The High 5

Human Capital, Productivity, and Structural Transformation

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Abstract

This paper revisits the role of investment in human capital in closing the productivity gap, boosting labor productivity growth, speeding the rate of structural transformation, and ultimately creating high-quality jobs in Africa. Analysis of detailed sector-level historical data on employment, value added, and human capital shows that investment in human capital is significantly and positively associated with the rate at which countries close the labor productivity gap between agriculture and the rest of the economy. Investment in human capital also significantly increases labor productivity within sectors and the speed at which labor is reallocated from low-productivity to high-productivity employment. In line with other research on this topic, the findings from this study underscore that Africa is ready to benefit significantly from improving human capital through investments in education, health care, and nutrition.

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Human Capital, Productivity, and Structural Transformation

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1. Introduction

The rate of poverty reduction is often synonymous with the rate of structural transformation—the reallocation of economic activities (labor, land, and capital) across the broad sectors of agriculture, manufacturing, and services. This long-term process is at the center of economic development, so much so that the speed at which countries transform their economies is often equated with the pace at which poverty declines (Duernecker and Herrendorf 2016; Herrendorf, Rogerson, and Valentinyi 2013; McMillan et al. 2014). Indeed, it was through this long-term process of shifting economic activities from traditional to modern sectors that today's advanced economies pulled their populations out of poverty (McMillan et al. 2014). One of the channels through which structural transformation improves welfare is through higher employment in high-productivity sectors. In addition, structural transformation has important implications for labor productivity growth, hours worked, urbanization, and key features of the labor market, such as labor force participation and job polarization (Ngai and Petrongolo 2017; Barany and Christian 2018; Duernecker and Herrendorf 2015).

Over the last decade or so, Africa has seen a modest shift in employment from agriculture to high-productivity nonagricultural sectors, particularly to the services sector. However, unlike other emerging economies, such as the fast-growing East Asian countries, whose rapid economic growth was realized through export-oriented industrialization, the recent growth in Africa has been driven largely by the boom in commodity prices (Diao, McMillan, and Rodrik 2017). Industrialization has remained immature, and some countries have even experienced premature de-industrialization. Much of the labor force is still concentrated in the low-productivity agriculture sector, which accounts for about 60 percent of employment in Sub-Saharan Africa. Any shifts in labor from the agriculture sector have been mainly flows into jobs in the also low-productivity informal sector (Diao, McMillan, and Rodrik 2017; McMillan et al., 2014).

The muted structural transformation in Africa, despite the large and persistent labor productivity gap between agriculture and other sectors, is a widely shared concern among development economists. Detailed sector-level data on value-added and employment for 13 African countries show that labor productivity in services and industry sectors was about 2 to 3 times higher than the economy-wide average over 2005–2010, while labor productivity in agriculture was only 43 percent of the economy-wide average (Timmer, de Vries, and de Vries,

2015). Why does this large labor productivity gap between agriculture and nonagriculture sectors persist in Africa? Why has labor not been moving from low- to high-productivity sectors more rapidly in response to this large productivity gap? And what are the key factors that contribute to the low overall labor productivity growth and the slow pace of labor reallocation? Considering these policy issues, this paper revisits the role of investment in human capital in increasing labor productivity growth and structural transformation.

Three strands of the literature offer some explanations for the high productivity gap and the slow pace of structural transformation in Africa. One strand argues that preferences and technologies that generate a reallocation of labor from agriculture to other sectors are the results of growth (Herrendorf, Rogerson, and Valentinyim 2013). Based on the classical assumption of efficient allocation of labor—with minimal distortions—labor would move from low-productivity to high-productivity sectors in response to productivity differentials. Countries therefore must grow first to see a reallocation of labor from agriculture. A second strand of the literature argues that large productivity gaps persist in Africa because multiple distortions and barriers create inefficiency in allocating labor across sectors (Caselli 2005; Restuccia, Yang, and Zhu, 2008). The key difference between these two strands is the direction of causality—whether growth precedes the reallocation of labor or whether the reallocation precedes growth—which is more of an empirical matter concerning the efficiency of labor allocation than a philosophical one.

The third strand of the literature explains the persistent gap from a human capital perspective (Herrendorf and Schoellman, 2015). Using detailed data from advanced economies (Canada and United States), middle-income economies (Brazil and Mexico), and low-income economies (India and Indonesia), one study decomposed wage (productivity) gaps into the average sectoral human capital of workers and residual wage gaps. Using sector-level estimates of Mincerian returns to education (Mincer, 1974), and controlling for human capital, the analysis showed that the barriers that were the key reasons for the misallocation of labor accounted for a relatively small part of the wage gap—smaller than previously thought. A larger part of the gap was accounted for by the difference in human capital between low-productivity and high-productivity sectors. Whether this holds for a larger sample of developing countries, particularly in Africa, is the empirical question that this paper attempts to answer.

However, the literature discussed above and much of the broader growth and structural transformation literature fail to establish causality. As such, it is not clear whether moving workers from agriculture to the modern sectors would increase their productivity by a factor of 2 or 3 and thus also their incomes. A recent study tackled this issue head on (Hicks et al., 2017). Using carefully constructed micro-level panel datasets that followed individuals in Indonesia and Kenya over 30 years, the study found that nearly all (about 90 percent) of the observed productivity gap was attributable to individual self-selection or sorting between sectors. After controlling for individual fixed effects including abilities, the analysis found that the observed productivity gap between agriculture and the modern sectors is not as large as estimated in previous studies that used national accounts data. And after controlling for education and other factors, the analysis found that in both Indonesia and Kenya people with greater abilities were more likely to move (sort themselves) into urban and nonagriculture sectors.

The policy implications of these findings are consequential. First, the observed productivity gap between agriculture and modern sector using national accounts data could be misleading. Second, the typical wholesale policy prescription that moving labor out of agriculture increases productivity could be wrong, so caution is recommended before deducing that the labor shift would greatly increase productivity or incomes. Rather, policies to increase overall productivity and growth should focus on improving productivity in both agriculture and nonagriculture sectors, such as by improving skills and education (de La Fuente 2011; Herrendorf and Schoellman 2014; Hicks et al. 2017).

This study complements the literature on productivity gaps in Africa by revisiting investment in human capital as the key contributing factor to speedy structural transformation. Using detailed historical data on employment, value added, and human capital in 10 sectors for 13 African countries, the study analyzes the associations between human capital and the labor productivity gap, economy-wide labor productivity growth, within-sector labor productivity growth, and structural transformation (between-sector productivity growth). These associations, albeit noncausal, provide fresh evidence to policymakers on the nexus between human capital and the jobs crises in Africa. The database provides long-run internationally comparable data on sectoral productivity performance in Africa, Asia, and Latin America (see Table A1 in Appendix A for the full list of countries included in the database.)

2. Data and Descriptive Analysis

This paper uses data from the Groningen Growth and Development Center (GGDC) and the Penn World Table 9.0. The GGDC 10-Sector Database provides a long-run internationally comparable dataset on sectoral productivity performance in Africa, Asia, and Latin America. Variables covered in the data set are annual series of value added, output deflators, and persons employed for 10 broad sectors. The African countries included are Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia. The ten sectors are: 1) agriculture include agriculture, hunting and forestry, fishing; 2) mining include mining and quarrying; 3) manufacturing; 4) utilities include electricity, gas and water supply; 5) construction; 6) trade services include wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods, hotels and restaurants; 7) transport include transport services, storage and communications; 8) finance include financial intermediation, renting and business activities (excluding owner occupied rents); 9) government services include public administration and defense, education, health and social work; and 10) others include personal services, community, social and personal service activities, activities of private households.

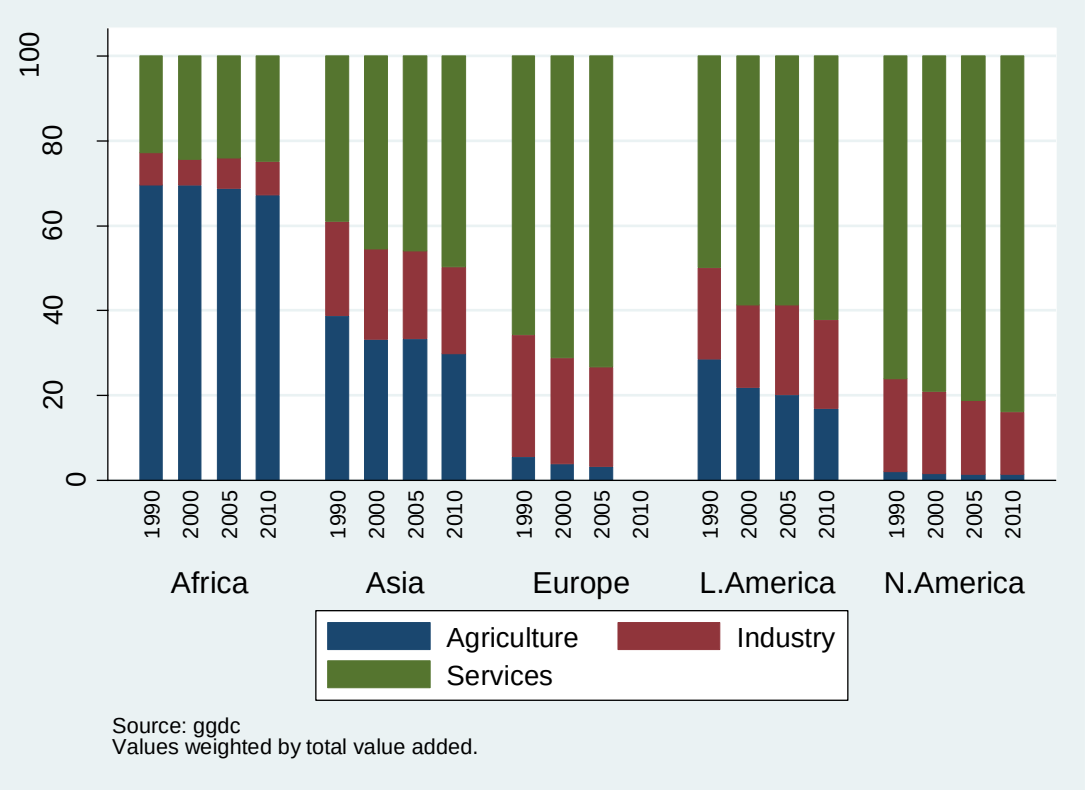
Employment and productivity patterns

Sectoral distribution of employment

Employment in Africa has historically been concentrated in the low-productivity agriculture sector (figures 1 and 2). Although agriculture's share in employment has been trending downward—from 66 percent in 1970 to 46 percent in 2010—the rate of decline has been sluggish, at just 0.76 percent a year.[‡] This is well above agriculture's share in Asia (21 percent) and Latin America (14 percent). Agriculture continues to be the largest employer in Africa.

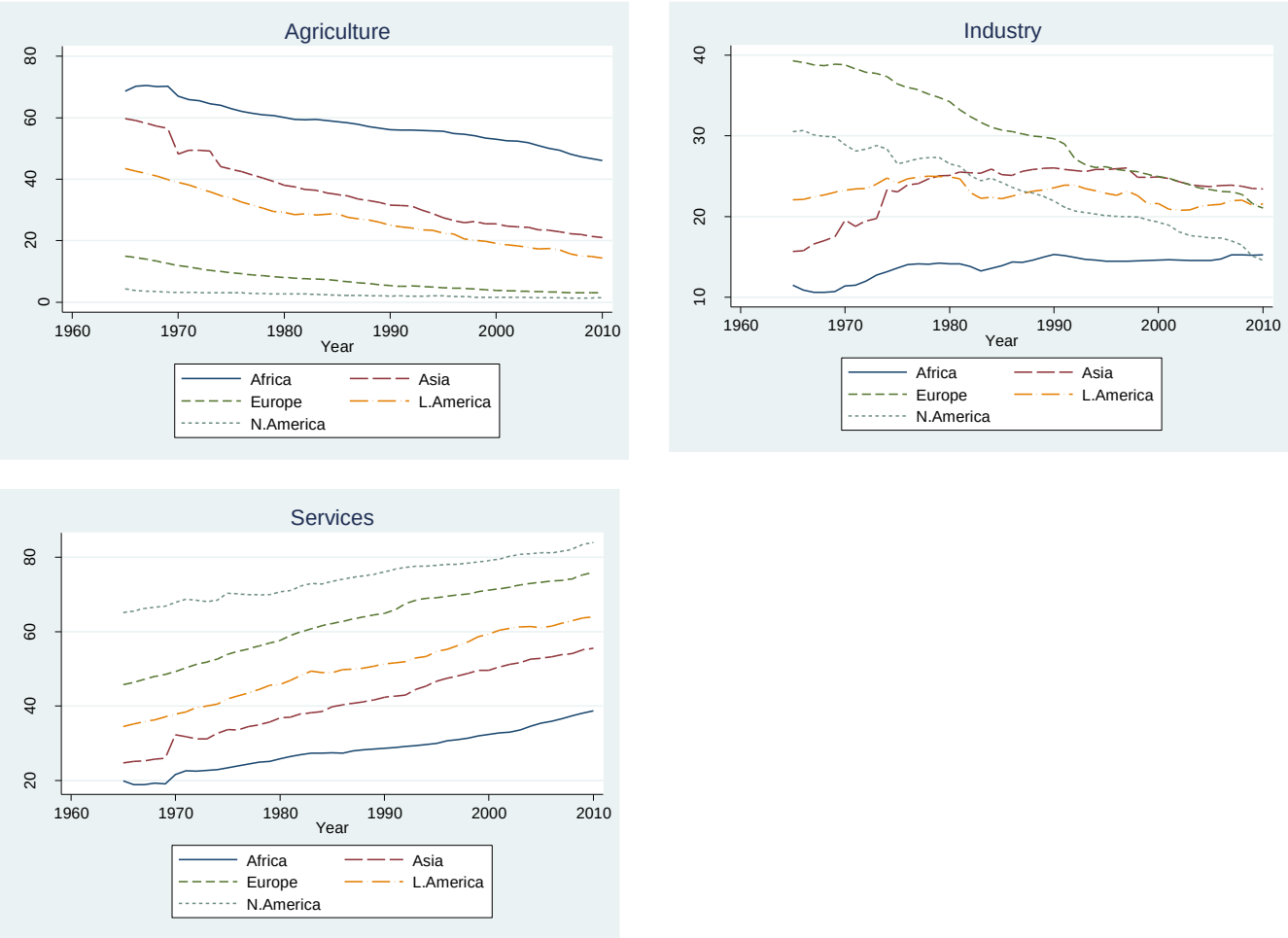
[‡] While this paper generally refers to 2010 as the end date for data series, the date is meant to stand in for the latest year for which data are available. The actual date may vary for some countries depending on availability of data. See table A1 for the full list of countries and periods for which data is available.

Figure 1 Agriculture's share in employment remains higher in Africa than in other regions, 1990, 2000, 2005, and 2010 …



Source: Calculation based on Groningen Growth and Development Center 10-sector data. Note: African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia.

Figure 2 Agriculture's share in employment has been declining much more slowly in Africa than in other regions, 1965–2010



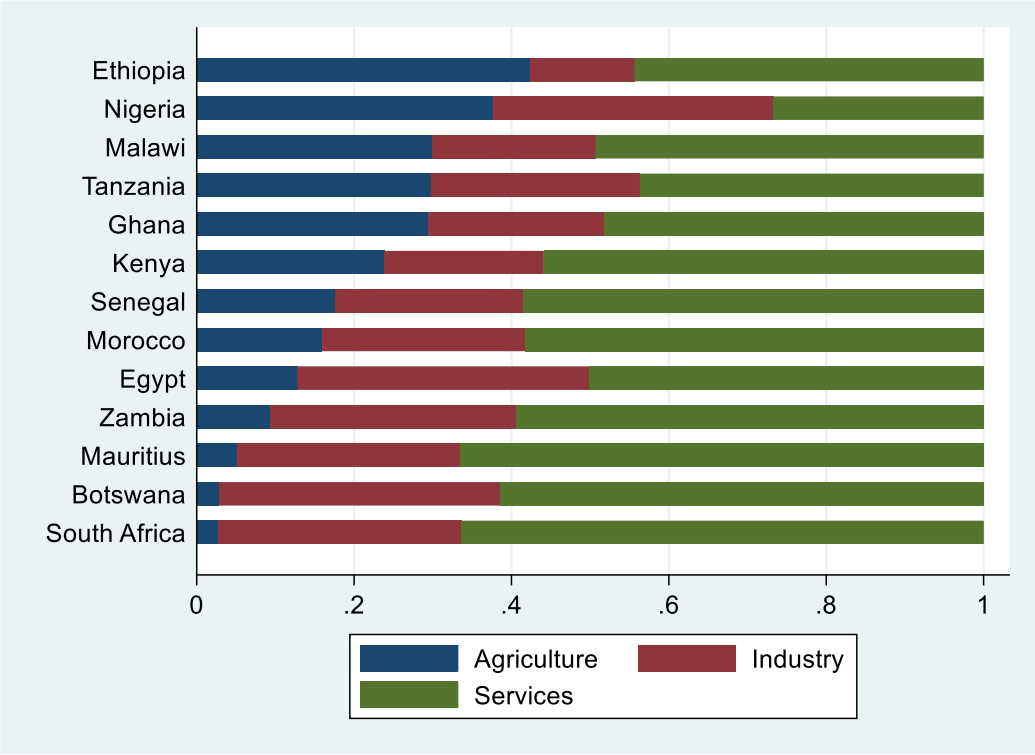
Source: Calculations based on Groningen Growth and Development Center 10-sector data. Note: African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia.

Two important patterns emerge for African countries. First, the majority of workers who moved out of agriculture moved into the services sector, which has been growing at 2 percent a year. Second, industry's share of employment has been growing at a near-stagnant average annual rate of 0.8 percent over 1970–2010, as the sector absorbed just a small proportion of new labor market entrants and workers exiting agriculture. Industry's share in total value added has been similarly anemic, at just 27 percent in 2010, well below the average of 38 percent in Asia and Latin America. Some countries in Africa have even experienced de-industrialization. The declining importance of industry began in the aftermath of the policy experiment with structural adjustment

programs in the 19080s. Scholars and policymakers are now calling for a renewed push toward industrialization in Africa.

Within these averages, there are considerable differences in the sectoral distribution of employment across African countries (figure 3). For most low-income Sub-Saharan African countries in the dataset (Ethiopia, Malawi, Nigeria, Tanzania, and Zambia), agriculture accounted for more than 60 percent of employment in 2010, while industry accounted for less than 10 percent. In contrast, in the more advanced economies of Mauritius and South Africa, the services sector accounted for more than 50 percent of employment, while agriculture's share was below 16 percent in 2010. Industry's share of employment was also substantial, at 30 percent in Mauritius and 21 percent in South Africa in 2010.

Figure 3 The sectoral share of employment varies in African countries, though agriculture predominates in most countries, 2010



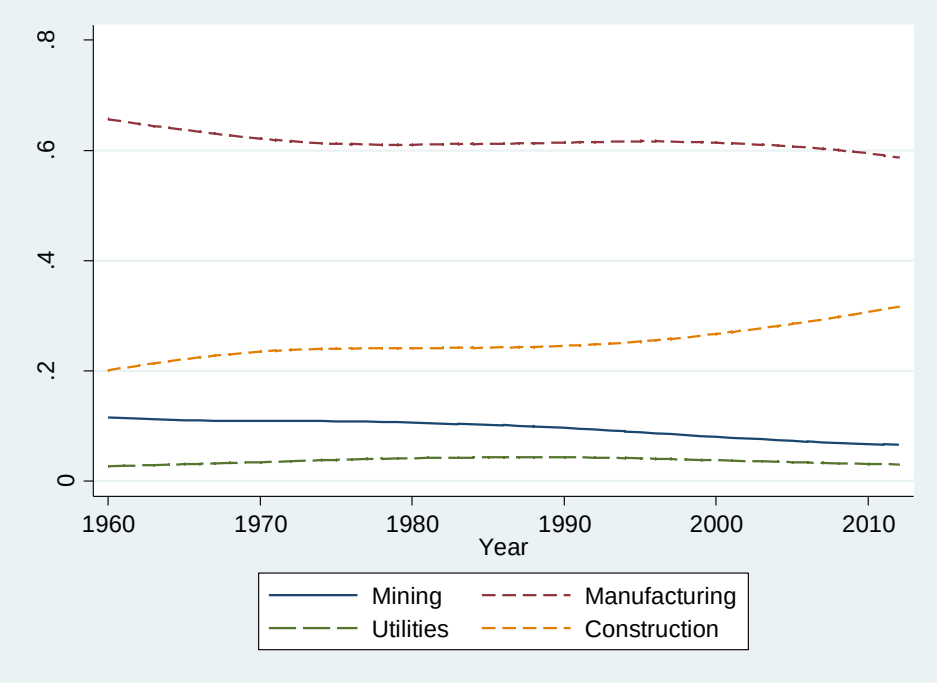
Source: Calculations based on Groningen Growth and Development Center 10-sector data. Note: African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia.

Within-sector distribution of employment

Employment distribution in the nonagriculture sectors reveals important patterns and differences (figures 4 and 5).

First, within the industry sector, manufacturing has been the dominant employer, but its relevance has been steadily declining in many parts of Africa. During manufacturing's heyday in the 1960s and 1970s, when most African countries used protectionist policies to support the growth of domestic manufacturing, it accounted for about 62 percent of industry employment. The share changed little until the late 1990s, when it started to decline, falling at an average annual rate of 0.46 percent after 2000. By 2010, manufacturing accounted for 59 percent of industry employment. Construction has been the second major employer in the industry sector, with a slightly increasing share of industry sector jobs over time. In 2010, that share was about 30 percent, a sizeable increase compared to the 25 percent average share during the 1990--1999 period. The shares of mining and utilities have remained small, together accounting for only 10 percent of industry employment.

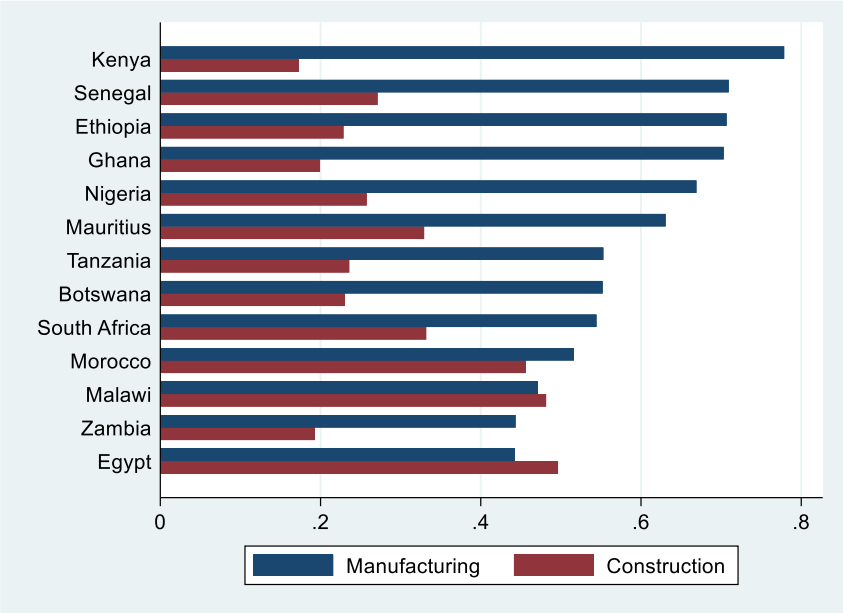
Figure 4 Within industry, construction employment shares have been rising in Africa while manufacturing shares have been falling, 1960-2010



Source: Calculations based on Groningen Growth and Development Center 10-sector data. Note: African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia.

There is considerable cross-country variation as well in the distribution of employment in the industry sector in the 13 countries included in the analysis (figure 5). In 2011, the highest share of manufacturing employment in industry employment was in Kenya (77 percent) and the lowest was in Egypt (42 percent). Generally, in half of the countries, two of every three workers in the industry sector were employed in manufacturing. In Egypt and Malawi, however, employment was higher in construction than in manufacturing.

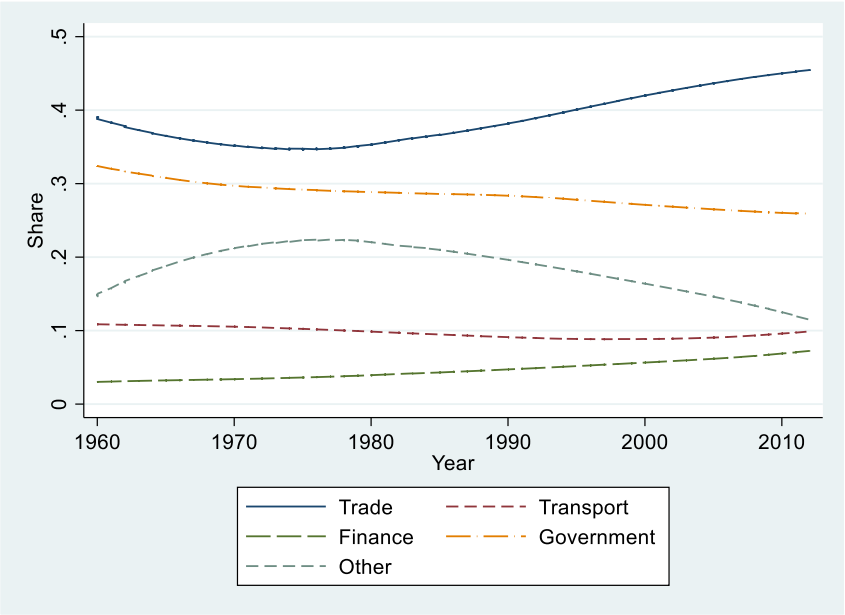
Figure 5 Manufacturing and construction shares of employment in the industry sector, by African country, 2010



Source: Calculations based on Groningen Growth and Development Center 10-sector data. Note: African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia.

Second, within the services sector, wholesale and retail trade have historically accounted for the bulk of sectoral employment, although much of that activity is in the informal sector. Trade's share has been rising since the mid-1990s, from below 40 percent to about 46 percent over 2010–13 (figure 6). The government sector (public administration and defense, education, health, and social work) is the second largest employer in the services sector, at 26 percent in 2010, though its share has been declining. The employment shares of other services sectors, including finance, transport, and other services, are small, each at 10 percent or less of services sector employment in 2010.

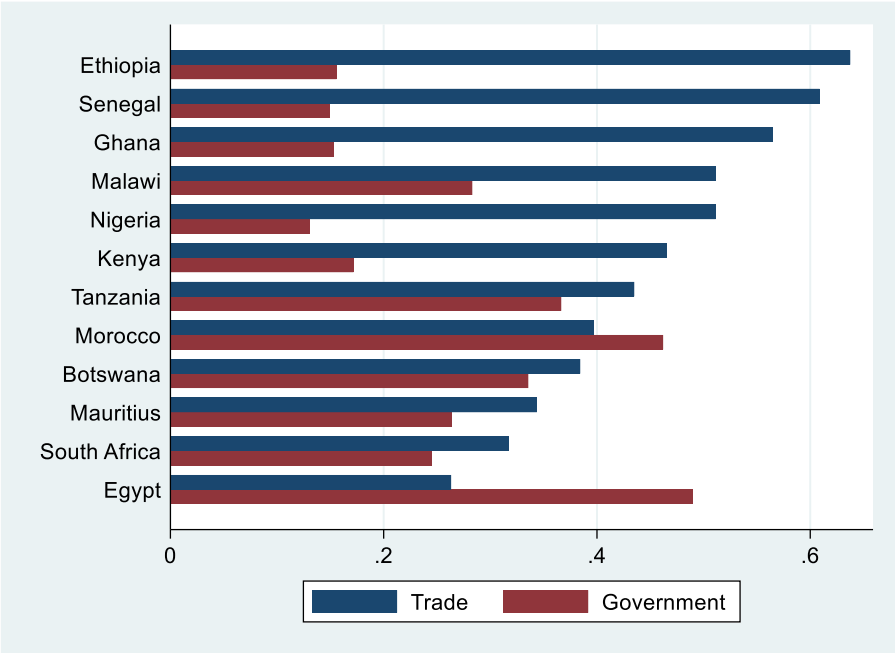
Figure 6 Trade continues to have the largest employment share within the services sector in Africa, 1960–2010



Source: Calculations based on Groningen Growth and Development Center 10-sector data. Note: African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia.

Within these averages, there are considerable differences across countries in the employment shares of trade and the government sector in total services sector employment (figure 7). Trade is the biggest employer in Ethiopia (64 percent), Senegal (60 percent), Ghana (57 percent), Zambia (52 percent), Malawi (51 percent), and Nigeria (51 percent). Egypt and Morocco stand out for the size of their government sector employment. Nearly one in two Egyptians and Moroccans working in the services sector (and nearly one in four workers overall in Egypt) worked for the government sector in 2012.

Figure 7 Trade and government sector shares of employment in the services sector, by African country, 2010



Source: Calculations based on Groningen Growth and Development Center 10-sector data. Note: African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, and Tanzania (excluding Zambia due to missing observation.)

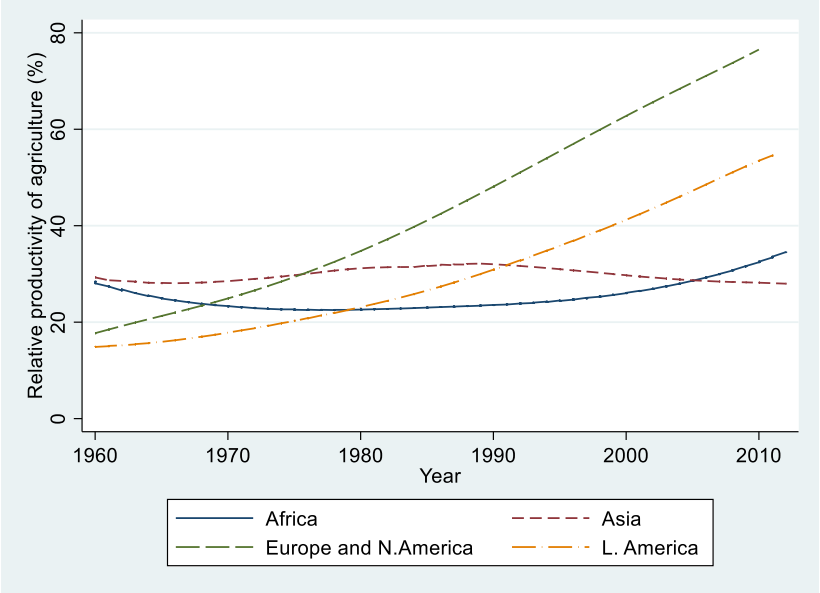
The productivity gap between agriculture and other sectors

Productivity—output per input—is a measure of real compensation for factors used in production—labor, capital, and land. Growth in labor productivity is a key indicator of improvement in welfare as it measures the compensation of labor and, under perfect conditions and wage distribution, real wages.

Labor productivity varies by sector. Agriculture has historically been associated with lower wages, and manufacturing and services with higher wages. In developing countries, the productivity gap between agriculture and other sectors is particularly large and persistent. Development economists argue that a large productivity gap could be an engine of growth: a reallocation of labor from a low-productivity sector to a high-productivity sector could result in economic growth even if within-sector labor productivity remained constant (McMillan et al., 2014).

For quite some time, the ratio of the productivity of labor in agriculture to the productivity of labor in nonagriculture sectors (relative productivity of agriculture) has been lower in Africa than in other regions of the world, where agricultural productivity has improved significantly (figure 8). In 2010, labor productivity in agriculture was 80 percent of that in nonagriculture sectors in Europe and North America, 52.7 percent in Latin America, and 31.2 percent in Africa. This implies that an average agricultural worker in Europe and North America generates 80 percent of the value produced by an average worker in the nonagriculture sectors compared with 31.2 percent in Africa. Only Asia has a lower relative productivity of agriculture than Africa, at 28 percent. Changes in the relative productivity of agriculture can reflect improvements or declines in agriculture or improvements or declines in other sectors—or both.

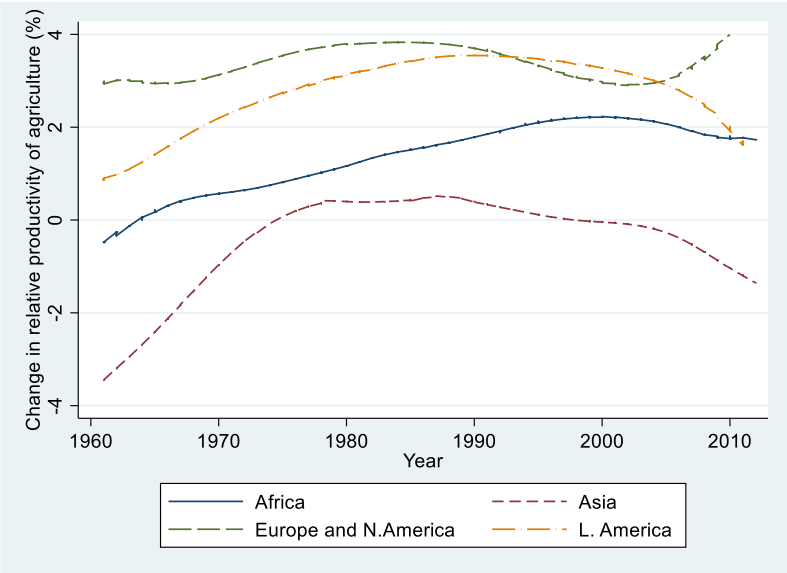
Figure 8 Trends in the relative productivity of agriculture, by region, 1960–2010



Note: The relative productivity of agriculture is the ratio of labor productivity in agriculture to labor productivity in nonagriculture sectors. African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia. Source: Calculations based on Groningen Growth and Development Center 10-sector data.

The productivity gap has remained more or less unchanged for African countries, closing by an average annual rate of only about 1 percent over 1960–2010 (figure 9). The productivity gap even widened for Asia, at a rate of 0.02 percent a year, presumably due to large improvements in nonagriculture sector productivity. These trends are in sharp contrast with the rapid closing of the labor productivity gap in Europe and North America, at 3.35 percent a year.

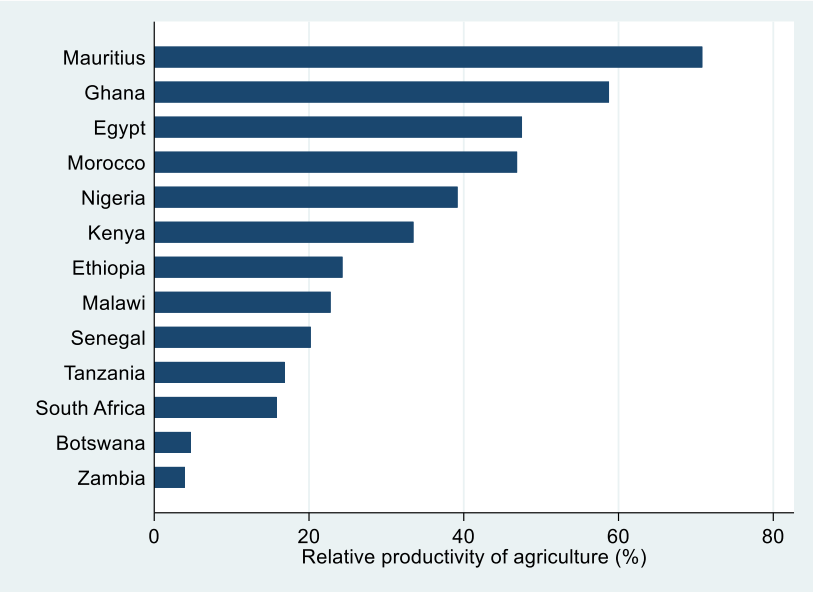
Figure 9 Percentage change in the relative productivity of agriculture, by region, 1960–2010



Note: The relative productivity of agriculture is the ratio of labor productivity in agriculture to labor productivity in nonagriculture sectors. African countries included in the computation: Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Morocco, Nigeria, Senegal, South Africa, Tanzania, and Zambia. Source: Calculations based on Groningen Growth and Development Center 10-sector data.

However, since 2000, the productivity gap in Africa has been narrowing much more rapidly, at more than 2 percent a year, due mainly to improving productivity within the agriculture sector. Though this trend is positive and encouraging, the pace of change is still slow compared with advanced economies. Furthermore, there are large differences across African countries, and the current relative productivity of agriculture is low in many of them (figure 10). For instance, in 2010, the relative productivity of agriculture ranged from 71 percent in Mauritius to 4 percent in Zambia. There were also differences across countries in the trend as well (see figure A1 in the appendix). The relative productivity of agriculture has been trending upward in Egypt, Ghana, Kenya, Malawi, and Tanzania and, recently in Ethiopian and South Africa, while Nigeria experienced a large decline between the 1960s and 1980s, with a slight rebound since 2000.

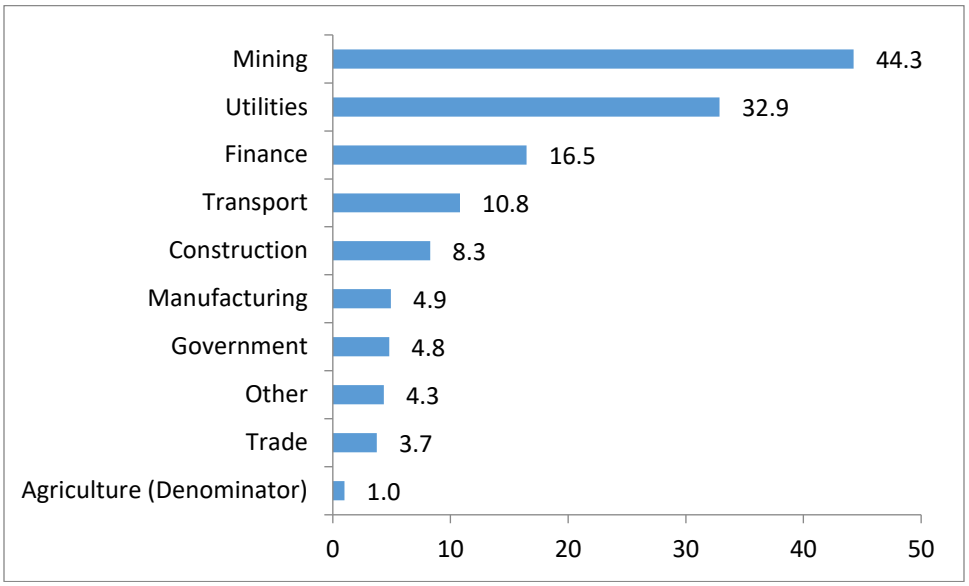
Figure 10 Relative productivity of agriculture, by African country, 2010



Note: The relative productivity of agriculture is the ratio of labor productivity in agriculture to labor productivity in nonagriculture sectors. Source: Calculations based on Groningen Growth and Development Center 10-sector data.

Looking at productivity in the subsectors covered in the data relative to productivity in agriculture (this time with agriculture as the denominator and the other sectors as the numerator) reveals even more dramatic variations in the labor productivity gap (figure 11). Productivity in the mining sector is an astonishing 44.3 times higher than in agriculture, followed by the utilities sector, where productivity is 32.9 times higher. Similarly, labor productivity in the other nonagriculture sectors are much higher than in agriculture 6.3 times in finance, 10.8 times in transport, 8.3 times in construction, 4.9 times in manufacturing; 4.8 times in the government sector, 4.3 in other sectors, and 3.7 times in trade.

Figure 11 Labor productivity of nonagriculture subsectors relative to labor productivity in agriculture, 2010



Source: Calculations based on Groningen Growth and Development Center 10-sector data. Note: Computation based on 10 African countries: Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, and Tanzania.

This analysis of the productivity gap in Africa raises two questions. Why are such large segments of the labor market in Africa still stuck in the agriculture sector? To what extent does human capital explain the slow pace of labor movement from low-productivity to high-productivity sectors?

Economy-wide labor productivity growth

This section delves deeper to assess the speed of structural transformation in Africa. The standard approach is to decompose economy-wide labor productivity growth into two components: within-sector labor productivity growth and between-sector labor productivity growth (due to the movement of labor from low-productivity to high-productivity sectors, or structural transformation). Economy-wide labor productivity growth can be decomposed as follows:

$$\Delta y^t = \sum_i \theta_i^{t-k} \Delta y_i^t + \sum_i y_i^t \Delta \theta_i^t, \qquad (1)$$

This decomposition follows McMillan and Rodrik (2011), where y^t denotes economy-wide productivity, y_i^t denotes sectoral productivity levels, and θ_i^t is the share of employment in sector

i. The first term on the right side of the equation measures the within-sector productivity growth, and the second term measures the productivity effect of reallocating labor between sectors (structural transformation). The decomposition results are displayed in table 1 and in figure A3 in the appendix).

Between 1960 and 2010, average economy-wide labor productivity in the 12 African countries in the dataset grew by 1.1 percent annually. Labor productivity grew faster than average in the period right after independence (1960–74), at an average annual rate of 1.2 percent. However, in the following period (1975–90), when much of the continent experienced the disruption of civil wars and political instability, productivity growth slowed to an average of 0.3 percent annually and was even negative for many African countries. Not until the early 2000s did productivity growth start to pick up again. Since 2000, it has grown at an average rate of 2.2 percent annually.

More than half (56 percent) of the growth in economy-wide labor productivity over 1960–2010 was due to within-sector productivity growth, which grew at 0.6 percent annually. But the rate varied considerably over the period. Reflecting the overall economic and political instability during 1975–90, within-sector productivity growth declined at 0.15 percent annually. During 2000–10, labor productivity growth rebounded, and within-sector productivity grew at an average annual rate of 1.6 percent, which accounted for 73 percent of the growth in economy-wide labor productivity. Thus, despite the faster economy-wide labor productivity growth in 2000–10, the contribution of structural change to productivity growth was small and even declined, underscoring the deep concern of policymakers about the lack of the type of high-quality job creation that usually accompanies rapid economic growth.

Botswana, Egypt, Ethiopia, Mauritius, Nigeria, South Africa, and Zambia broadly followed this pattern, with within-sector productivity growth accounting for much of the growth in economy-wide labor productivity during 2000–13. For instance, in Mauritius, which has had the highest growth in Africa, at 4.9 percent a year, structural transformation contributed just 15.4 percent to economy-wide labor productivity growth (figure 12). However, in Ghana, Kenya, Malawi, Senegal, and Tanzania, economy-wide labor productivity growth was more modest and was accounted for primarily by structural change. Tanzania and Nigeria are at the extreme ends of

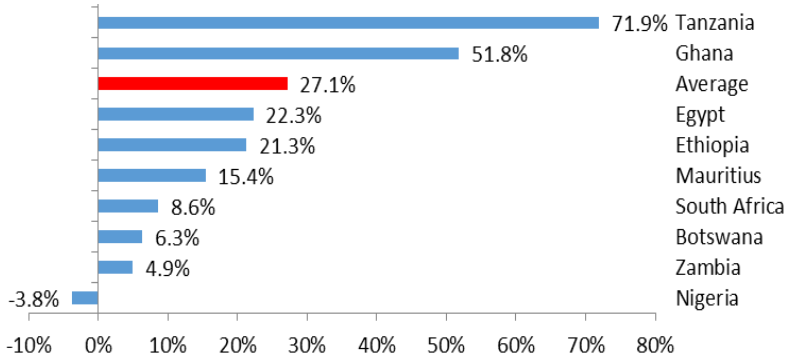
the distribution, with contributions of structural change to overall labor productivity growth of 71.9 percent and –3.8 percent, respectively. This heterogeneity across countries arises from different factors, including weather patterns that adversely affected agriculture, geography, macroeconomic conditions, and other country specific factors.

Table 1 Decomposition of annual labor productivity growth, by country and period, 1960–2010

Country	1960–2010			1960–75			1975–90			2000–10 (or latest)		
	Overall	Within-sector	Between sectors	Overall	Within-sector	Between sectors	Overall	Within-sector	Between sectors	Overall	Within-sector	Between sectors
Botswana	2.94	1.7	1.24	2.63	0.91	1.72	3.77	1.34	2.43	2.38	2.23	0.15
Egypt	2.67	2.02	0.65	2.04	1.56	0.47	4.47	3.56	0.91	3.14	2.43	0.7
Ethiopia	–0.26	–0.32	0.06	–0.56	–0.43	–0.13	–1.63	–1.59	–0.03	2.07	1.63	0.44
Ghana	0.45	0.12	0.33	–0.61	–0.83	0.22	–1.31	–1.33	0.03	2.2	1.07	1.14
Kenya	–0.04	–0.71	0.67	0.22	0.16	0.06	–0.02	–0.44	0.42	0.71	–0.02	0.73
Mauritius	4.36	3.42	0.93	7.35	6.09	1.26	2.8	2	0.8	4.94	4.18	0.76
Malawi	0.03	–0.31	0.34	–0.37	–0.31	–0.06	–0.55	–0.49	–0.06	0.6	–0.61	1.21
Nigeria	0.9	0.96	–0.07	1.67	1.49	0.18	–1.04	–1.48	0.44	2.88	2.98	–0.11
Senegal	–0.56	–1.19	0.63	–1.28	–1.49	0.21	–1.78	–2.31	0.53	0.76	–0.12	0.88
South Africa	1.95	0.96	0.99	3.73	2.09	1.65	0.05	–1.03	1.08	3.72	3.4	0.32
Tanzania	0.38	0.09	0.3	0.18	0.12	0.07	0.03	–0.16	0.19	1.21	0.34	0.87
Zambia	0.18	0.44	–0.26	–0.73	–0.45	–0.28	–0.8	0.09	–0.89	1.85	1.76	0.09
Average	**1.08**	**0.6**	**0.48**	**1.19**	**0.74**	**0.45**	**0.33**	**–0.15**	**0.49**	**2.21**	**1.61**	**0.6**

Source: Calculations based on Groningen Growth and Development Center 10-sector data. Note: Unweighted averages; values might not sum to totals because of rounding.

Figure 12 The contribution of structural change to economy-wide labor productivity growth varied considerably by country but was low in most countries, 2000–2010



Note: Kenya, Malawi, and Senegal are not shown in the figure because their within-sector productivity growth was negative during the period, which would show a contribution of structural change of more than 100 percent. Moreover, the economy-wide productivity growth for these countries was below 1 percent a year. Source: Calculations based on Groningen Growth and Development Center 10-sector data.

Labor productivity growth in services and industry sectors

The same decomposition equation as for economy-wide productivity growth was also used to decompose productivity growth separately for the services and industry sectors (figure 13).

Since 2000, a large part of labor productivity growth in the services sector in Nigeria, Botswana, South Africa, Egypt, and Mauritius was driven by within-sector labor productivity growth rather than by the reallocation of labor across subsectors, for example, from trade to transport. Mirroring the economy-wide decline in labor productivity growth during the period, within-sector labor productivity growth in the services sector was negative. Furthermore, the reallocation of labor between subsectors of the services sector contributed very little to labor productivity growth in the sector in most of the countries in the study (see figure 13).

Three countries stood out, however: Nigeria, Ethiopia, and Zambia. In Nigeria, the reallocation of labor from low-productivity to high-productivity services subsectors contributed negatively to the broader services sector labor productivity growth. This is in line with the between-sector contribution to economy-wide labor productivity growth in Nigeria (see table 1), reflecting a much deeper structural issue on the allocation of labor and other resource within the economy. In contrast, in Ethiopia and Zambia, the reallocation of labor between subsectors of the services sector contributed positively to overall services sector labor productivity growth This

shows that there is room for realizing productivity gains simply by reallocating labor from one services subsector to another.

Figure 13 Labor productivity growth decomposition in the services and industry sectors, 2000–2010

Source: Calculations based on Groningen Growth and Development Center 10-sector data.

Industry sector labor productivity growth was very small throughout the decade (see figure 13). However, the contributions of the two components of labor productivity growth to overall labor productivity growth in the sector varied across countries. The reallocation of labor between subsectors (structural transformation) contributed negatively to labor productivity growth in the industry sector in Mauritius, Egypt, Botswana, South Africa, Ghana, and Morocco, countries in which industry's economic importance declined or stagnated over 2000–10 (see figure A4 in the appendix). The opposite is true for Ethiopia, Senegal, Nigeria, and Zambia, where the importance of the industry sector has been increasing.

The role of human capital

The importance of human capital in economic growth and structural transformation is well documented (Among many other studies, see Acemoglu, Gallego, and Robinson 2014; Herrendorf, Rogerson, and Valentinyi 2013; Diao and Rodrik 2017; Barro 2001). Conditional on the initial

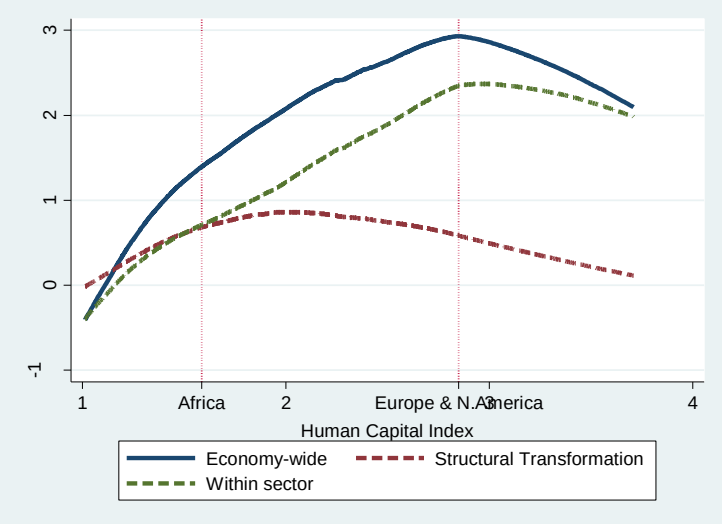
level of development (GDP), human capital accelerates economic growth through at least two channels: it facilitates the absorption of technologies, and unlike physical capital, it is difficult to destroy. Higher levels of human capital enable countries to absorb new technologies from leading countries faster and more easily, it augments or complements the existing factors of production, and facilitates innovation. And because human capital is more or less indestructible, even countries whose physical capital has been destroyed through war and natural causes, such as Tsunamis, tend to grow much faster than those with lower levels of human capital (Barro, 2001). An example is Germany after the Second World War: because of its wealth of human capital, Germany was able to rebuild its economy out of ruins in less than a generation.

Human capital growth and structural transformation

In Africa, too, human capital[4] exhibits a positive relationship with average annual growth in labor productivity (figure 14), revealing promise for speeding the pace of structural transformation and thus the pace of high-productivity job creation. But the magnitude of the correlation decreases after a certain level. Human capital is also positively correlated with both within-sector and between-sector (structural transformation) labor productivity growth. This implies that countries that started off with lower levels of human capital have more scope to accelerate labor productivity growth, including structural transformation, by increasing human capital through investments in education, health, and nutrition. However, for more advanced economies, which have already passed through the early stages of development, the role of human capital in structural transformation appears to be marginal. For example, the contribution of human capital to economy-wide and within-sector labor productivity growth starts to decline beyond a Human Capital Index of 3, which is the average value for Europe and North America.

[4] The data on the human capital index are obtained from the Penn World Table version 9.0, which was derived from average years of schooling and returns to education (available at https://www.rug.nl/ggdc/docs/human_capital_in_pwt_90.pdf).

Figure 14 The relationship between labor productivity growth and human capital



Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital. Note: The Human Capital Index is calculated index of human capital per person, based on years of schooling (Barro/Lee, 2012) and returns to education (Psacharopoulos, 1994). Human capital per worker does not have a natural unit. The value of human capital index in the PWT9.0 ranges between 1 and 3.7.

But for countries with low human capital (an index value below 3), the correlation between human capital and economy-wide labor productivity growth—primarily through a positive contribution to within-sector labor productivity growth—is high and positive. Human capital also contributes to structural transformation, but the inflection point beyond which its contribution begins to decline is lower, at around an average index value of 2. The pooled average was around 2 in 2010 for the 12 countries included in the analysis; of these countries, Ethiopia, Malawi, Nigeria, Senegal, and Tanzania had an index value of less than 2. That implies that there is considerably scope to speed up the pace of labor productivity growth and of structural transformation through investments in human capital. Although the level of human capital in Africa is far behind that in other regions, the trend is upward. And again, there is wide variation across countries, with Botswana far advanced and Ethiopia trailing (see figures A5 and A6 in the appendix).

3. Regression Results and Discussions

To further inform the assessment of positive correlations between human capital and economy-wide labor productivity growth and structural transformation, a simple ordinary least squares regression was run on a pooled cross-country sample 41 countries over 1970–2010 to determine the extent to which human capital explains the observed productivity gap between agriculture and nonagriculture sectors (table 2).[5] Similar regressions were run for economy-wide labor productivity growth, within-sector labor productivity growth, and the rate of structural transformation (all derived from equation 1; tables 3–5). The regressions controlled for the initial levels of human capital and GDP using 1960s averages. Year and regional dummy variables were included to control for time and geographic factors that vary by region, and region–year interaction terms were included to factor out region-specific time-varying factors.

Human capital significantly increases growth in the relative productivity of agriculture (ratio of the productivity of labor in agriculture to the productivity of labor in nonagriculture sectors), indicating a reduction in the labor productivity gap between agriculture and the other sectors (table 2a). After initial human capital, initial GDP, region, year, and region-specific time effects are controlled for in specification 6, the coefficient implies that a 1 percentage point increase in the growth of human capital increases growth in the relative productivity of agriculture by 0.73 percentage point. However, the coefficients on region-specific estimations show that the relationship between human capital growth and growth in the relative productivity of agriculture for African countries is positive but statistically insignificant (table 2b).

[5] Data on human capital are from Penn World Table 9.0; other data are from the Groningen Growth and Development Center.

Table 2a Simple ordinary least squares regression of growth in relative productivity of agriculture, pooled sample, [1970–2010]

		(1)	(2)	(3)	(4)	(5)	(6)
Growth in human capital	0.226	0.560	0.520	0.783**	0.725*	0.725*	
	(0.338)	(0.355)	(0.357)	(0.362)	(0.388)	(0.388)	
Observations	1,642	1,642	1,642	1,642	1,642	1,642	
R-squared	0.000	0.006	0.010	0.022	0.157	0.157	
Initial human capital		X	X	X	X	X	
Initial GDP			X	X	X	X	
Region				X	X	X	
Year					X	X	
Region-year interaction						X	

* p<0.1; ** p<0.05. Note: Numbers in parentheses are standard errors. The relative productivity of agriculture is the ratio of labor productivity in agriculture to labor productivity in nonagriculture sectors. Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital.

Table 2b Simple ordinary least squares regression of growth in relative productivity of agriculture, by region, [1970–2010]

	Developing country regions			Europe and North America
	Africa	Asia	Latin America	
Growth in human capital	0.896	–0.0226	1.349*	–0.282
	(0.688)	(0.699)	(0.725)	(2.546)
Observations	499	446	376	321
R-squared	0.102	0.130	0.106	0.180
Initial human capital	X	X	X	X
Initial GDP	X	X	X	X
Year	X	X	X	X

* p<0.1. Note: Numbers in parentheses are standard errors. The relative productivity of agriculture is the ratio of labor productivity in agriculture to labor productivity in nonagriculture sectors. Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital.

The evidence is quite strong on the positive contribution of human capital to economy-wide labor productivity. A 1 percentage point increase in human capital growth leads to a 0.37 percentage point increase in growth in economy-wide labor productivity (table 3a). The relationship is even stronger for African countries, with a 1 percentage point increase in human

capital growth leading to a 0.9 percentage point increase in economy-wide labor productivity growth (table 3b). As in the relationship shown in figure 13, human capital growth appears not to be associated with economy-wide labor productivity in Asia or Europe and North America, while contributing negatively in Latin America.

Table 3a Simple ordinary least squares regression of economy-wide labor productivity growth, pooled sample, [1970–2010]

	(1)	(2)	(3)	(4)	(5)	(6)
Growth in human capital	0.200	0.501***	0.501***	0.284*	0.366**	0.366**
	(0.150)	(0.157)	(0.154)	(0.154)	(0.157)	(0.157)
Observations	1,660	1,660	1,660	1,660	1,660	1,660
R-squared	0.001	0.022	0.061	0.104	0.305	0.305
Initial human capital		X	X	X	X	X
Initial GDP			X	X	X	X
Region				X	X	X
Year					X	X
Region-year interaction						X

* p<0.1; ** p<0.05; *** p<0.01. Note: Numbers in parentheses are standard errors. Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital.

Table 3b Simple ordinary least squares regression of economy-wide labor productivity growth, by region, [1970–2010]

	Developing country region			Europe & North
Variable	**Africa**	**Asia**	**Latin America**	**America**
Growth in human capital	0.896***	0.435	–1.156***	–0.756
	(0.224)	(0.321)	(0.362)	(0.806)
Observations	499	448	378	335
R-squared	0.152	0.232	0.355	0.322
Initial human capital	X	X	X	X
Initial GDP	X	X	X	X
Year	X	X	X	X

*** p<0.01. Note: Numbers in parentheses are standard errors. Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital.

There is no statistically significant relationship between human capital growth and within-sector labor productivity for the pooled sample (table 4a). However, when the model is run by

region, human capital growth is found to be significantly and positively associated with within-sector productivity growth in Africa but not in other regions (table 4b). A 1 percentage point increase in the growth of human capital is associated with a 0.65 percentage point increase in within-sector labor productivity growth in Africa.

Table 4a Simple ordinary least squares regression of within-sector labor productivity growth, pooled sample, [1970–2010]

	(1)	(2)	(3)	(4)	(5)	(6)
Growth in human capital	0.0727	0.387**	0.403***	0.194	0.257	0.257
	(0.148)	(0.155)	(0.154)	(0.153)	(0.157)	(0.157)
Observations	1,660	1,660	1,660	1,660	1,660	1,660
R-squared	0.000	0.023	0.054	0.103	0.283	0.283
Initial human capital		X	X	X	X	X
Initial GDP			X	X	X	X
Region				X	X	X
Year					X	X
Region-year interaction						X

** p<0.05; *** p<0.01. Note: Numbers in parentheses are standard errors. Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital.

Table 4b Simple ordinary least squares regression of with sector labor productivity growth, by region, [1970–2010]

	Developing country region			Europe & North America
Variable	**Africa**	**Asia**	**Latin America**	
Growth in human capital	0.648***	0.479	–1.138***	-0.641
	(0.224)	(0.318)	(0.376)	(0.788)
Observations	499	448	378	335
R-squared	0.131	0.221	0.315	0.318
Initial human capital	X	X	X	X
Initial GDP	X	X	X	X
Year	X	X	X	X

*** p<0.01. Note: Numbers in parentheses are standard errors. Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital.

After controlling for initial human capital levels, initial GDP, region, year, and region-year interaction terms (specification 6), the pooled regressions show that a 1 percentage point increase in human capital growth is associated with a 0.11 percentage point increase in the rate of structural transformation (tables 5a). What is striking is that this positive and statistically significant association is driven primarily by African countries. The coefficient is positive and statistically significant only for African countries; it is negative and not significant for other regions (table 5b). In Africa, a 1 percentage point increase in human capital growth is associated with a 0.25 percentage point increase in the rate of structural transformation.

Table 5a Simple ordinary least squares regression of rate of structural transformation, pooled sample, [1970–2010]

	(1)	(2)	(3)	(4)	(5)	(6)
Growth in human capital	0.128***	0.114**	0.0980**	0.0896*	0.109**	0.109**
	(0.0446)	(0.0471)	(0.0471)	(0.0478)	(0.0512)	(0.0512)
Observations	1,660	1,660	1,660	1,660	1,660	1,660
R-squared	0.005	0.005	0.019	0.030	0.162	0.162
Initial human capital	--	X	X	X	X	X
Initial GDP	--	--	X	X	X	X
Region	--	--	--	X	X	X
Year	--	--	--	--	X	X
Region-year interaction	--	--	--	--	--	X

** p<0.05; *** p<0.01. Note: Numbers in parentheses are standard errors. Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital.

Table 5b Simple ordinary least squares regression of rate of structural transformation, by region, [1970–2010]

	Developing country regions			Europe & North
Variable	**Africa**	**Asia**	**Latin America**	**America**
Growth in human capital	0.248***	–0.0447	–0.0176	–0.116
	(0.0668)	(0.102)	(0.148)	(0.110)
Observations	499	448	378	335
R-squared	0.117	0.164	0.180	0.516
Initial human capital	X	X	X	X
Initial GDP	X	X	X	X
Year	X	X	X	X

*** p<0.01. Note: Numbers in parentheses are standard errors. Source: Calculations based on Groningen Growth and Development Center 10-sector data on sector-level employment and value added and Penn World Table 9.0 data on human capital.

4. Conclusion and policy implications

Africa's buoyant economic growth over the past decade and a half failed to be accompanied by the robust creation of good quality jobs. Although there has been a modest shift in employment from agriculture to nonagriculture sectors, the shift has been mainly to jobs in the low-productivity informal sector. The slow rate of structural transformation—despite the wide and persistent productivity gaps between agriculture and other sectors—has long been seen as a manifestation of a fundamental and structural jobs problem. Unemployment, underemployment, and informality have taken deep root as decent job opportunities remain elusive, especially for the increasingly large youth population in Africa. With the enormous pressure that impending demographic change will bring to African labor markets, the jobs problem will become not just an economic issue but also a social and political issue, threatening the political and social stability of the continent.

Building on previous research, this study found that, despite some shift of employment into nonagriculture sectors, most notably since 2000, the gap in productivity persists—and not only between the agriculture on the one hand and services and industry on the other, but also within these sectors. However, there is considerable variation across African countries in the patterns and distribution of employment and labor productivity.

Important for policy, the level and growth in human capital in countries are significantly associated with how fast countries close their productivity gaps. Furthermore, human capital is the main driver of both productivity growth within sectors and the pace of structural transformation in Africa. In line with the findings in the literature, the implication of this study is that human capital is the fundamental factor behind structural transformation of the economy and the creation of decent job opportunities. Africa is particularly well positioned to reap large benefits in labor productivity growth and accelerated structural transformation from investing in human capital by improving education, health, and nutrition. Africa should seize the opportunity.

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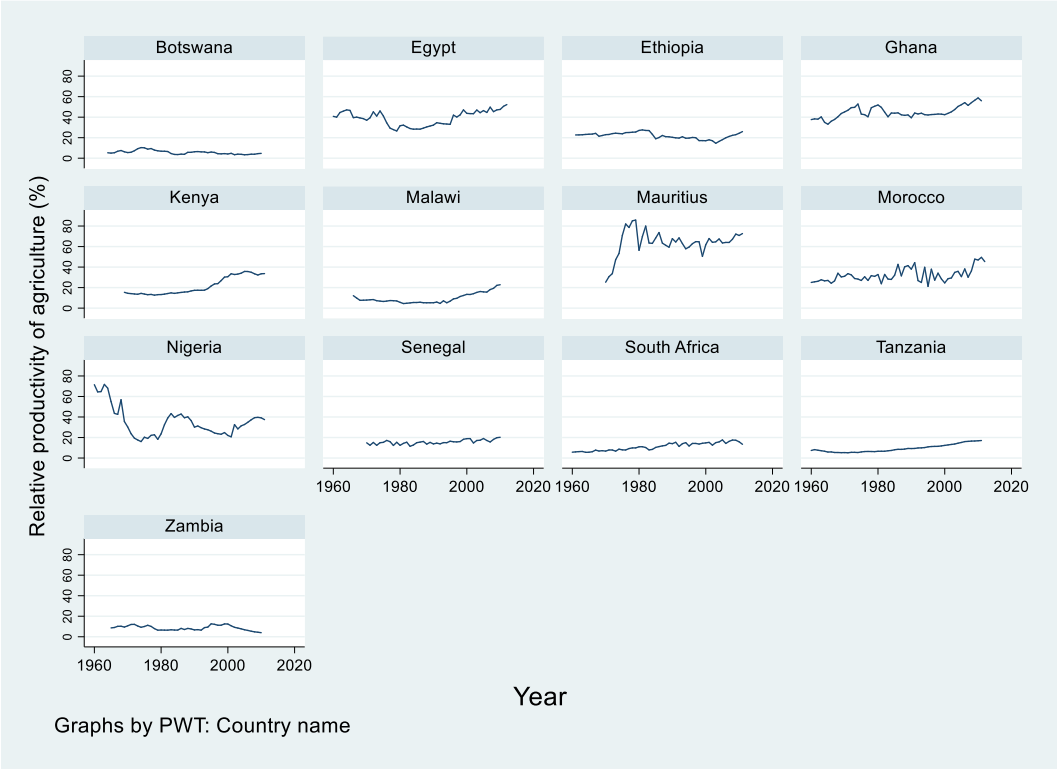
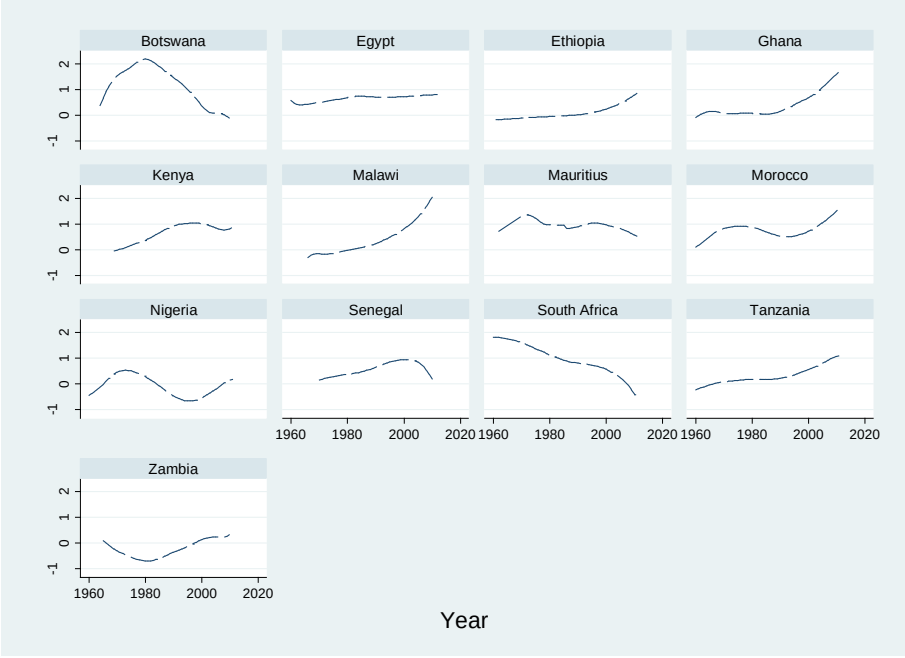
Appendix. Additional Tables and Figures

Figure A1 Labor productivity in agriculture relative to nonagriculture sectors, 1960–2010



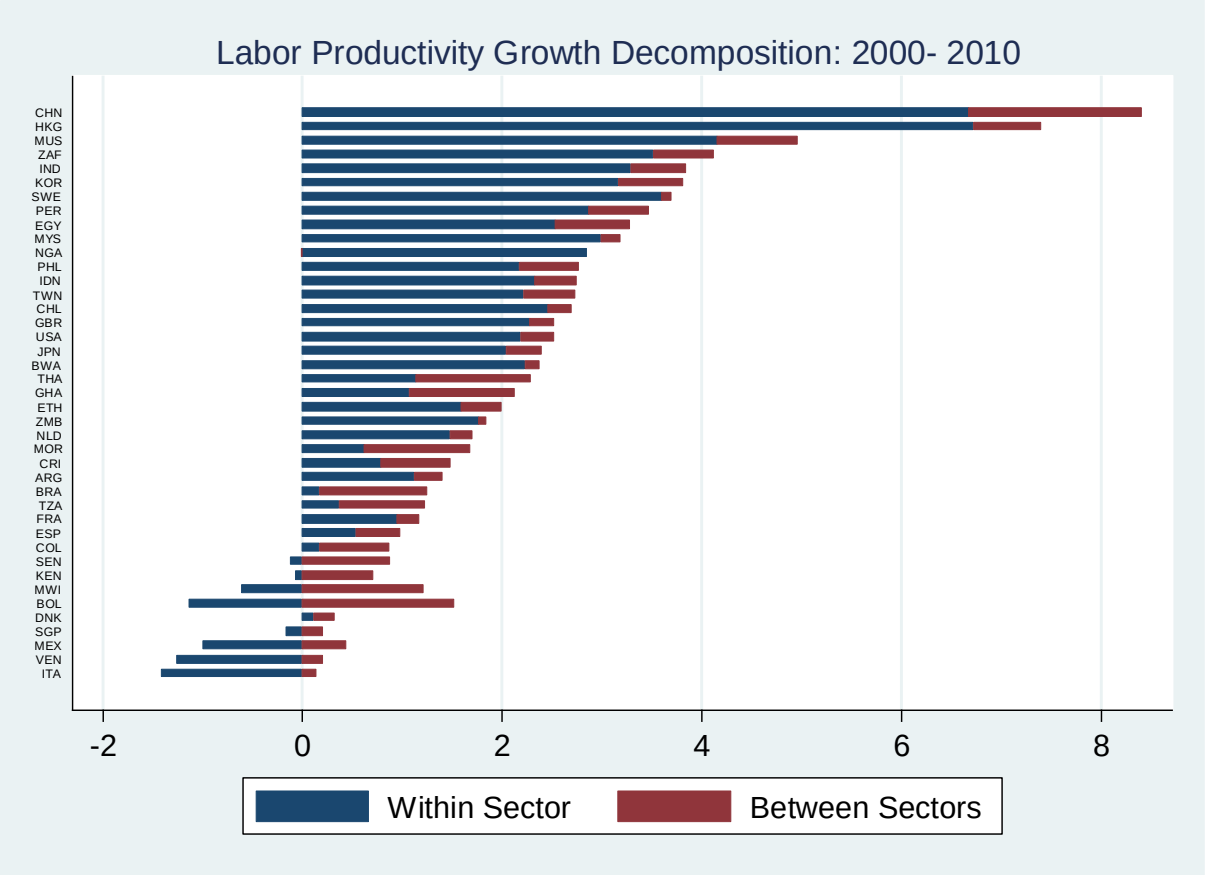
Source: Calculations based on Groningen Growth and Development Center 10-sector data.

Figure A2 Trends in average annual economy-wide labor productivity growth due to structural transformation, [1960–2010]



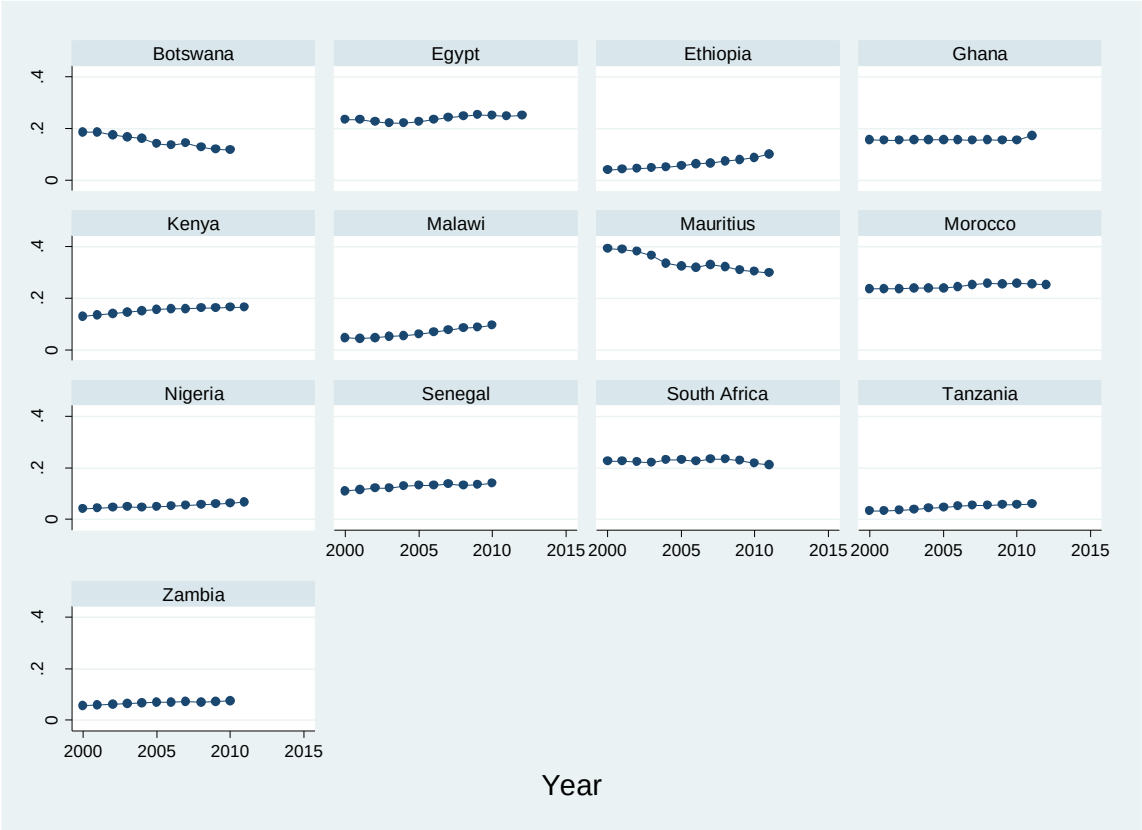
Source: Calculations based on Groningen Growth and Development Center 10-sector data.

Figure A3 Average labor productivity growth decomposition, by country, 2000-2010



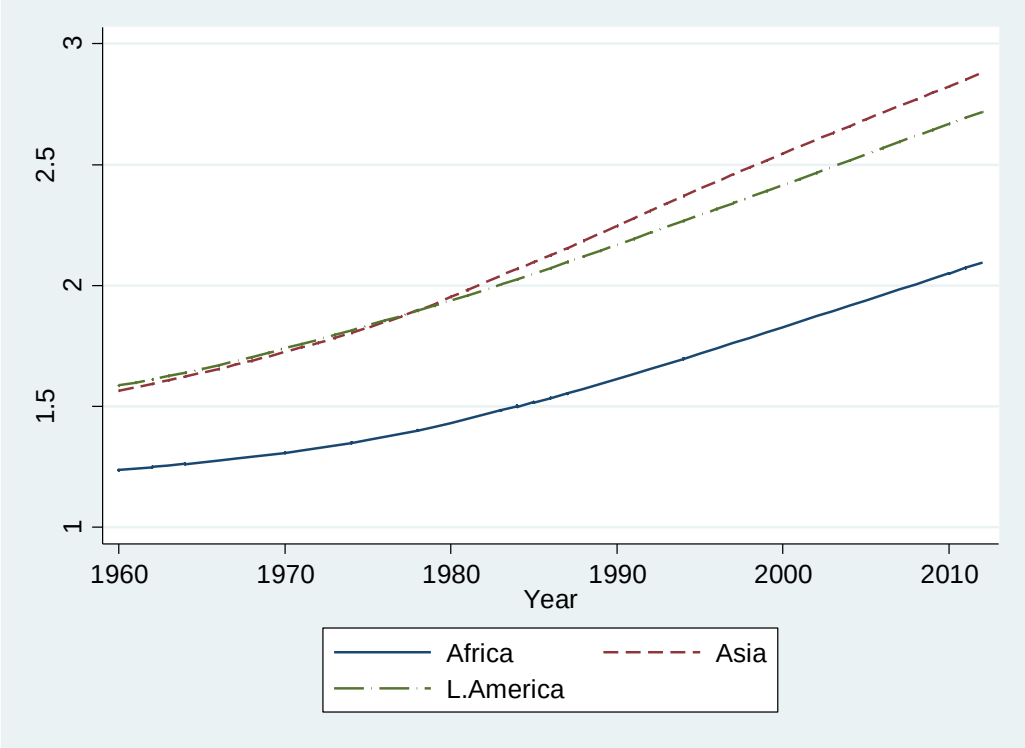
Source: Calculations based on Groningen Growth and Development Center 10-sector data.

Figure A4 Trends in the share of industry in total employment, 2000–10



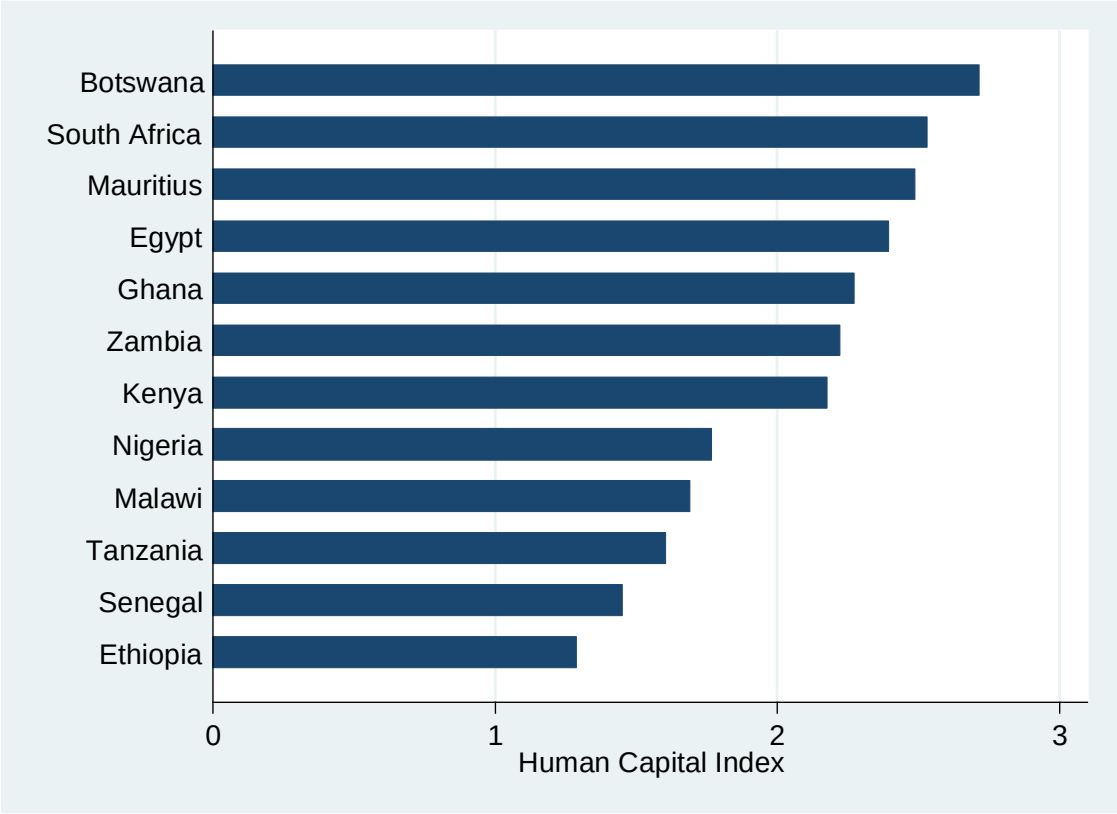
Source: Calculations based on Groningen Growth and Development Center 10-sector data.

Figure A5 Trends in human capital index, 1960–2010



Note: The Human Capital Index is calculated index of human capital per person, based on years of schooling (Barro/Lee, 2012) and returns to education (Psacharopoulos, 1994). Human capital per worker does not have a natural unit. The value of human capital index in the PWT9.0 ranges between 1 and 3.7.
Source: Calculations based on data from Penn World Table 9.0.

Figure A6 Human capital index for African countries, 2010 or latest available



Source: Calculations based on data from Penn World Table 9.0.

Table A1. Full list of countries in the GGDC Database

Countries	Start	End
Argentina	1960	2011
Bolivia (Plurinational State of)	1960	2010
Botswana	1964	2010
Brazil	1960	2011
Chile	1960	2012
China	1960	2011
China, Hong Kong SAR	1974	2011
Colombia	1960	2010
Costa Rica	1960	2011
Denmark	1960	2011
Egypt	1960	2012
Ethiopia	1961	2011
France	1960	2011
Ghana	1960	2011
India	1960	2010
Indonesia	1975	2012
Italy	1960	2011
Japan	1960	2012
Kenya	1969	2011
Malawi	1966	2010
Malaysia	1975	2011
Mauritius	1970	2011
Mexico	1960	2012
Morocco	1960	2012
Netherlands	1960	2011
Nigeria	1960	2011
Peru	1960	2011
Philippines	1971	2012
Republic of Korea	1963	2010
Senegal	1970	2010
Singapore	1970	2011
South Africa	1960	2011
Spain	1960	2011
Sweden	1960	2011
Taiwan	1963	2012
Tanzania	1960	2011
Thailand	1960	2011
United Kingdom	1960	2011
United States	1960	2010
Venezuela (Bolivarian Republic of)	1960	2011
Zambia	1965	2010