

Appendix 5C: Value-added Data

Data on value-added are available from 1990 to 2010. These data are reported in constant 1990 US dollars, calculated using sector-specific deflators applied to sector-specific nominal value-added. The specific sectors do not conform directly to the two-digit ISIC revision 2 categories on which our labor force data are organized. We aggregate the reported sectors from the Nigerian national accounts into the two-digit ISIC categories ourselves.

Two anomalies in the reported value-added data 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 5C.1 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 Food and Agriculture Organization of the United Nations (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

Figure 5C.1 Measures of crop production, 1996–2009



Source: "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 (FAO various years).

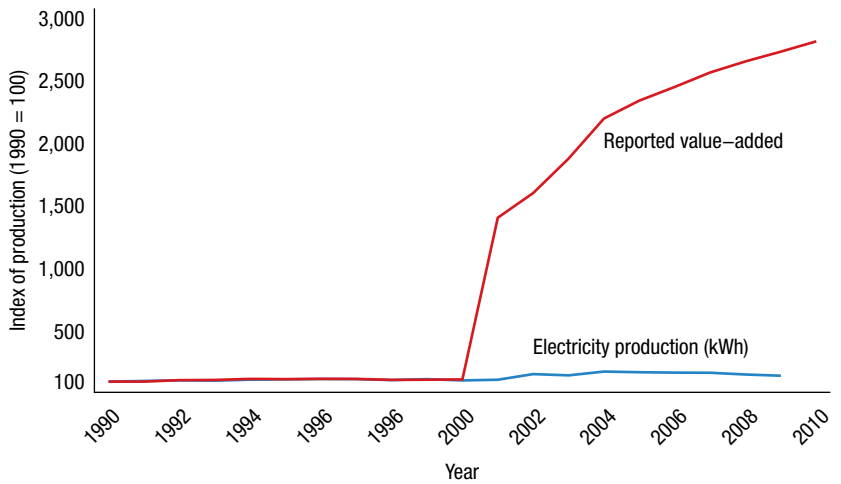
Note: Each series in the figure has been scaled to equal 100 in 1996. The crop production index is a measure created by FAO to capture production of field crops valued at reference world prices, constant at 2005 international dollars. Cereals production is the metric tons of rice-milled equivalents of major cereal crops produced. Rice-milled equivalents scale crops by nutritional value to be comparable.

production is much higher than the apparent growth in real output, as evidenced by the other indexes.

A similar issue appears 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 1,300 percent in one year. Figure 5C.2 shows how the reported value-added in electricity evolves compared with kilowatt-hours (kWh) reported in the World Development Indicators (WDI) database (World Bank, various years). 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.

We adjust the electricity value-added data in a manner similar to that used for the process of 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.

Figure 5C.2 Measures of electricity production, 1990–2010



Source: "Reported value-added" is from the Nigerian national accounts, in constant 1990 dollars. Authors' calculations using the Nigerian General Household Surveys (FRN/NBS various years). "Electricity production (kWh)" is taken from the World Development Indicators (World Bank, various years).

Note: Each series in the figure has been scaled to equal 100 in 1990.

Appendix 5D: Human Capital and Hours Worked

There are distinct differences across industries in the human capital levels of workers. As can be seen in Table 5D.1, in agriculture, most workers have completed only primary education, and just about one-third have completed secondary or postsecondary schooling. In the trade, transport, and manufacturing industries, roughly half of the workers have only a primary education, with the remainder possessing secondary or postsecondary education. 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 postsecondary education, which includes not only typical bachelor's degrees, but also vocational degrees (such as nursing certificates, the Higher National Diploma, or the National Diploma).

What these differences imply is that while output per worker may be much higher in finance and business services 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 a standard Mincerian technique. This method has two components. First, it assumes that workers' human capital is a function of their stock of schooling. Specifically, human capital is equal to $exp(S)$, where S is the stock of schooling. Second, the stock of schooling is equal to a rate of return applied to each year, $S = \varphi \times years$, where φ is a coefficient that is derived from studies of labor markets, and captures the average

Table 5D.1 Human capital and hours worked by industry, 2009

Sector	Percentage with highest level of schooling				Average weekly hours worked
	Below primary	Primary	Secondary	Postsecondary	
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 communications	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

Source: Authors' calculations using the 2009 Nigerian General Household Survey (FRN/NBS 2010).

Note: The industry definitions are translated from the reported ISIC revision 4 data in the 2009 GHS to International Standard Industrial Classification revision 2 to be consistent with the data across all years. See Appendix 5A for details on the translation.

gain in wage for an additional year of schooling. In our case, we adopt a typical assumption that $\varphi = 0.10$ (a 10 percent increase in wage per year of school). With that value, each individual is assigned human capital equal to $exp(0.1 \times years)$. Using an alternative return rate does not produce results that are qualitatively different.[9] Using the exponential function in this formulation implies that human capital rises with years of schooling, but at a decreasing rate.

One thing to note is that we are assuming that human capital itself is perfectly fungible among sectors. That is, if a female worker has 10 years of education, then her human capital is $exp(0.1 \times 10) = 2.72$, regardless of the sector that she works in. This is a crude measurement of her human capital, and it ignores sector-specific skills that she may possess. Measuring human capital as we do here means that all workers can carry their human capital with them between sectors, so it makes sense to think of productivity per unit of human capital. In the prior section, we considered only productivity per worker. In that formulation, we were implicitly assuming that every worker within a sector was identical in productivity—meaning that when our worker left agriculture she left behind her agricultural human capital and instantly gained a new set of manufacturing human capital. Comparing the two measures allows us to discover if the labor shifts we observe are broad based in the sense that workers of all levels of education are moving, or if it is only a smaller group of workers with specific levels of education who are moving.

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

9 Practically, for years of schooling, workers with less than primary education are assigned 0 years; those with primary education, 6 years; those with secondary education, 12 years; and those with postsecondary education, 16 years. While some surveys report specifically the years of education completed, the surveys are not consistent in how they report this information across years. Alternative means of allocating years of schooling do not produce meaningfully different results.

Appendix 5E: Calculating the Potential Gains from Reallocation

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

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

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 are combined into a single term.[10]

L_i 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 to (subtracted from) a sector. Value-added per worker, our measure of labor productivity, is

$$\frac{VA_i}{L_i} = \frac{X_i}{L_i^{\alpha}} \tag{2}$$

As seen earlier in Table 5.5, 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 (such as agriculture) into high-productivity sectors (such as 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.

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

$$\frac{L_i}{L} = \frac{X_i^{\alpha}}{\sum_j^n X_j^{\alpha}} \tag{3}$$

10 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.

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

$$VA^{Pot} = \left(\sum_j^n X_j^{\alpha}\right)^{\alpha} L^{1-\alpha} \tag{4}$$

where L is the total of all labor available.[11] 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

$$M = \frac{VA^{Pot}}{\sum_j^n VA_j} = \frac{\left(\sum_j^n X_j^{\alpha}\right)^{\alpha} L^{1-\alpha}}{\sum_j^n X_j L_j^{1-\alpha}} = \frac{\left(\sum_j^n X_j^{\alpha}\right)^{\alpha}}{\sum_j^n X_j \left(L_j/L\right)^{1-\alpha}} \tag{5}$$

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 (2) 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 $\alpha = 0.3$, matching the typical assumptions made in the literature. If the value of α were sector specific, that would complicate the calculations, but would not change the general concept behind our exercise. As it stands, there is little evidence that labor shares differ across sectors substantially (Gollin, Lagakos, and Waugh 2011). Additionally, assuming that $\alpha = 0.3$ matches estimates of the own price elasticity of labor demand found in Hamermesh (1993).

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

References

African Development Fund. 2005. *Appraisal Report.* Nigeria Skills Training and Vocational Education Project. Abuja.

Billetoft, J. 2010. "Labor Market Trends and Skills Development." In *Putting Nigeria to Work*, edited by V. Treichel. Washington DC: World Bank.

CBN (Central Bank of Nigeria). 2010. *Statistical Bulletin, 2010.* Abuja.

Chanda, A., and C-J. Dalgaard. 2008. "Dual Economies and International Total Factor Productivity Differences: Channelling the Impact from Institutions, Trade, and Geography." *Economica* 75: 629–661.

Cordoba, J-C., and M. Ripoll. 2009. "Agriculture and Aggregation." *Economics Letters* 105 (1): 110–112.

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

FAO (Food and Agriculture Organization of the United Nations). Various years. FAOSTAT database. http://faostat.fao.org/default.aspx.

FRN/NBS (Federal Republic of Nigeria/National Bureau of Statistics). 1996–2009. *Nigeria—General Household Survey*. Abuja.

———. 2010. *Nigeria—General Household Survey 2009, Fifth Round*. Abuja. http://nigerianstat.gov.ng/nada/index.php/catalog/36.

———. 2013. *Nigeria—General Household Survey–Panel 2010–2011 (PostHarvest), First Round (Wave one).* Abuja. http://nigerianstat.gov.ng/nada/index.php/catalog/31.

———. Various years. http://nigerianstat.gov.ng/.

FRN/NPC (Federal Republic of Nigeria/National Planning Commission). 2010. *Nigeria Vision 20:2020—Economic Transformation Blueprint.* Abuja.

Gollin, D., D. Lagakos, and M. Waugh. 2011. *The Agricultural Productivity Gap in Developing Countries*. Working Paper. London: International Growth Centre.

Hamermesh, D. 1993. *Labor Demand*. Princeton, NJ: Princeton University Press.

Haywood, L., and F. Teal. 2010. "Employment, Unemployment, Joblessness, and Incomes in Nigeria, 1999–2006." In *Putting Nigeria to Work: A Strategy for Employment and Growth,* edited by V. Treichel, 167–202. Directions in Development. Washington, DC: World Bank.

McMillan, M., and K. Harttgen. 2014. *What Is Driving the 'African Growth Miracle'?* NBER Working Paper 20077. Cambridge, MA: National Bureau of Economic Research.

McMillan, M., and D. Rodrik. 2011. *Globalization, Structural Change and Productivity Growth*. NBER Working Paper 17143. Cambridge, MA: National Bureau of Economic Research.

Mousley, P. 2010. "Building the Enterprise Sector for Employment and Growth: Some Policy Options." In *Putting Nigeria to Work*, edited by V. Treichel. Washington DC: World Bank.

Phillip, D., and V. O. Adetimir. 2001. *Enhancing the Transfer and Commercialization of Agricultural Technologies in Nigeria*. PRA Survey Report on the South West Zone of Nigeria. Ouagadougou, Burkina Faso: Organization of African Unity/Semi-Arid Food Grain Research and Development-Scientific Technical and Research Commission.

Phillip, D., E. Nkonya, J. Pender, and O. A. Oni. 2009. *Constraints to Increasing Agricultural Productivity in Nigeria: A Review*. Nigeria Strategy Support Program Background Paper NSSP 006. Washington, DC: International Food Policy Research Institute.

PTFP (Presidential Task Force on Power). 2013. *Nigeria Roadmap for Power Sector Reform: Revision I.* Abuja: Federal Republic of Nigeria, Office of the President.

Raballand, G., and E. Mjekiqi. 2010. "Nigeria's Trade Policy Facilitates Unofficial Trade but Not Manufacturing." In *Putting Nigeria to Work*, edited by V. Treichel. Washington, DC: World Bank.

Schultz, T. 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*. Washington, DC: World Bank.

UN (United Nations). 2013. *World Population Prospects: The 2012 Revision, Key Findings and Advance Tables.* ESA/P/WP.227. New York: UN Department of Economic and Social Affairs, Population Division.

Vollrath, D. 2009. "How Important Are Dual Economy Effects for Aggregate Productivity?" *Journal of Development Economics* 11 (3): 187–228.

World Bank. Various years. Doing Business database. www.doingbusiness.org/rankings.

World Bank. 2002. *An Assessment of the Private Sector in Nigeria*. Washington, DC: World Bank Regional Programme on Enterprise Development.

———. 2007. *Nigeria: Competitiveness and Growth: Country Economic Memorandum*. Report 36483-NG. Washington, DC.

———. 2008. *Nigeria: Agriculture Public Expenditure Review.* Report 44000-NG. Washington, DC.

———. Various years. World Development Indicators database. http://data.worldbank.org/data-catalog/world-development-indicators.

WTO (World Trade Organization). 2005. *Trade Policy Review, Nigeria.* WT/TPR/S/147. Geneva.