Chapter 5

AFRICA'S UNFOLDING AGRICULTURAL TRANSFORMATION

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For decades, observers of Africa have referred to the region's economic transformation in the future tense.[2] Today, most development scholars agree that Africa has experienced an extraordinary period of economic development in the 21st century, even while the underlying causes are still not fully understood.

This chapter on Africa documents the region's unfolding agricultural and broader economic transformations, explores the underlying drivers and implications of these transformations, and considers the new policy priorities dictated by these developments. It starts with an analysis of the shifting role of agriculture in the development of African economies, and the history and status of agricultural transformation and its implications for economic growth, poverty reduction, food systems, and nutrition. The second section reviews changes in agricultural productivity growth over time. The third section discusses patterns of poverty reduction and urbanization and related changes in diets, as well as their effects on agrifood systems and nutrition outcomes. The fourth section summarizes four broad trends that illustrate Africa's agricultural transformation to date and briefly discusses their possible future evolution.

Changing Roles of Agriculture[3]

Agricultural transformation is an important element in overall economic transformation processes (Mellor 1976; Timmer 1988). During the course of agricultural transformation, agrifood systems shift from traditional low-productivity subsistence production systems to commercially oriented, high-productivity systems with significant value addition occurring off the farm (Timmer 1988). Agricultural transformation contributes to overarching

1 This chapter has benefited from excellent research assistance by Julia Collins.

2 *Africa* refers to "Africa south of the Sahara," which is the regional focus of this chapter.

3 This section draws heavily on Jayne, Chamberlin, and Benfica (2018).

economic and rural transformation processes, which are associated with increased heterogeneity of livelihood opportunities, stronger links between rural and urban areas, and changing roles for agriculture (IFAD 2016).

As is discussed in Chapter 1, agriculture plays a central role in economic transformation as the main source of employment, income, and fiscal resources, all of which are essential in fueling demand for goods produced in the nascent industrial sector and financing public goods and services necessary to foster broader growth in the economy. As the nonagricultural sector expands, labor moves from agriculture to manufacturing and services, resulting in higher overall productivity and incomes as the economy matures.

Many of these transformation processes are now clearly visible in Africa. After decades of stagnation, much of Africa has enjoyed sustained agricultural growth—4.73 percent per year on average between 2000 and 2018.[4] Real per capita gross domestic product (GDP) grew by over one-third on average between 2000 and 2014, with faster growth of 100 percent or more in some countries (Barrett et al. 2017). Poverty rates have fallen significantly—the share of people in Africa living on less than US$1.90 a day declined from 55 percent in 1990 to 42 percent in 2015 (World Bank 2020b).[5] Africa's workforce is shifting, in some cases quite rapidly, from farming to off-farm sectors. The number of medium- and large-scale farms is increasing, and in some countries they account for a sizable and rising portion of total farmland (Jayne et al. 2016). Agribusiness and downstream food systems are responding dynamically to population growth and urbanization. Changing food diets associated with income growth and urbanization are raising the demand for processed food products and creating new employment opportunities in agrifood systems (Tschirley et al. 2015b). Governments that have invested robustly in their agricultural sectors, such as in Ethiopia, Rwanda, and Burkina Faso, are reaping the benefits—stronger economic growth, declining poverty rates, and better nutritional status (Badiane and Makombe 2015). The countries with the highest rates of agricultural productivity growth during this period also tended to experience the most rapid diversification of the labor force into off-farm and nonfarm employment (Yeboah and Jayne 2018).

4 Based on World Development Indicators annual growth of agricultural value-added, defined as constant local currency unit value of agriculture, forestry, and fishing outputs minus input costs (WDI code NV.AGR.TOTL.KD.ZG). Africa's impressive agricultural growth rate over the 2000–2018 period is weighted by population and is led by high rates of growth in Nigeria and Ethiopia, but many African countries also achieved annual growth rates well over the world average of 2.75 percent in this period.

5 All dollars are US dollars.

The economic landscapes in which small farmers have traditionally operated are therefore shifting rapidly. Urbanization and development of food systems to feed growing cities are reshaping African farmers' access to markets, starting with those closest to towns and moving outward into hinterland areas (Richards et al. 2016). The rise of secondary cities has expanded market access and extended value chains into previously hard-to-reach areas (Chamberlin and Jayne 2013). Access to output and input markets is increasing for many farmers, and the share of rural populations living in isolated areas—while still high—has fallen sharply (Masters et al. 2013). In many countries, average farm sizes are increasing as a growing group of urban-based investor farmers acquire medium- and large-scale farms. Markets for agricultural factors, including land, labor, and labor-saving inputs such as fertilizer, pesticides, herbicides, and mechanization, are seeing increased farmer participation in many areas (Deininger, Savastano, and Xia 2017; AGRA 2016; Jayne et al. 2019). Agricultural commercialization is increasingly attracting private investment. In areas with growing numbers of medium-scale farms, large-scale traders are also increasing investments and expanding operations (Sitko, Burke, and Jayne 2018). Africa's rapid urbanization has created sharply rising demand for food in urban markets, leading to growing opportunities for farmers, traders, and food processing along the value chain (Reardon 2015).

While these are unmistakable positive developments, there remain at least three major challenges that, if not proactively addressed, will impede the pace of Africa's economic transformations. First, unlike in the stylized Asian structural transformation process, a large majority of African countries have not achieved meaningful growth in manufacturing. In Asian countries such as Bangladesh, China, the Republic of Korea, and Viet Nam, labor-intensive manufacturing, often for export, offered a higher-productivity and more remunerative alternative to farming. People are leaving farming in Africa as well, but most of the former agricultural labor force enters informal sectors that are not able to provide sufficient numbers of well-paying jobs (Diao, Magalhaes, and McMillan 2018). The fastest-growing occupations are often nontradable, such as construction, the food trade, cooking goods, and personal care services. Private-sector employment, whether informal or formal, is growing more rapidly in most countries than public-sector jobs (Diao, Harttgen, and McMillan 2017; Yeboah and Jayne 2018).

Second, the region's transformation in recent years masks great heterogeneity across countries. Countries experiencing particularly severe challenges are those in which fast population growth and urbanization are taking place in the absence of significant productivity growth and dynamism in either

agricultural or nonfarm sectors. This process, termed *urbanization without industrialization*, has occurred in countries such as Angola, Equatorial Guinea, Zambia, and others where natural resource exports (for example, oil and mining products) are a main driver of growth but do not show strong linkages with rural areas. In these countries, growth has resulted in little or no poverty reduction (McMillan, Rodrick, and Verduzco 2014; Gollin, Jedwab, and Vollrath 2016; IFAD 2016).

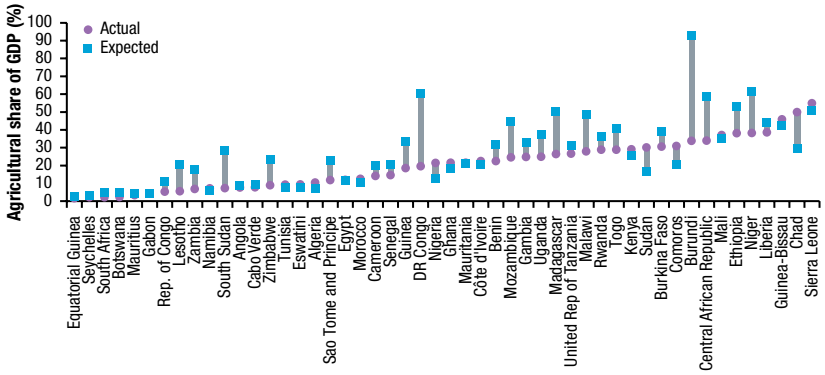
Third, agricultural growth in Africa has been driven mainly by area expansion rather than productivity increases (Fuglie and Rada 2013). In addition, the intensification that has taken place has resulted in widespread land degradation and soil nutrient depletion (Drechsel et al. 2001; Barbier and Hochard 2012; Tittonell and Giller 2013). Sustainable output growth will result not from exhausting natural resources but from increased productivity, producing more per unit of land and labor. The limits of production growth based on land expansion will be reached quickly, given continued population growth (Masters et al. 2013; Chamberlin, Jayne, and Headey 2014). Relatedly, Africa's recent agricultural growth has been supported by a period of unprecedentedly high world commodity prices. Unlike in the past, however, actors all along the commodity value chains were able to respond to the relatively high post-2007 food prices, thanks to sectoral commodity market reforms undertaken during the 1990s and early 2000s that cleared away major policy barriers to private investment in the agrifood systems of many African countries (Badiane, Benin, and Makombe 2016; Jayne, Chamberlin, and Benfica 2018).

How Important Is Agriculture Still?

A major emerging question about Africa's unfolding economic transformation is about the role of agriculture. The decades-long stagnation or even decline of the agricultural sector has delayed structural transformation and undermined livelihoods across the continent. In nearly all countries, agriculture as a share of GDP has declined so rapidly that African economies entered the new millennium with markedly smaller agricultural sectors than would be expected based on their level of development (Figure 5.1). And countries where this *stunting* of the agricultural sector was the strongest also historically experienced the highest rates of poverty (Figure 5.2).

As downstream agrifood systems and nonfarm employment grow rapidly in Africa, agriculture could be viewed as a declining sector and hence less crucial as a driver of continued economic transformation. As noted earlier, a growing proportion of young people are entering into off-farm and nonfarm

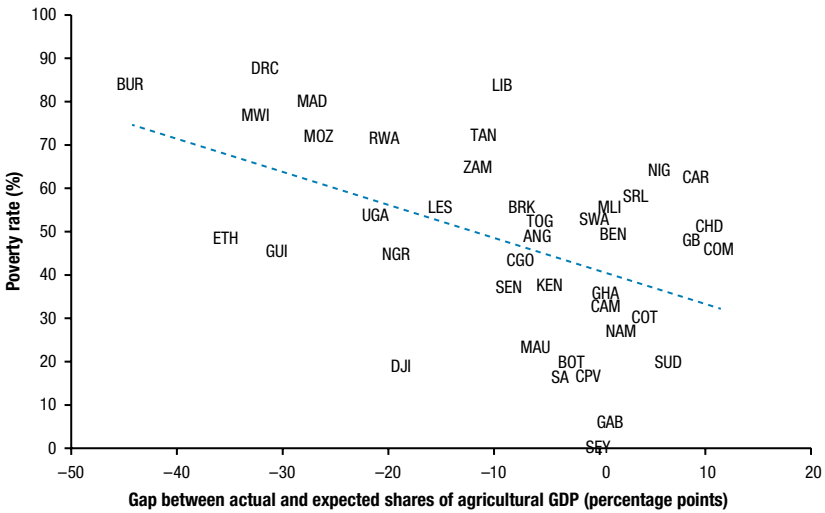
FIGURE 5.1 Actual versus expected agricultural sector GDP shares (2010–2018)



Source: Authors' calculations.

Note: Expected agricultural sector GDP shares are calculated based on a random effects model of the relationship between GDP per capita and agricultural sector GDP share for a sample of 197 countries over the 1980–2018 period. For further methodological details, see Badiane (2011).

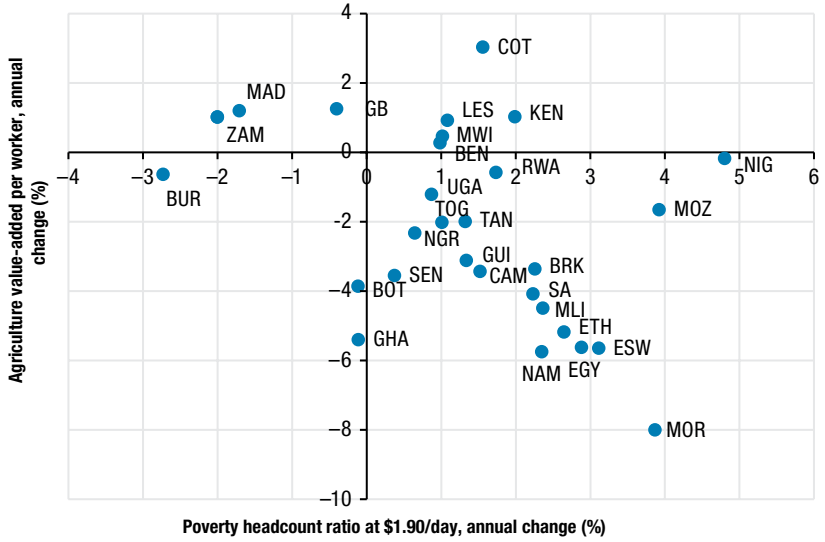
FIGURE 5.2 Agricultural sector underperformance and poverty levels



Source: Badiane and Collins (2016).

Note: ANG = Angola; BEN = Benin; BOT = Botswana; BRK = Burkina Faso; BUR = Burundi; CAM = Cameroon; CAR = Central African Republic; CGO = Republic of Congo; CHD = Chad; COM = Comoros; COT = Côte d'Ivoire; CPV = Cabo Verde; DJI = Djibouti; DRC = Democratic Republic of the Congo; ETH = Ethiopia; GAB = Gabon; GB = Guinea Bissau; GHA = Ghana; GUI = Guinea; KEN = Kenya; LES = Lesotho; LIB = Liberia; MAD = Madagascar; MAU = Mauritania; MLI = Mali; MOR = Morocco; MOZ = Mozambique; MWI = Malawi; NAM = Namibia; NGR = Niger; NIG = Nigeria; RWA = Rwanda; SA = South Africa; SEN = Senegal; SEY = Seychelles; SRL = Sierra Leone; SUD = Sudan; SWA = Eswatini; TAN = Tanzania; TOG = Togo; UGA = Uganda; ZAM = Zambia.

FIGURE 5.3 Agricultural transformation and rural poverty, 1991–2018



Source: Authors' calculations base on ReSAKSS (2020).
Note: For country names, see the note for Figure 5.2.

employment activities, and the share of the labor force primarily engaged in farming has declined rapidly. In many countries, farming constitutes less than 50 percent of the total labor force when computed in terms of full-time equivalents (Yeboah and Jayne 2018). Secondary cities and towns have produced the most rapid employment growth in some countries and are thus likely to accelerate structural transformation (Christiaensen and Todo 2014).

However, the causal relationships between growth in agricultural production, downstream value-chain segments, and nonfarm employment have yet to be clearly disentangled. The region's impressive agricultural productivity growth since 2000 may have had a big hand in driving the growth of nonfarm and downstream agrifood systems in recent years. Yeboah and Jayne (2018) find for a set of African countries that those registering the greatest growth in agricultural productivity per worker in farming have also tended to experience the most rapid shifts in the labor force out of farming as well as faster labor productivity growth in nonfarm sectors. Countries with faster agricultural labor productivity growth have been observed to experience greater poverty reduction than countries with lower productivity growth (Figure 5.3). And Imai et al. (2017) find that agricultural growth remains strongly associated

with poverty reduction and that greater emphasis on promoting rural development (both agricultural and nonagricultural) may still provide the most effective means of reducing poverty in most African settings. In addition, some evidence suggests that sectoral productivity differences may be exaggerated: Hicks et al. (2017) found, using data from Kenya, that a large part of observed productivity differences between the farm and nonfarm sectors were explained by differences in the education and ability of the individuals who chose to migrate out of agriculture. When individual fixed effects were controlled for, the estimated labor productivity gap decreased by around 90 percent. Growth dynamics in Africa's agricultural sector and their implications for development and poverty reduction are examined in greater depth in the next section.

A Review of Productivity Growth in Africa's Agriculture

The 21st century is undeniably an unprecedented new era for Africa. Because of the disappointing growth performance in the 1980s and early 1990s, for many countries, the current levels of per capita GDP or per capita agricultural GDP/agricultural production are still below their historical peak in the 1960s or 1970s. Table 5.1 summarizes this situation. Among 44 African countries with GDP data available for the 1960s to 1980s, there are 29 countries for which the best performance of per capita GDP growth was in the early years, before growth faltered and per capita GDP fell in the late 1970s. A similar situation is also seen for agricultural growth performance, with more countries having a long growth-declining period in agriculture. Among these countries, some have fully recovered in the 21st century, with the new high in per capita GDP or agricultural GDP (AgGDP) per output in the 2000s above the peak level in the past. Column 7 of Table 5.1 lists the total number of such countries. In terms of gross production of agriculture, the number of countries that have yet to recover to their historical high in per capita agricultural output is still more than the countries that have recovered (Table 5.1).

Comparisons of Africa's Agricultural Productivity

Against the background of the longer-term growth performance in Africa highlighted in Table 5.1, we compare agricultural productivity between the period of 1986–1989 and the period of 2010–2014. Following Hayami and Ruttan (1985), agricultural labor productivity is measured as agricultural

TABLE 5.1 Number of African countries with peak levels of per capita GDP or per capita AgGDP/output in the past

Product/output (per capita)	Number of countries with maximum value in the past				No data in 1960s–1980s	No decline following 1960s–1980s	Whether the new high created in the 2000s was above the historical peak	
	1960s	1970s	1980s	Peak year in 1960s–1980s			Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP	5	12	12	29	4	15	14	15
AgGDP	8	11	7	26	11	11	7	19
Ag output	21	19	1	41	2	5	17	24

Source: Authors' calculation using GDP, AgGDP, and population data from World Bank (2017) and agricultural output data from FAO (2017).

Note: GDP = gross domestic product; AgGDP = agricultural GDP; Ag output = gross production of agriculture. The numbers reported in the first three columns are the numbers of countries with maximum levels of per capita GDP or agricultural GDP/agricultural output having occurred in the 1960s, 1970s, or 1980s respectively. The fourth column is the sum of the first three columns. The fifth column reports the number of countries with no data in the 1960s–1980s. The sixth column reports the number of countries that did not experience a decline in growth and in which the maximum levels of per capita GDP or agricultural GDP/agricultural output did not occur in the past.

output per worker,[6] while agricultural land productivity is output per hectare. There are significant differences in both labor and land productivity across African countries, as well as the difference between the two periods within a country. We want to assess whether such differences and change in land and labor productivity can be partially explained by the situation of agricultural endowment proposed in the induced technical innovation hypothesis in Hayami and Ruttan (1985).

COMPARISONS IN LABOR AND LAND PRODUCTIVITY ACROSS COUNTRIES

Figure 5.3 reports labor and land productivity for 46 African countries in 1985–1989 and 2010–2014 and the land-labor ratio in the two periods. Significant variation exists across countries for both labor and land

6 This section uses data from FAOSTAT on the number of agricultural workers to calculate agricultural labor productivity. The FAOSTAT data have the advantage of covering a large number of countries over time, but they also present two major disadvantages. First, FAOSTAT estimates of numbers of agricultural workers are often larger than those suggested by household survey data. Second, the data do not account for the fact, apparent from survey data, that rural people are devoting a declining share of their time to agriculture as engagement with rural nonfarm activities increases. Thus, even though the numbers of agricultural workers are rising, the actual labor time devoted to agriculture is not rising as quickly. The implication of the first issue is that labor productivity may be underestimated in this analysis; the implication of the second issue is that the growth of labor productivity over time is also likely to be underestimated.

productivity in the past and at present. In Figure 5.4, South Africa and Mauritius stand out as the two countries with the highest labor productivity in the past and at present, and in Figure 5.4 Mauritius is the country with the highest land productivity both in the past and at present. A few countries at the bottoms of both figures changed over time, including Malawi, Mozambique, and Angola in Figure 5.4 and Angola, Sao Tome and Principe, and Equatorial Guinea in Figure 5.4, while the agricultural land and labor ratio seems to be relatively stable over time for most countries (Figure 5.4). In the late 1980s, Ethiopia had the lowest labor productivity (Figure 5.4), and Niger had the lowest land productivity (Figure 5.4) in Africa, while in the 2010s, Ethiopia moved up the ladder slightly as shown in Figure 5.4, while Niger remained at the bottom in Figure 5.4. Moreover, the cross-country differences are larger in labor productivity than in land productivity, and such differences are further widened in recent years. We use standard deviations (SD) to measure such differences. In the late 1980s, the SD in labor productivity is 1.6 times higher than the SD in land productivity, while the difference in SD between labor and land productivity increases to 2.7 times in recent years.

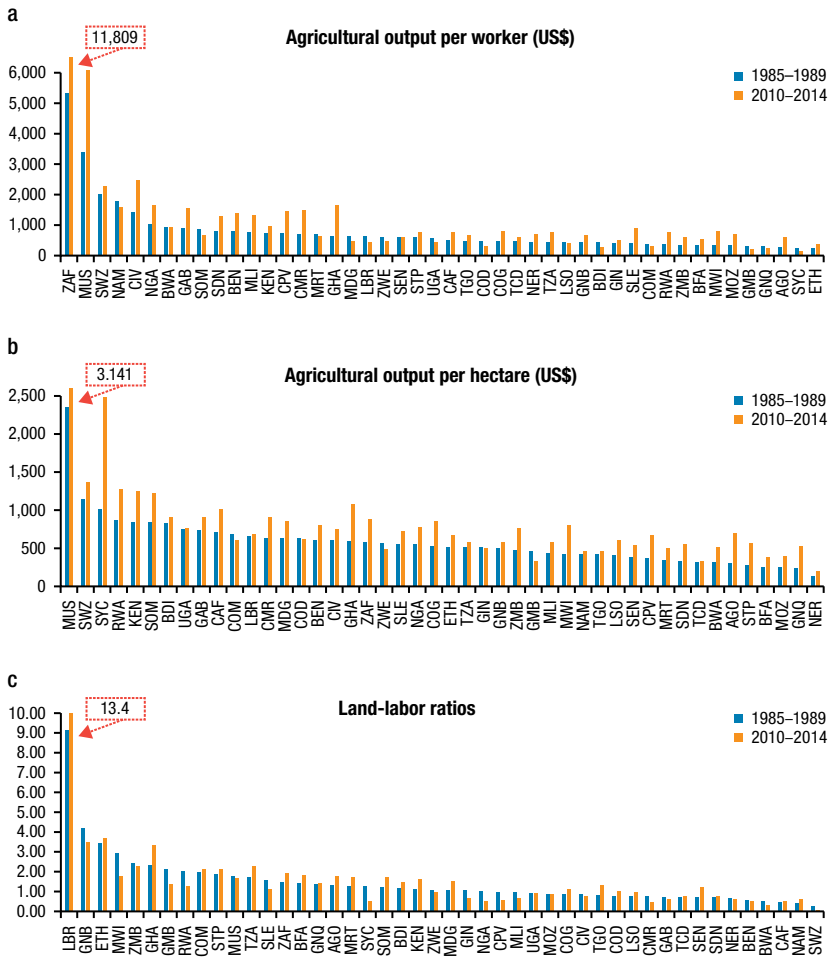
The association between the level of per capita income (measured by GDP per capita) and labor and land productivity is observed internationally. Table 5.2 shows that the correlation between GDP per capita and labor productivity in Africa is stronger than the correlation between GDP per capita and land productivity in both periods, while the two correlation coefficients converge in the recent period. We also report the correlation between per capita GDP and the land-labor ratio, which seems to be stable over time.

COMPARISONS BETWEEN LABOR AND LAND PRODUCTIVITY WITHIN COUNTRIES

The difference between labor and land productivity within a country is associated with the country's land-labor ratio, which represents the pattern of agricultural endowment in the country. Given that $(Y/L) = (A/L) \times (Y/A)$, where Y is agricultural output, L agricultural workers, and A agricultural land, when $A/L \geq (<)1$, labor productivity is either higher than or equal to (lower than) land productivity. When the ratio of land to labor is greater than one, land is a relatively abundant endowment compared with agricultural labor, and hence, labor productivity is higher than land productivity. The ratio of land and labor (A/L) is shown in Figure 5.4.

However, the ratio of land and labor is not constant over time and is affected by both the expansion of agricultural areas through agricultural investment and increased employment opportunities outside agriculture.

FIGURE 5.4 Agricultural land and labor productivity and land-labor ratios, 1985–1989 and 2010–2014



Source: Authors' calculations from agricultural output obtained from FAO (2017); Groningen Growth and Development Centre (GGDC) 10-sector database (Timmer, de Vries, and de Vries 2015); USDA-ERS (2017).

Note: AGO = Angola; BDI = Burundi; BEN = Benin; BFA = Burkina Faso; BWA = Botswana; CAF = Central African Republic; CIV = Côte d'Ivoire; CMR = Cameroon; COD = DR Congo; COG = Congo; COM = Comoros; CPV = Cabo Verde; ETH = Ethiopia; GAB = Gabon; GHA = Ghana; GIN = Guinea; GMB = Gambia; GNB = Guinea-Bissau; GNQ = Equatorial Guinea; KEN = Kenya; LBR = Liberia; LSO = Lesotho; MDG = Madagascar; MLI = Mali; MOZ = Mozambique; MRT = Mauritania; MUS = Mauritius; MWI = Malawi; NAM = Namibia; NER = Niger; NGA = Nigeria; RWA = Rwanda; SDN = Sudan; SEN = Senegal; SLE = Sierra Leone; SOM = Somalia; STP = Sao Tome and Principe; SWZ = Eswatini; SYC = Seychelles; TCD = Chad; TGO = Togo; TZA = United Rep of Tanzania; UGA = Uganda; ZAF = South Africa; ZMB = Zambia; ZWE = Zimbabwe. Values are the averages in the corresponding periods. The FAOSTAT agricultural output is measured as gross production of agriculture in constant 2004–2006 international dollars. Agricultural workers are economically active adults (15+) in agriculture reported by FAO, while for some countries with employment data available in the GGDC dataset (Timmer, de Vries, and de Vries 2015), they are the number of individuals employed in agriculture. Agricultural land is compiled by Fuglie (USDA-ERS 2017) and is in rainfed cropland equivalents.

TABLE 5.2 Correlation values of per capita GDP and labor and land productivity in agriculture

Indicator	1985–1989	2010–2014
Labor productivity	0.450	0.430
Land productivity	0.261	0.372
Land-labor ratio	0.364	0.369

Source: Authors' calculations.

Because of rapid urbanization that creates more jobs in urban areas outside agriculture, a decline in the share of agricultural employment can reverse the land-labor ratio from less than one to greater than one, as in Tanzania (Table 5.3).

Table 5.3 puts African countries into four groups. For the 22 countries in group one, labor productivity is consistently higher than land productivity during both periods (1985–1989 and 2010–2014). In group two, with 16 countries, land productivity is consistently higher than labor productivity in both periods. Countries in group three had higher labor productivity than land productivity in 1985–1989, but land productivity becomes higher in 2010–2014. The reverse is true for countries in group four. There are fewer countries in groups three and four, indicating that the endowment ratio is relatively stable for most African countries.

Table 5.3 also shows that there are more African countries with relatively abundant land as an agricultural endowment. However, apart from South Africa, which has land-labor ratios of 9.2 and 13.4 in the two periods, which is close to what the UK had in the 1960s, there are only 7 other countries with land-labor ratios greater than 2 in the two periods, a situation similar to the one in Asia.[7] On the other hand, out of 26 European countries, there are 24 with land-labor ratios higher than 2 and many countries with ratios similar to South Africa's, and out of 31 American countries, there are 23 with land-labor ratios higher than 2 and many with ratios much higher than South Africa's.

7 Land is measured as rainfed cropland equivalents, with higher weights for irrigated cropland than for permanent pastureland. Irrigated areas in Asia are three times those in Africa, while there is much more pastureland area in Africa than in Asia. This leads to higher measured land-labor ratios in many Asian countries and lower measured ratios in many African countries than actual land-labor ratios in these countries.

TABLE 5.3 Comparison between labor and land productivity, 1985–1989 and 2010–2014

Groups	Countries
Labor productivity > land productivity in both periods	Benin, Botswana, Burkina Faso, Cabo Verde, Cameroon, Chad, Côte d'Ivoire, Eswatini, Gabon, Ghana, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Sao Tome and Principe, Senegal, South Africa, Sudan, Togo
Labor productivity < land productivity in both periods	Angola, Burundi, Central African Republic, Comoros, Democratic Republic of Congo, Republic of Congo, Ethiopia, Gambia, Kenya, Liberia, Madagascar, Malawi, Rwanda, Seychelles, Uganda, Zambia
Labor productivity > land productivity in period 1 and reversed in period 2	Equatorial Guinea, Lesotho, Somalia, Zimbabwe
Labor productivity < land productivity in period 1 and reversed in period 2	Guinea, Guinea-Bissau, Sierra Leone, United Republic of Tanzania

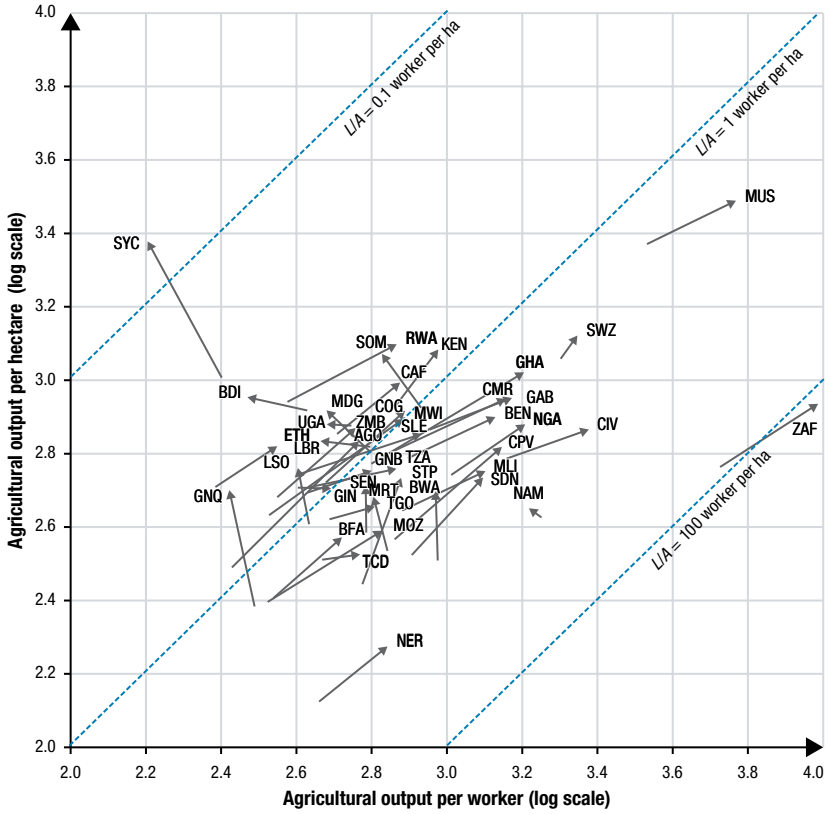
Source: Authors' calculations.

Changes in Agricultural Productivity over Time

The trends of labor and land productivity between 1985–1989 and 2010–2014 across all African countries are presented in Figure 5.5. Both labor (along the *x*-axis) and land (*y*-axis) productivity are in log scale. The three diagonal dashed lines represent ratios of labor to land of 0.1, 1, and 100, with the middle line dividing countries into relatively land-abundant (above the middle line) and labor-abundant (below the middle line) groups. All 22 countries in group one of Table 5.3 locate in the area below the middle dashed line, and the 16 countries in group two locate in the area above the middle line. Eight countries that are in groups three and four have crossed the middle line and switched from land (labor) abundant to labor (land) abundant over time.

According to the induced technical innovation hypothesis (Hayami and Ruttan's hypothesis), countries with favorable land-labor ratios tend to have faster growth in labor productivity than land productivity as they adopt labor-saving technologies to take advantage of their relatively abundant land endowment. This implies that for the countries below the middle dashed line in Figure 5.5, trend lines are expected to be flatter than the diagonal dashed lines, while for the countries above the middle line, trend lines are expected to be steeper than the diagonal dashed lines. The productivity movements in Figure 5.5 are consistent with Hayami and Ruttan's hypothesis for many countries but with quite a few exceptions. For example, Rwanda is a land-scarce country locating above the middle dashed line, but the trend for its productivity movement is flatter than the diagonal dashed line. The same is also

FIGURE 5.5 Agricultural labor and land productivity between 1985–1989 and 2010–2014



Source: Authors' calculation using data from USDA-ERS (2017).

Note: For country names, see the note for Figure 5.4. Both agricultural output per hectare and per worker are measured in purchasing power parity dollars ($PPP) (on a log scale). Four countries with negative changes in both land and labor productivity are excluded from the figure. Three are in group two and one in group three of Table 5.3.

true for Ethiopia and Malawi. The high growth in agricultural labor productivity in these countries is partially driven by rapid structural change (Diao, McMillan, and Rodrik 2017). When more labor moves from agriculture with low productivity to nonagricultural sectors with higher productivity, structural change has enhanced economywide labor productivity growth. In this process, not only does the land-labor ratio rise, but also labor productivity in agriculture grows more rapidly than land productivity.

Process of Substitution of Labor and Land

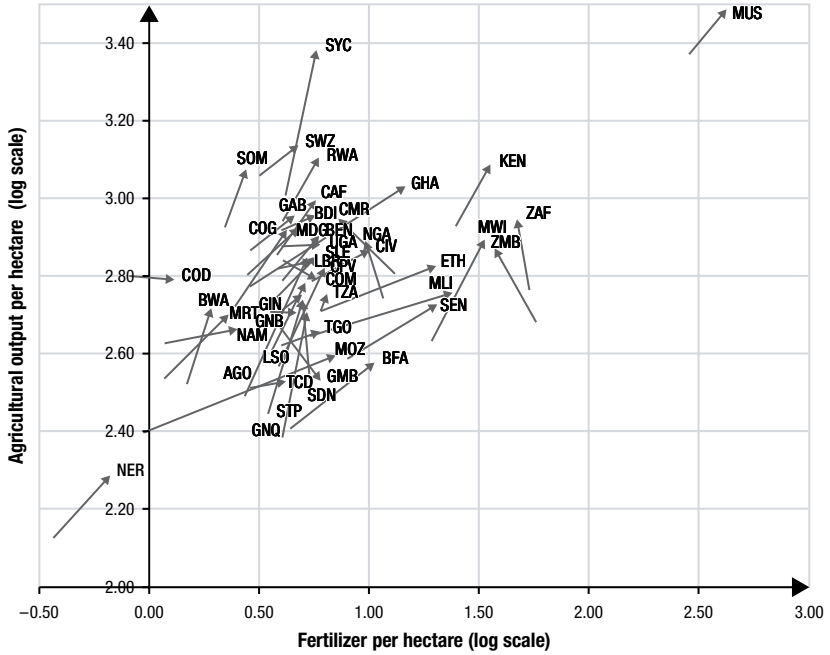
Figure 5.6 is used to assess whether increases in land productivity are associated with use of a modern input—fertilizer. The trends of output per hectare (*y*-axis) and fertilizer per hectare (*x*-axis) between 1985–1989 and 2010–2014 are presented in the figure. With Mauritius as an exception, the level of fertilizer use per hectare is extremely low among most African countries in the initial period. While for some countries the trend lines in Figure 5.6 are relatively flat, indicating that the pace of growth in fertilizer use is faster than land productivity growth, a steep trend is seen for many countries. In some countries, such as Zambia and South Africa, use of fertilizer per hectare even falls over time.

Measures of Total Factor Productivity

The productivity comparisons in the previous subsections are based on partial factor (land or labor) measures of productivity. Total factor productivity (TFP) is measured by combining the effects of all the resources used in agricultural production, which include not only labor and land, but also capital and other inputs. TFP measures critically depend on the calculation of capital stock and capital services, which are unobservable and arguably the most difficult production factors to measure. Moreover, when multiple factors are combined to derive the residue that is not explained by any such factors, it requires an assumption on the production function, and shares of labor, land, and capital are also unobservable and have to be assumed. Keeping such limitations in measuring TFP in mind, the TFP measures used in this subsection come from USDA-ERS (2017).

USDA-ERS (2017) considers inputs of land, labor, machinery power, livestock capital, synthetic nitrogen-phosphorus-potassium (N-P-K) fertilizers, and animal feed, which are weighted by their cost shares. The cost shares are assumed to be constant and the same across countries in Africa. TFP growth is the difference between growth in agricultural output and growth in weighted inputs. We report growth rates for two periods, 1981–1990 and 2001–2014, for which average TFP growth is available in USDA-ERS (2017). Figure 5.7 shows the annual growth rate of TFP in these two periods for the same countries we included in the previous analysis on partial productivity growth. Countries with land-labor ratios greater than one in 2010–2014 are represented by red dots, and the other countries are represented by blue triangles.

FIGURE 5.6 Land productivity and fertilizer use per hectare of land between 1985–1989 and 2010–2014

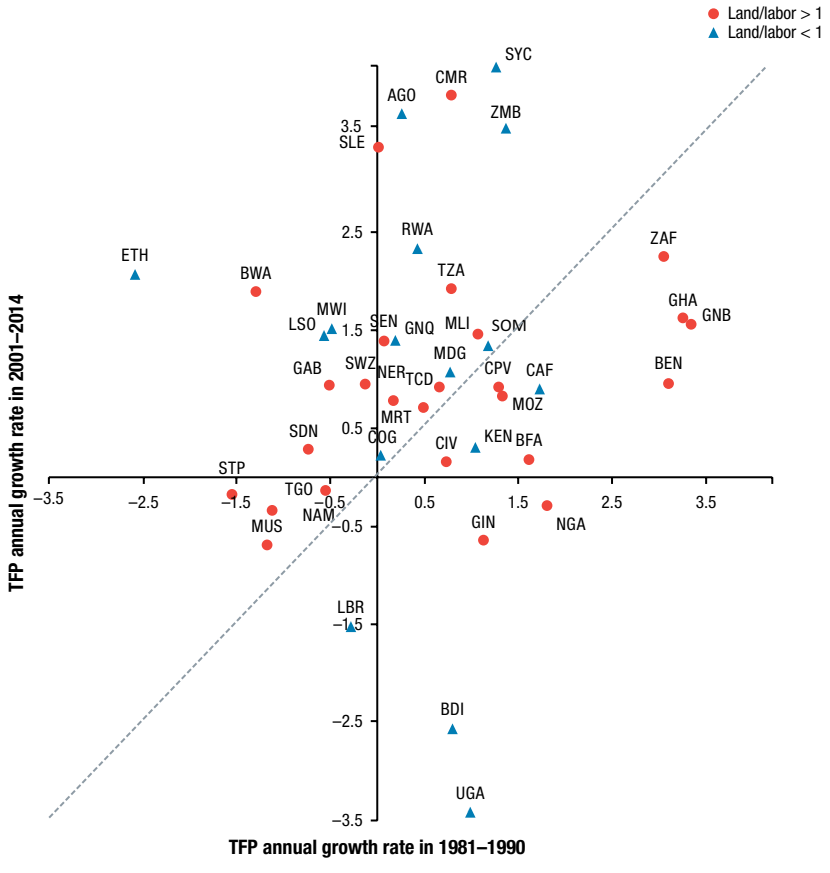


Source: Authors' calculation using data from USDA-ERS (2017).

Note: For country names, see the note for Figure 5.4. Fertilizer per hectare is measured in kilograms (in a log scale), and agricultural output per hectare is measured in purchasing power parity dollars (log scale). A negative log value of fertilizer use per hectare indicates that the absolute level of fertilizer use per hectare is less than 10 kilograms (in Niger).

The majority of countries locate in the upper right corner of Figure 5.7, implying that they have positive growth in TFP in both periods. However, for the 16 countries locating in the areas above the 45-degree line in this corner, TFP growth in the recent period (2001–2014) is higher than in the early period (1981–1990). There are 4 other countries that locate in the lower right corner of Figure 5.7, indicating that their TFP growth rate was positive in the past but turned negative in recent years. There are 5 countries with negative TFP growth in both periods, and they locate in the lower left corner of Figure 5.7.

FIGURE 5.7 TFP growth rate in 1981–1990 versus 2001–2014 (annual percentage)



Source: Authors' calculation using data from USDA-ERS (2017).
Note: TFP = total factor productivity; for country names, see the note for Figure 5.4.

Summary

While it should not be expected that TFP and partial productivity growth will be highly consistent, because they measure different things and utilize different data, we do see a similar pattern of productivity growth across countries. In general, more countries have positive and higher growth in both partial and total factor productivity in recent years than in the past. More countries have positive land productivity growth than labor productivity

growth. Land-labor ratios can partially explain the endowment situation of a country, and substitutions in land are generally consistent with the Hayami and Ruttan hypothesis. However, high labor productivity growth among some land-scarce countries is associated with growth-enhancing structural change through which labor moves out of agriculture into nonagricultural sectors.

Agricultural Growth, Urbanization, and Nutrition Transition

Income Growth and Poverty Trends

Poverty reduction in Africa also accelerated with growth acceleration, particularly in the 21st century. However, with poverty rates in Africa being the highest of any world region, recent improvements have not been sufficient to significantly reduce the absolute numbers of poor. In the meantime, Africa's middle class is growing. The share of the middle class jumped to 34 percent of the population in 2010, from 26–27 percent in the 2000s, and numbers rose to 327 million people, an increase of 122 million over the preceding decade (AfDB 2011). The definition for *middle class* here is rather broad, including those with income at $2–$4 per day. This "floating middle class" is still susceptible to falling back into poverty, and the purchasing power of this group of vulnerable middle class people is still limited (*Economist* 2015).

Africa is one of the fastest-urbanizing regions of the world. The urban share of the continent's population increased from 30.8 percent in 2000 to 37.9 percent in 2015, an increase of more than 160 million people in 15 years (UNDESA 2014). Both cities and rural towns are growing, with secondary cities and towns of less than 1 million inhabitants among the fastest-growing urban areas (UNDESA 2015). This pattern of less-concentrated urbanization may have implications for the inclusiveness of future growth; it has been argued that the expansion of the rural nonfarm economy and secondary cities has a greater effect on poverty reduction than growth concentrated in megacities (Christiaensen and Todo 2014). The rapid rise of secondary and tertiary towns in Africa is improving market access for many rural farmers by extending the reach of value chains into areas formerly considered remote (Richards et al. 2016).

Nutrition Transition

Dietary changes referred to as the nutrition transition have been widely observed in the developing world (Popkin, Adair, and Ng 2012). Africa is no exception. Numerous studies have documented different aspects of the nutrition transition, showing declining shares of staples in food expenditures and higher shares for higher-value food, including processed and perishable food and animal-sourced foods. For example, analysis of household consumption data in Ethiopia from 2000 to 2011 showed that households increased their relative consumption of animal products, fruits and vegetables, and oils and sugars at the expense of cereals; however, processed cereals increased as a share of food expenditures even as the overall share of cereals declined (Hassen et al. 2016).

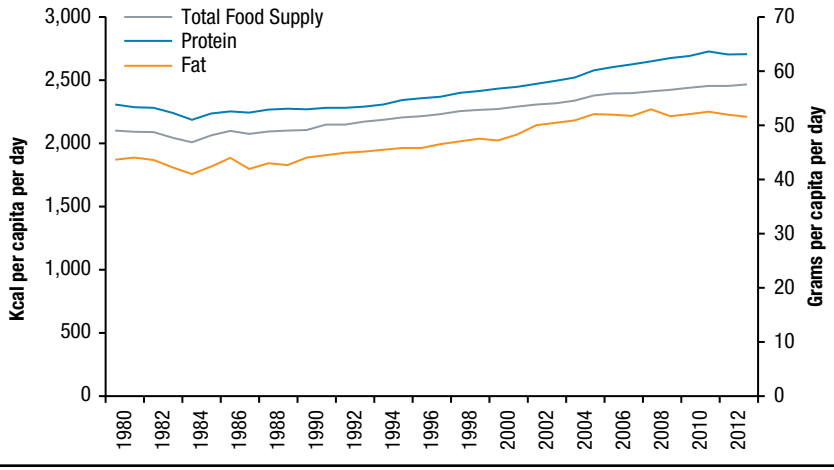
Many of these changes are associated with urbanization, which raises the demand for convenient, easy-to-prepare foods and food away from home (Hollinger and Staatz 2015). However, transformation is occurring across a broad range of consumers in Africa, in both rural and urban areas and among different income groups. Studies of dietary change in eastern and southern African countries have found that purchased and processed foods account for a large share of diets even among the poor; demand for processed and perishable foods increases quickly as incomes rise in both urban and rural areas (Tschirley et al. 2015a).

Food balance sheets constructed by FAO provide estimates of food supply over time based on national data on production, trade, and other activities affecting food availability. The FAO data reveal that total food availability in Africa has increased significantly over time, from around 2,000 kilocalories per person per day in the mid-1980s to nearly 2,500 kilocalories in the early 2010s (Figure 5.8, left axis). The availability of fat and protein similarly increased over the same period (Figure 5.8, right axis).

Implications for Nutrition Outcomes

Increasing food consumption and wider dietary diversity are expected to lead to better nutrition outcomes in Africa. The Global Hunger Index (GHI), which combines data on child mortality and undernourishment and population undernourishment into a single indicator of hunger, improved markedly for Africa between 2000 and 2016, with several countries improving their GHI score by over 40 percent (Figure 5.9). However, levels of undernourishment and child malnutrition are still unacceptably high in Africa. Over a third of children under five were stunted in 2016, while around 8 percent

FIGURE 5.8 Supply of protein and fat (grams per capita per day) and total food supply (kilocalories per capita per day) in Africa



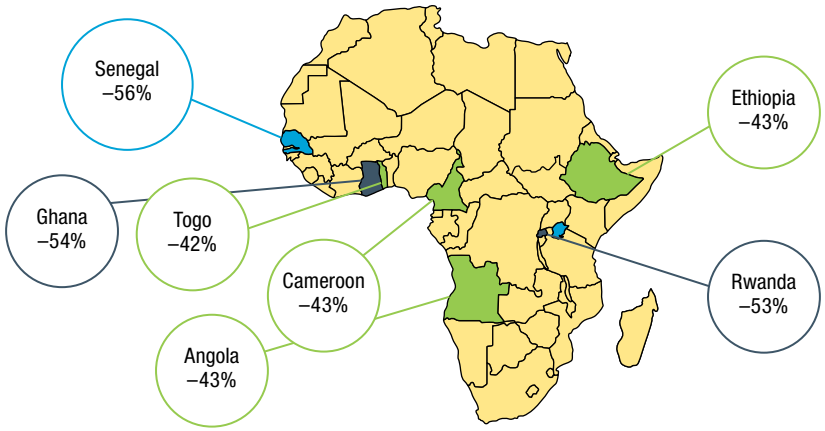
Source: Authors' calculations based on FAO (2017).

were wasted (Table 5.4). Of the 24 countries with sufficient time series data, only 5 are considered on track to meet the World Health Assembly (WHA) target of reducing child stunting by 40 percent between 2012 and 2025; another 13 countries had made at least some progress. Countries perform somewhat better on addressing child wasting, with 11 African countries (of 26 with sufficient data) on track to meet the WHA target of reducing wasting to under 5 percent (Development Initiatives 2017).

Despite increasing diversity in diets, micronutrient deficiencies remain widespread in Africa. An estimated 48 percent of preschool-age children suffered from vitamin A deficiencies in 2013 (Development Initiatives 2017). Rates of anemia are estimated at 40 percent and 60 percent in women of reproductive age and children under five, respectively (Table 5.4). No African countries are considered to be on track to meet the WHA target of reducing anemia in women by half by 2025, while 23 countries have made some progress (Development Initiatives 2017).

Much progress remains to be made in improving infant and young child feeding practices in Africa. The minimum acceptable diet (MAD) indicator for children under two years combines measures of dietary diversity and meal frequency; the 2017 Global Nutrition Report found that only 2 African countries (of 33 with available data) had shares of children benefiting from

FIGURE 5.9 Improvements in Global Hunger Index, 2000–2016



Source: von Grebmer et al. (2016).

TABLE 5.4 Selected nutrition indicators for Africa, 1990–2016

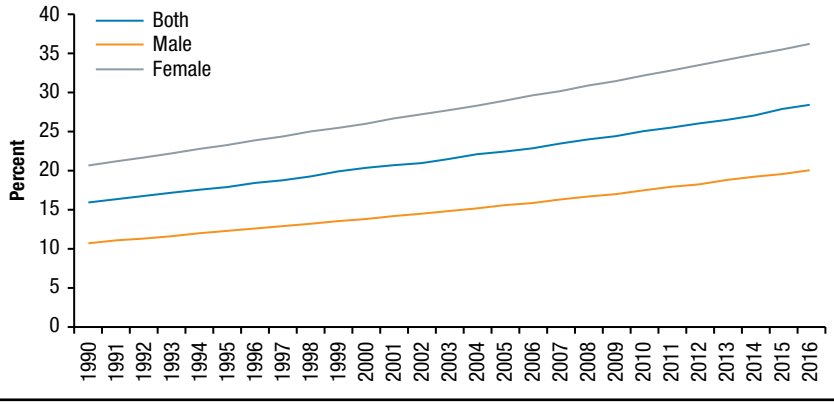
	1990	2000	2010	2016
Child stunting	49.2	43.2	37.5	34.1
Child wasting				7.8
Child underweight	30.3	25.3	20.8	18.5
Child overweight	4.8	4.4	4.1	3.9
Undernourishment		27.0	19.8	20.2*
Women's anemia	51.1	45.7	40.1	38.9
Child anemia	75.9	71.3	63.7	59.9

Source: Data from World Bank (2017).
Note: * Value is for 2015.

the MAD of over 20 percent. In 9 countries, the share was under 10 percent (Development Initiatives 2017).

In addition to still worryingly high rates of undernourishment and child undernutrition, Africa increasingly suffers from a double burden of malnutrition, with overnutrition coexisting with undernutrition. The World Health Organization estimates that adult overweight has increased over time in every African country. Rates of overweight are significantly higher for women, with the gap increasing over time (Figure 5.10). While the overall overweight rate of 28 percent in 2016 is lower than the world average of 39 percent, Africa's rate is increasing faster than the global average as well.

FIGURE 5.10 Prevalence of adult overweight, Africa south of the Sahara (%)



Source: Authors' calculations based on WHO (2017).

Higher rates of adult overweight and obesity are associated with increased risk for nutrition-related noncommunicable diseases, including heart disease and diabetes. In 2014, an estimated 6.5 percent of adults in Africa had diabetes or elevated blood glucose levels. The 2017 *Global Nutrition Report* classified every African country for which estimates were available as "off course" regarding progress in meeting the WHA 2025 targets of no increase in obesity and diabetes (Development Initiatives 2017).

Projected Growth and Diet Trends

The income and urbanization trends giving rise to the nutrition transition in Africa seem likely to continue into the medium term. Simulations based on current patterns of income and production growth suggest that the majority of countries in Africa will achieve middle-income status by 2030 (Sulser et al. 2015). Rapid urbanization is also expected to continue in Africa, with the urban population share projected to increase from 37.9 percent in 2015 to 54.8 percent by 2050 (UNDESA 2014).

Widespread dietary and nutrition transformation will also continue. Studies by Zhou and Staatz (2016) and Tschirley et al. (2015a) suggest that overall demand for higher-value foods will increase sharply. Projected increases in demand exceed increases in domestic supply for all products examined, particularly for meat and dairy products, followed by vegetable oil and fruits and vegetables (Zhou and Staatz 2016). Tschirley et al. (2015a) project rising shares for perishable foods and for processed foods, particularly for high-value-added processed foods.

Implications

The nutrition transition has broad implications for health. The increased availability of food is slowly reducing the most visible forms of undernutrition, but micronutrient deficiencies persist and problems of overnutrition are on the rise. Animal-sourced foods provide protein and micronutrients that can improve children's nutritional status, but consumption of larger quantities of meat is associated with an increased risk of chronic health issues (IFPRI 2015). As the nutrition transition continues, the burden of nutrition-related noncommunicable diseases is likely to increase, making more pronounced the multiple burdens of malnutrition faced by African countries.

African leaders have increasingly recognized the importance of concerted efforts to improve nutrition. The 2014 Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods included a commitment to ending hunger by 2025; recent work by African governments to design new National Agricultural Investment Plans is taking nutrition into account to a much greater extent than previously. The Malabo Montpellier Panel's 2017 report on nutrition in Africa finds that countries that achieved impressive improvements in nutrition were able to make policy innovations in several areas. These include positioning nutrition as a top priority for public policy; building partnerships with the private sector, development partners, and national research institutions; mainstreaming nutrition into strategies and actions across sectors; mitigating threats associated with conflict and extreme weather and building resilience to crises; improving regulation and controls of food systems to promote production of safe and healthy foods; enhancing national agricultural and nutrition research systems; strengthening nutrition education to promote healthy food consumption; building women's leadership capacities; improving national data systems to better track nutrition outcomes; capitalizing on synergies between agriculture, water, sanitation, and health; and prioritizing the emerging issue of obesity. Scaling up these practices could bring significant progress in improving nutrition in Africa (Malabo Montpellier Panel 2017).

Drivers of Agricultural Transformation and Innovation

The changes in agricultural productivity and food demand described above are manifestations of the agricultural and structural transformation currently underway in Africa. The structural transformation process is unfolding at

different paces across African countries. We see signs of rapid economic transformation in parts of Ghana, Ethiopia, and Rwanda, featuring a rise in the workforce engaged in nonfarm sectors, major self-investments by households in youth education and skill training, and a rapid reduction in poverty rates (McMillan and Harttgen 2014). Other countries have made variable progress. This section will examine the dynamics underlying the agricultural transformation in greater detail by highlighting four major trends: (1) greater vibrancy of agricultural factor markets; (2) the rise of commercialized African investor farmers; (3) major new investment in agricultural value chains by African entrepreneurs, leading to profound agrifood systems transformation; and (4) increasing linkages between science and policymaking to support the use of evidence in policy innovation.

Greater Participation and Vibrancy in Agricultural Factor Markets

Markets for land, labor, agricultural inputs (chemicals, fertilizers), and mechanization are rising rapidly in much of Africa. As land values rise, land rental markets are growing in importance (Holden, Otsuka, Place 2009). The research evidence generally finds that land markets are positive developments—they shift land from less productive to more productive users and support overall agricultural productivity growth (Holden, Otsuka, and Place 2009; Jin and Jayne 2013; Chamberlin and Ricker-Gilbert 2016; Deininger, Savastano, and Xia 2017).

There is also growing evidence of rising land rental values in areas of agricultural commercialization with favorable access to markets. Table 5.5 provides illustrative examples of a broader trend over the past decade in parts of Africa: that land prices have risen dramatically in areas of high agroecological potential within reasonable proximity of urban areas (Jayne et al. 2016; Wineman and Jayne 2018). These trends have created new stresses on the ability of customary tenure systems to protect small-scale farmers' land from encroachment or appropriation. The region has experienced rising demand for agricultural land by both international and national companies (Deininger and Byerlee 2011), as well as urban investor farmers (Sitko and Jayne 2014; Jayne et al. 2016).

Other agricultural factor markets are also increasing in importance in Africa. Despite conventional wisdom suggesting thin or absent agricultural labor markets, nationally representative data collected in 2008–2011 from Ethiopia, Niger, Malawi, Tanzania, and Uganda show that a significant share of farm households in each country hired labor to help with preharvest

TABLE 5.5 Land rental rates and purchase values

		Land rental rates			Land purchase values		
		Market access conditions			Market access conditions		
Country	Year	Remote	Near	Total	Remote	Near	Total
Tanzania	2008/2009	96	104	100	89	132	100
	2014/2015	137	155	146	148	227	179
Malawi	2010/2011	91	115	100	74	172	100
	2016/2017	162	199	190	137	522	334
Zambia	2011/2012	97	110	100	—	—	—
	2014/2015	127	113	123	—	—	—
Nigeria	2012/2013	62	112	100	64	136	100
	2018/2019	148	195	163	140	202	195

Source: Land rental and purchase prices for Tanzania, Malawi, and Nigeria come from household respondents in World Bank LSMS/ISA national survey data; in Zambia, the data are from the nationally representative Rural Agricultural Livelihoods Survey conducted by the Indaba Agricultural Policy Research Institute.

Notes: — = data not available. Reported prices are means within the 20th and 80th percentiles of the data. Prices are deflated by national consumer price indices published by the national statistical offices of each country and then reported as indices with 100 being the national mean in the first survey year. For example, land rental rates for the full sample of rural households in Tanzania were 46 percent higher in real terms in 2014/2015 than for the full sample in 2008/2009. Market access conditions were based on distance or travel time to urban areas of 100,000 or more people. Real land rental rates in rural Tanzania near urban areas were 55 percent higher than the national mean in 2008/2009. Rental rates and purchase values in Tanzania, Malawi, and Nigeria are the subjective views of plot operators and not necessarily based on actual transactions.

agricultural work, ranging from 30 percent in Ethiopia and Tanzania to 49 percent in Niger (Dillon and Barrett 2017). Increasingly active rural labor markets are also evident from the great rise of rural–rural migration, which has now become more important than rural-to-urban migration in many African countries (Mercandalli and Losch 2017).

The circumstances affecting the development of land and labor markets also impact markets for other factors of production. As land-labor ratios change due to the expansion of agricultural area or shifts of labor to other sectors, the relative costs of factors of production change and different land- or labor-saving technologies become profitable, giving rise to growing markets. In particular, labor-saving and capital-using technologies are becoming more important in areas affected by labor shortages due to low population density or the migration of workers to opportunities in other sectors (Jayne et al. 2019). Such technologies, including fertilizers, agrochemicals, and mechanization, are clearly becoming more prevalent in many areas. Sheahan and Barrett (2017) show that 35 percent of farming households in Ethiopia, Niger, Nigeria, Malawi, Tanzania, and Uganda apply inorganic fertilizer, with application

rates per hectare significantly higher than previous estimates. In addition, 16 percent of households use other agrochemicals such as pesticides and herbicides during the main growing season, a significant increase over use rates before 2000 (FAO 2019).

The development of agricultural equipment markets remains impeded by constraints related to importing or manufacturing equipment. However, some countries have experienced more dynamic growth in mechanization, often by emphasizing equipment rental or service hiring markets, as in Ethiopia and Malawi, and by carrying out interventions to increase mechanization in the form of public-private partnerships (Malabo Montpellier Panel 2018). Mechanization appears to be rising especially rapidly in areas experiencing robust economic growth and out-migration of labor (Jayne et al. 2019).

The existence of factor markets and their functioning at higher levels than previously believed are positive developments. However, input use intensity in Africa still lags behind most other regions (Sheahan and Barrett 2017). Evidence suggests that factor markets often function poorly due to high transaction cost, weak information flows, and in some cases, government behavior. For example, Dillon and Barrett (2017) provide evidence of multiple factor market failures in their five countries of analysis. Other sources of continued slow increases in technical innovation are due to chronically underfunded and poorly performing national agricultural science and extension systems (World Bank 2011). Removing constraints to technology adoption and market performance is a priority in efforts to advance agricultural transformation.

The Rise of Commercialized African Investor Farmers[8]

The development of land rental markets described above has paved the way for major changes in farm size distributions. The most salient development is rapid growth of an entrepreneurial, educated, and relatively capitalized class of African investor farmers.

Medium-scale farms of 5 to 100 hectares account for around 20 percent of total farmland in Kenya, over 40 percent in Tanzania, over 50 percent in Ghana, and over 60 percent in Zambia (Table 5.6). Many owners of medium-scale farms are urban professionals or well-connected rural residents; around half purchased farmland later in life, using income from nonfarm sources. A greater share of savings in urban areas is being reinvested in farming and agribusiness.

8 This section draws on Jayne et al. 2016.

TABLE 5.6 Changes in farm structure in Ghana (1992–2005), Tanzania (2008–2012), Zambia (2008–2014), and Kenya (1994–2006) based on official national survey data

Farm size category (hectares)	Percentage of total operated land on farms between 0–100 hectares		Percentage growth in number of farms between initial and latest year
Ghana	**1992**	**2005**	
0–5	60.7	48.9	37.1
5–100	39.3	51.1	194.3
Total	**100.0**	**100.0**	**49.5**
Tanzania	**2008**	**2012**	
0–5	62.4	56.3	12.8
5–100	37.6	43.7	37.2
Total	**100.0**	**100.0**	**14.5**
Zambia	**2008**	**2014**	
0–5	54.1	38.8	15.9
5–100	45.9	61.2	148.7
Total	**100.0**	**100.0**	**227.2**
Kenya	**1994**	**2006**	
0–5	61.5	72.0	34.0
>5	38.5	28.0	–80.2
Total	**100.0**	**100.0**	**25.2**

Source: Jayne et al. (2016). Reproduced by permission of the publisher; this table is not covered by the CC By 4.0 license.
Note: Data for Zambia shown in the two middle columns are for land owned; Ghana, Kenya, and Tanzania are for operated farm size.

The change in farm size distributions is likely to have complicated effects that are difficult to generalize. Larger and more commercialized farms benefit from economies of scale related to skills, technology, and learning; finance and access to capital; and marketing, logistics, and storage (Collier and Dercon 2014). Rising numbers of medium-size farms may thus facilitate technology adoption, accelerate productivity growth, and ultimately catalyze agricultural transformation. However, their short- and medium-term effects on welfare in the rural sector are unknown. They may help to link smallholders to commercial opportunities, but they may also aggravate land scarcity in densely populated areas. Investor farmers often have outsize influence in farm lobbies and, in turn, on agricultural policy; while strong agricultural lobbies may have positive effects on macroeconomic management in resource-dependent economies (Gelb and Grasmann 2010), their effects on overall rural development are yet to be explored. Data from nationally representative Demographic and Health Surveys in six countries (Ghana, Kenya, Malawi,

Rwanda, Tanzania, and Zambia) suggest that between 10 and 35 percent of agricultural land is owned by urban households; in countries with multiple survey years, this share has risen over time (Jayne et al. 2016).[9]

Agrifood System Transformation: Inclusive and Driven by Local African Entrepreneurs

The changes in income, urbanization, and food consumption described earlier have significant implications for agrifood systems in Africa. Rising food expenditures have increased the volume of food being handled by African value chains, in particular for the midstream and downstream segments of food value chains (Reardon et al. 2015). Value chains are expanding to serve rapidly growing cities, and artisanal, micro, and small enterprises processing domestic crops have expanded significantly in the past several decades (Hollinger and Staatz 2015; AGRA 2019).

Higher food basket shares for processed food are reflected in increased imports of processed products, but also in the growing importance of various processed ready-to-cook or ready-to-eat traditional staples. Retail inventories carried out in Mali (Thériault et al. 2017), Ghana (Andam et al. 2015), and Tanzania (Snyder et al. 2015) demonstrate the enormous variety of domestically processed food products that have appeared in African countries. Around one-quarter of the processed products inventoried in Mali and Ghana were locally produced; in Tanzania, domestically produced products accounted for the majority of processed products inventoried. Locally produced products were strongly represented among grain products and traditional dairy products in Mali; products based on starchy root crops (for example, fufu flour, gari) in Ghana; and milled grain products in Tanzania, with over 60 Tanzanian brands of maize flour identified in Dar es Salaam alone. The retail inventories do not examine the spending or consumption shares of locally produced products, but they do provide initial evidence that dietary shifts are changing domestic value chains and giving rise to new products.

Agrifood system changes raise many questions about the implications for agriculture, nutrition, and overall economic growth in Africa. To meet rising demand for higher-value foods, productivity increases are urgently needed both on-farm and in downstream value-chain segments. The emerging processing sector provides great opportunities for job creation in processing,

9 Medium-scale farm holdings in the four countries studied by Jayne et al. (2016) were found to utilize a lower percentage of their landholdings than small-scale farms, and the share of medium-scale farms in national agricultural production was therefore somewhat lower than the share of medium-scale farms in total agricultural land.

distribution, packaging, and marketing, as well as increased incomes for farmers. However, the small and medium-enterprises (SMEs) undertaking these new activities face significant challenges. Rising numbers of firms combined with low levels of innovation will lead to a situation with an abundance of small firms with persistently low productivity and profitability and limited ability to drive agricultural transformation (Badiane and Ulimwengu 2017).

Strengthening the links between producers and processors is an important intervention to facilitate firm growth as well as benefit smallholders. One means of connecting producers with midstream processors is contract farming, an arrangement in which processing firms, most commonly medium or large enterprises, sign contracts with smallholders to buy farm outputs at specified prices. Contract farming has been welcomed as having the potential to alleviate farmers' constraints related to the lack of information and capital and the presence of risk (Minot and Sawyer 2016). Although many studies have identified positive effects on farmer incomes, nearly all research on contract farming is observational and suffers from selection bias: since farmers and processors self-select into contract farming, any differences between participants and nonparticipants may be driven by the same factors that determined their participation (Bellemare and Bloem 2018). However, experimental findings from Arouna, Michler, and Lokossou (2019) suggest that contracts produced positive effects on farmer welfare when participants were randomly selected into a contract farming arrangement in Benin.

SMEs have by far the largest role in African agrifood systems and will for many years. Most African value chains are benefiting from local SME investment by African entrepreneurs, resulting in a competitive and inclusive situation for most agricultural commodity value chains. Smallholder farmers are the main source of supply for SMEs. Therefore, strengthening the ability of SMEs to innovate in terms of product quality and business practices, increase their scale of operation and profitability, and compete in output markets is central to strengthening smallholder farmer links to agribusiness.

Evidence-Based Policymaking and Links between Science and Policy

Despite the importance of technological innovations, perhaps nothing affects African farmers more than the policy environment they operate within, which affects both the generation of technological innovations and the farmers' incentives to adopt them. Much of the agricultural stagnation and decline of the 1970s and 1980s can be attributed to policy bias against agriculture, which showed abrupt shifts in focus, at times inflicting genuine harm upon

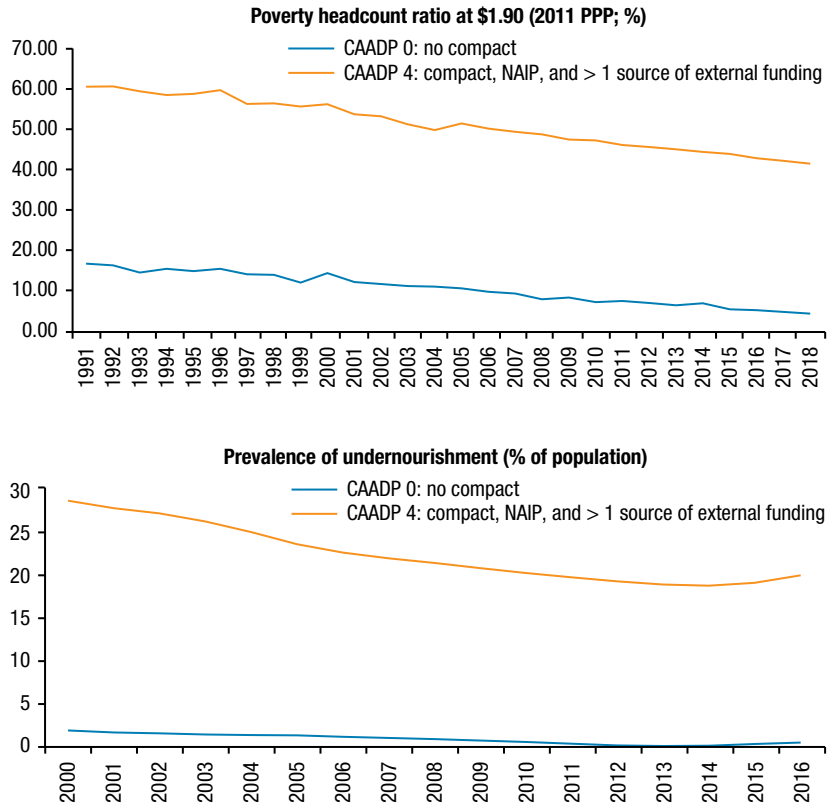
agriculture sectors in an effort to protect industry (Badiane and Makombe 2014). In many countries, agriculture was neglected, taxed heavily, or tightly regulated, or all of these, such that farmers were barred from selling their output to buyers and at prices of their own choosing. During much of this time, agricultural policymaking was completely delinked from scientific evidence, with policies dictated by still-forming development theory and uninformed by empirical knowledge of outcomes.

The broadness of the current recovery owes much to policy reforms that improved the agriculture sector and macroeconomic management and gave greater freedom to the private sector. The situation has changed markedly since the years of agricultural and economic decline in the 1970s and 1980s: the growth recovery has afforded greater fiscal space to governments, and political systems are more responsive. These are important and welcome developments, but coupled with a new generation of leaders and limited institutional memory, they pose the risk of policy reversal. The increasing use of costly input subsidies, export bans, price controls, and public agricultural agencies could all signal the beginnings of a return to the failed policies of the past.

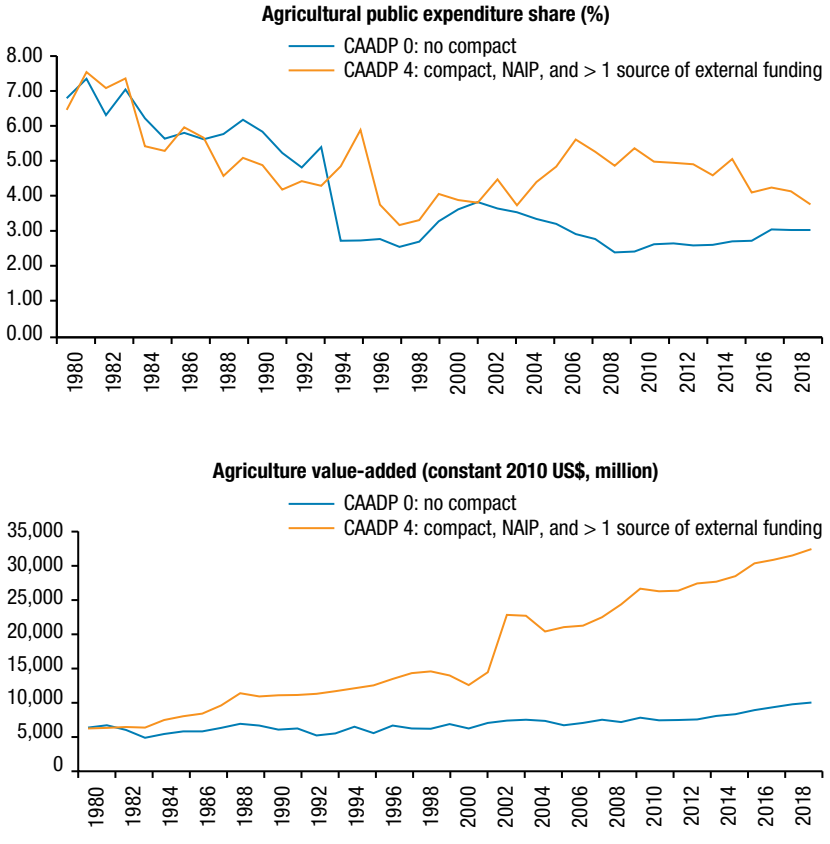
The best guard against bad policymaking is the use of locally relevant evidence in policy formulation, as well as the establishment of robust systems for review, monitoring and evaluation, and consultation and dialogue. The development of mechanisms for evidence-based policy formulation and review, as well as their increasing use, is itself one of the most important innovations of the past two decades affecting the prospects of Africa's agriculture sector. In 2003 the African Union launched the Comprehensive Africa Agriculture Development Programme (CAADP) as the continent-wide framework for agriculture-led growth and development. African leaders committed to a set of key CAADP principles and values, including African ownership and leadership; inclusivity of different stakeholder groups; evidence-based policy planning, implementation, and review; and mutual accountability for actions and results. Key CAADP mutual accountability platforms include agricultural Joint Sector Reviews at the national and regional levels, which bring together state and nonstate actors for annual reviews of agricultural commitments and outcomes, and the Biennial Review (BR), a continent-wide review of progress against CAADP agricultural transformation goals. The first BR was carried out in January 2018, with 47 of 55 African Union member states participating and sharing data on national-level progress.

The emphasis of CAADP on evidence-based policymaking and careful review of outcomes has created stronger demand for data and analysis and

FIGURE 5.11 Selected performance and outcome indicators by CAADP implementation status



new incentives to better link science with policy. Institutions including the Regional Strategic Analysis and Knowledge Support System (ReSAKSS) are building connections between ministries of agriculture and local universities and think tanks capable of carrying out research to guide governments' actions. Greater use of evidence has enabled agricultural stakeholders to make a successful case for increased agricultural investment. Figure 5.11 shows poverty, hunger, agricultural expenditure, and agricultural growth outcomes in CAADP-0 countries—those that have not begun implementation of CAADP—and in CAADP-4 countries—those that are most advanced in the implementation process. The CAADP-4 group has had more success in maintaining agricultural expenditures and has seen faster agricultural growth and hunger reduction and slightly faster progress in reducing poverty. A detailed



Source: ReSAKSS (2019).

Note: CAADP = Comprehensive Africa Agriculture Development Programme; NAIP = National Agriculture Investment Plan; PPP = purchasing power parity.

impact analysis of CAADP by Benin (2018) found that CAADP implementation had enabled countries to raise government agricultural expenditure, receive higher levels of agricultural development aid, and increase land and labor productivity compared with countries that were less advanced in the implementation process.

A Hidden "Spoiler"—What Could Arrest Progress if Not Adequately Addressed: Land Degradation

Since the 1960s, agricultural production growth in Africa south of the Sahara (SSA) has occurred primarily through area expansion. Yield growth contributed less than 20 percent of SSA's total agricultual production growth between 2000 and 2008 (Fuglie and Rada 2013). But rising population

densities in many parts of Africa are making continued reliance on area expansion untenable for millions of African farmers. The land frontier has already been reached in many smallholder areas, causing farms to become subdivided, fragmented, and increasingly small. Smallholders have responded to shrinking farm sizes by more continuously cropping their fields every year, mainly growing their priority staple foods. Fallows have largely disappeared in densely populated areas, and for the overall SSA region, fallowed land as a proportion of total farmland has declined steadily from 40 percent in 1960 to 15 percent in 2011 (Fuglie and Rada 2013). It will be harder to sustain production growth on existing smallholder farms through area expansion, putting more pressure on African farming systems to raise yields and the value of farm output per hectare and per labor unit.

The challenge of achieving sustainable yield growth in SSA in the context of rising land scarcity is complicated by mounting evidence of yield-depressing soil degradation arising from unsustainable intensification in SSA's densely populated areas (Stoorvogel and Smaling 1990; Drechsel et al. 2001; Barbier and Hochard 2012; Tittonell and Giller 2013; Montpellier Panel 2014). Continuous cultivation of existing plots would not pose problems for sustainable intensification if farmers were able to maintain or improve soil quality over time through sufficient use of fertilizers, soil amendment practices, and other land-augmenting investments. However, there is growing evidence of a significant relationship between population pressure, reduced fallow periods, and land degradation, pointing to an unsustainable dynamic between population, agriculture, and the natural resource base (Drechsel et al. 2001; Lal 2011). Losses of soil organic matter and acidification pose special problems, because they cannot be ameliorated by the application of conventional fertilizers and because they tend to depress the efficiency of inorganic fertilizer in contributing to crop output. Smallholder farmers are often unable to benefit from the current yield gains offered by plant genetic improvement, due to their farming on depleted soils that do not respond well to fertilizer application (Tittonell and Giller 2013). Given UN projections that rural SSA will contain 52 percent more people in 2050 than it did in 2017, the challenge of helping millions of African smallholders to raise the productivity of their existing farmland in sustainable ways is an urgent priority.

Conclusions

Africa is now on the move. Agricultural productivity has shown a strong recovery from the stagnation of previous decades. Per capita incomes have nearly

doubled since the 1990s. Poverty rates have declined significantly since 2000. Nutritional indicators are improving in most countries. The share of the labor force engaged in small-scale farming has declined substantially. Today, farming accounts for 40 to 65 percent of primary employment in Africa's working-age population, down from 70 to 80 percent just 10 years ago. The share of the workforce engaged in farming has declined most rapidly in countries enjoying the highest rates of agricultural productivity growth. These developments point to unmistakable economic transformation. SSA's agricultural system has been an important driver of the region's transformation, having experienced the most rapid agricultural growth of any region in the world.

Over the last decade, African governments have brought agriculture back to the top of their development agenda and are investing an increased proportion of their budgets from a growing national revenue base. The private sector is increasingly investing in agriculture, and the foundations have been laid for long-run dynamism in Africa's agrifood systems, powered by the enormous progress increasingly evident in farmers who have more options in the seeds they plant, the fertilizers they use, and the markets seeking to purchase their produce. So far, this is just a glimpse of success, and it is still largely a fragile success dependent on more decisive support from many African governments. But it offers an inspiring vision of a future Africa in which farming as a struggle to survive gives way to farming as a business that thrives.

However, despite the unprecedented decade of impressive growth across the continent, much more remains to be done to sustain these gains and truly drive the agricultural transformation needed for Africa's development and to ensure a better life for all its people as laid out in the Malabo Declaration and the Sustainable Development Goals. Africa is still facing tremendous challenges. The continent is the world's most food-insecure continent, with relatively low levels of agricultural productivity, low rural incomes, high rates of malnutrition, and a worsening food trade balance. It is a region challenged by climate change, the daunting prevalence of poverty, and an urgent need for jobs. In many countries, agriculture remains the predominant sector of the economy, accounting on average for 25 percent of the GDP in SSA and well above this level for many countries. The sector makes up close to half the GDP, on average, considering the broader agribusiness sector—including input supply, processing, and market access. Therefore, stronger agricultural growth can act as a powerful multiplier for economic growth.

The good news is that a vibrant agricultural sector, while not the solution to all of these problems, will clearly promote food security and economic opportunities for all Africans.

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