

# **The Structural Transformation of Rural Africa: On the Current State of African Food Systems and Rural Non-Farm Economies**

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**Abstract**

From 2000-2014, per capita GDP in Sub-Saharan Africa increased by almost 35% in real terms. Per capita GDP doubled even in some countries. Such progress has happened while agricultural productivity growth remained low in the aggregate, despite some bright spots, and poverty reduction has been limited. This paper argues that ending extreme poverty will be feasible primarily if structural change in agriculture begins in earnest. Based on a body of recent research on the subject, the paper outlines broad priority areas for policy actions to accelerate productivity and initiate structural change in the agriculture sector.

## 1. Introduction

Virtually every one of today's high income economies enjoyed sustained agricultural productivity growth coupled with transformation of the rural non-farm economy that jointly sparked rapid industrialization and inclusive economic growth. Indeed, the Nobel Laureate W. Arthur Lewis famously wrote: "industrial and agrarian revolutions always go together, and ... economies in which agriculture is stagnant do not show industrial development" (Lewis 1954, p. 433). The economies of Africa are finally enjoying robust economic growth and the region shows early signs of agricultural productivity growth that can be stimulated further by appropriate policy interventions to help reinforce and sustain that growth. But much remains to be done.

African agriculture today remains relatively unproductive by global standards, with an especially pronounced annual agricultural labor productivity gap that helps explain the region's high and persistent levels of ultra-poverty (i.e., households with income less than one-quarter of the global poverty line of US\$0.62/day per capita). According to World Bank data<sup>1</sup>, the number of ultra-poor in sub-Saharan Africa (SSA) more than doubled over the period 1981-2010, from 84 to 172 million people, due largely to rural population growth as the ultra-poverty headcount rate has remain stuck at 20-26 percent of the SSA population for more than a generation. Indeed, global ultra-poverty has become spatially concentrated in rural SSA, which was home to just 12 percent of the world's ultra-poor in 1981, but now accounts for more than 75 percent (Barrett 2014).

The challenge of spatially concentrated, persistent ultra-poverty that has plagued Africa for a generation is closely bound up with the halting structural transformation of the region's agriculture and rural economies. The vast majority of the ultra-poor live in rural areas and work in agriculture, while food comprises the bulk of their expenditures. Insufficient nutrient intake among the ultra-poor, perhaps especially of essential minerals and vitamins (Barrett and Bevis 2015), leads to high rates of child morbidity and mortality and permanent loss of cognitive and physical potential that retards the accumulation of human capital that is essential to sustained economic growth. Limited uptake of modern agricultural inputs, growing pressure on natural resources – especially soils and water – widespread imperfections in rural factor and product markets that discourage innovation and investment – many due to weak physical and institutional infrastructure – and meager investment in human capital, especially education, health and nutrition in rural areas, continue to hold back African agriculture and the continent's rural non-farm economies. These impediments have broader implications for inclusive economic growth in the region.

In this article, we describe the undercurrents necessary for structural transformation to occur, the current state of agricultural labor productivity growth in rural Sub-Saharan Africa, and the structural impediments currently slowing down potential progress. Our aim is to update contemporary African policymakers as they attempt to stimulate agricultural and rural transformation to foster sustained and inclusive economic growth to reduce the ultra-poverty that disfigures too much of Africa today. The rest of the paper is organized as follows. Section 2 provides the stylized fact on the path of structural transformation in agriculture with a brief review of the current state in Sub-Saharan Africa. Section 3 presents deep seated factors impeding structural change in the food systems, Section 4 documents advances towards positive structural change in African agriculture, Section 5 outlines key policy priority areas for further action and the last section concludes.

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<sup>1</sup> These figures are based on data from <http://iresearch.worldbank.org/PovcalNet/>.

## 2. Structural Transformation in agriculture: essentials and current status in Sub-Saharan Africa

### 2.1. The essentials of structural transformation of agricultural and rural economies<sup>2</sup>

The ‘structural transformation’ central to economic development describes the process by which low-income societies, in which agriculture absorbs most labor and generates most economic output, become high-income societies characterized by a relatively smaller but more productive agricultural sector. The primary macro-level descriptor of economic development has always been a steady decline of agriculture’s share of both employment and gross domestic product (GDP), a pattern strongly associated with income growth, urbanization, poverty reduction, and a demographic transition from high birth and death rates common in backward rural areas to lower ones associated with better health standards. The final outcome of the structural transformation is an economy in which well-functioning factor (e.g., financial and labor) and output (e.g., food) markets equalize the capital and labor productivity between agriculture and non-farm industrial, service and other sectors, leading to inclusive economic growth.

The historical record is very clear on the key role that agriculture plays in stimulating the non-agricultural economy (Timmer 2002, 2009, Syrquin 2006). The importance of the bidirectional linkages between rural agricultural and urban industrial economies has been a longstanding theme of the structural transformation literature, dating at least from Lewis (1954) and Johnston and Mellor (1961). Most experts have seen productivity growth, perhaps especially on small farms, as the key ingredient to rapid poverty reduction and a healthy structural transformation, although that view has been contested recently in the African case (Collier and Dercon 2014, Dercon and Gollin 2014). New macro-evidence suggests that agricultural productivity growth continues to be important in ushering in structural change even in transitioned societies (Chen and Liao 2015).

In the early stages of structural transformation there typically exists a substantial gap between the share of the labor force employed in agriculture and the share of GDP generated by that work force. In SSA, agriculture’s share of GDP has declined from 17 to 14% over the 2000-2012 period of accelerated real per capita GDP growth, according to World Bank data.<sup>3</sup> Meanwhile, agriculture still occupied more than half (52%) of the region’s economically active workforce in 2013, according to FAO data.<sup>4</sup> This implies especially large differences in annual average labor productivity among sectors within SSA. Within low-income countries, the value of output per non-agricultural worker is typically 2-4 times that of agricultural workers, even controlling for heterogeneity of input quality and various other measurement problems (Gollin, Lagakos and Waugh 2014a,b). These dramatic differences suggest significant barriers to more efficient allocation of factors of production, although precisely which obstacles account for the sharp discrepancy surely varies across contexts and remains a puzzle in need of more careful research, especially in the SSA setting.

These gaps typically narrow over time as incomes rise and labor and financial markets grow better integrated. These structural gaps nonetheless can widen during periods of rapid overall GDP growth, when the share of agriculture in GDP falls much faster than the share of agricultural labor in the overall labor force, generating a growing difference between agricultural and non-agricultural labor productivity. That has been true in Africa over the past decade.

Once agricultural productivity growth yields agricultural surpluses, intersectoral linkages typically enhance agriculture’s contribution to economic growth through factor markets, as labor and capital move from the low-productivity rural farm sector to higher productivity uses in the rural non-farm or urban sectors. If financial and labor markets worked perfectly, there would be few productivity gains from such

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<sup>2</sup> This section draws on Barrett, Carter and Timmer (2010).

<sup>3</sup> This and all subsequent ‘World Bank data’ come from the World Development Indicators data (<http://wdi.worldbank.org/>), unless otherwise indicated.

<sup>4</sup> This and all subsequent ‘FAO data’ come from FAOStat (<http://faostat.fao.org/>), unless otherwise indicated.

movements. Identifying and addressing market imperfections are therefore central to the task of stimulating agricultural transformation for the low-income rural economies of SSA.

After robust agricultural growth has been established and sustained for some period and the non-agricultural sector has become significant, economies move into an integration phase in which growing agricultural surpluses accelerate growth in the nonagricultural sectors by further mobilizing labor, savings, and tax revenues. Continued agricultural development then depends on increasing integration into the rest of the economy through improved infrastructure and the development of competitive markets.

The role of agriculture in an economy's structural transformation heavily depends on the extent of economic integration within the domestic economy and with global markets. In principle, food imports can enable an economy to skip some of the above stages by redirecting labor directly from agriculture into industry, relying on manufactured export earnings to finance food imports (Dercon 2009, Dercon and Gollin 2014). But that trade-based approach has only worked for a very limited number of small developing countries – such as Hong Kong or Singapore – with very low-cost connectivity to global markets. Most SSA countries have large populations distant from ocean ports and therefore must rely on domestic production for the overwhelmingly majority of their food supply for the foreseeable future. Indeed, from 1980-2009 the percentage of SSA agricultural output consumed within the country in which it was produced never fell below 80 percent, and was typically above 90 percent and increasing, on average, over the period, especially among land-locked countries (Barrett and Upton 2013).

The structural transformation perspective on the evolution of rural economies also sheds important light on the role of rural livelihoods diversification, which is too often thought of as just a risk mitigation strategy, whereby farmers trade off expected returns for stability in income or consumption, instead of as an avenue for achieving increased returns through strategic complementarities. Both within-farm diversification – crop rotations and intercropping strategies for conserving and stabilizing soil fertility, for example – and farm-nonfarm diversification – using off-farm earnings to obviate liquidity constraints to on-farm investment in soil and water conservation or in improved, purchased inputs, for example – can help accelerate productivity growth, equalization of labor returns across sectors and structural transformation. The rural non-farm sector thus provides a crucial bridge between commodity-based agriculture and livelihoods earned in the modern industrial and service sectors in urban centers (Haggblade, Hazell, and Reardon 2007). Most farming households earn a large share of their incomes from non-farm sources. Indeed, growth in off-farm/non-farm earnings by farm households is typical of the agricultural transformation, underscoring the importance of farm-nonfarm linkages.

Not only does the rural non-farm sector offer a ladder from under-employment on farm to regular salaried or wage employment in the local economy, it also provides a source of regular liquidity to obviate financial market failures that otherwise impede on-farm investment. Access to high-return non-farm opportunities is strongly associated, however, with households' initial holdings of human and other forms of capital and access to financial services, so poverty traps can arise in the absence of an initial impetus to productive diversification (Barrett, Bezuneh and Aboud 2001; Barrett, Reardon and Webb 2001; Haggblade, Hazell, and Reardon 2007; Marenya and Barrett 2007; Bezu, Barrett and Holden 2012; Stephens *et al.* 2012). Recent evidence suggests that rural diversification association with movement into the rural non-farm economy and secondary towns has a more powerful poverty reduction effect in Africa than does rural-to-urban migration, complementing the observation that agricultural growth has a more powerful poverty reducing effect than does non-agricultural growth (Minten and Barrett 2008; de Janvry and Sadoulet 2009; Christiaensen, Demery and Kuhl 2011; Christiaensen, DeWeerd and Todo 2013; Christiaensen and Todo 2014; Dorosh and Thurlow 2014). Higher urban wages suggest that individuals should be flocking towards cities to reap income gains. Low levels of internal migration within Africa may therefore signal excessive and counterproductive barriers to restricting the movement of people towards potentially more productive jobs (De Brauw, Mueller, and Lee 2014).

## **2.2. Current status of the structural transformation of African agriculture**

The Comprehensive Africa Agricultural Development Programme (CAADP), established by the Africa Union assembly in 2003, recognizes that a structural transformation of African agriculture is central to any strategy for inclusive economic growth and poverty reduction on the continent. African governments agreed through CAADP to increase public investment in agriculture to a minimum of 10 percent of their budgets. Uneven compliance with this pledge notwithstanding, this renewed commitment has sparked complementary efforts in cooperation with international donors, nonprofit organizations, and research institutions.

A concerted effort is required because Sub-Saharan Africa (SSA) remains the world region with the lowest agricultural labor productivity and the largest share of its work force engaged in agriculture. Tracking progress on labor productivity growth as it relates to structural transformation is a challenge in any context because total labor productivity growth represents an aggregate of (i) the increase of labor productivity within existing economic activities via technological change, capital accumulation, or shifts in the terms of trade as well as (ii) the movement of labor from low- to high-productivity sectors. This challenge is exacerbated in SSA because of limited data. But several recent efforts have significantly advanced our understanding of labor productivity, the gaps between productivity levels in agricultural and non-agricultural sectors, and what stands to be gained from a structural transformation in Sub-Saharan Africa.

Recent studies using national income accounts suggest accelerated growth in African labor productivity since 2000, which has contributed to overall productivity growth in African agriculture (Block 2010), and that reallocation of labor from agriculture to other sectors accounts for about half of growth in overall labor productivity across Africa (McMillan and Harttgen 2014). These trends have been linked to increasing per capita consumption values using the same national accounts data. Using similar data, Gollin, Lagakos, and Waugh (2014b) find that non-agricultural labor is 6 times more productive than agricultural labor in Africa, relative to 4.5 times in other developing countries, 3.4 times in middle income countries, and 2.2 in high income countries. These figures suggest huge gains still to be reaped through an accelerated structural transformation process. All of these studies using national level data, however, show the substantial heterogeneity in records across countries in the region.

Relying on national accounts data exclusively, however, may over-state the prospective gains that laborers can achieve by exiting agriculture. Important new work by McCullough (2015) uses data from the World Bank-led Living Standards Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA) nationally representative household surveys that report the hours worked in each sector by each household member. Once one accounts for inter-sectoral differences in time worked, which is particularly important due to the seasonal nature of agricultural work as well as often-diversified income portfolios of rural households, the productivity differentials commonly found in less fine-grained datasets nearly disappear. The powerful implication is that what is commonly understood as an intersectoral labor productivity gap may be more an employment gap. Using similar data, Chistiaensen and Kaminski (2014) estimate the average labor productivity gap between farming and urban self-employment in Uganda 2009/10 to be a mere 1.9. They also look more deeply into the distribution of productivity levels *within* sectors, finding highly skewed distributions and across most non-agriculture sectors driving some of the overall gaps. These two studies signal (i) the continued importance of focusing on agricultural productivity growth as a vehicle for ushering in structural transformation – rather than prematurely shifting workers to other sectors – and (ii) the substantial scope for improving labor productivity and employment within sectors. Agricultural transformation, based on productivity growth, improved market functioning and growth in the rural non-farm economy, remains essential to achieve the goal of inclusive growth and prosperity in SSA.

Other recent descriptive evidence drawn from the same six nationally representative LSMS-ISA household surveys (from Ethiopia, Malawi, Nigeria, Niger, Tanzania, and Uganda) provides an update to our understanding of African agricultural and rural areas, including the potential engines of and inhibitors

to agricultural productivity.<sup>5</sup> Sheahan and Barrett (2014) show that most African smallholder farmers still use modern inputs, although pockets of high use across and within several countries exist, particularly for chemical fertilizer and agro-chemicals. Country-level factors, embodying policy and enabling environment, appear most important in driving agricultural input adoption. Dillon and Barrett (2014) find high rates of participation of rural households in land and labor markets, coupled with strong evidence of pervasive factor market failure that are not specific to a given sub-population but rather appear general and structural in nature. Deininger, Xia, and Savastano (2015) study land markets in these same data sets and find that, despite significant inefficiencies, land rentals do transfer land to land-poor, labor-rich, and more productive cultivators. Binswanger-Mkhize and Savastano (2014) nonetheless find that agricultural intensification remains low in all countries except Uganda.

The current evidence reinforces the longstanding impression that non-farm income sources are crucial to structural transformation in rural Africa (Barrett, Reardon and Webb 2001; Haggblade, Hazell and Reardon 2007). Ricker-Gilbert, Jumbe, and Chamberlin (2014) explore the drivers of agricultural productivity growth in Malawi and find no evidence that increases in population density enable farmers to increase the gross value of agricultural output apart from through input intensification. Off-farm income appears to be most important in the most densely populated areas. Studying income diversification patterns across all included SSA countries, Davis, Di Giuseppe, and Zezza (2014) find that specialization in non-agricultural activities stochastically dominates farm-based activities in terms of welfare provisioning, despite the continued importance of agriculture as a source of income.

### **3. Structural features of African food systems that impede a structural transformation<sup>6</sup>**

Several key structural features of the region heavily condition the available paths for structural transformation and the policies most likely to help stimulate sustainable transformation. The net result of these structural features is the relatively low agricultural productivity compared to other world regions. FAO data indicate that global agricultural productivity, measured as the constant dollar value of food production per capita, increased nearly 2 percent annually over the 1980–2000 period, leading to historic low real global food prices, in SSA the value of food production per capita increased less than half as quickly, on average only from \$550 per worker to \$637 per worker from 1980 to 2000, an anemic 16 percent improvement in 20 years.

First, *land* is a growing problem even though SSA remains relatively land-abundant, averaging 0.2 hectares of arable land per capita (FAO) and accounts for nearly half of the world's uncultivated arable land (Deininger and Byerlee 2012), making it the world's primary remaining agricultural frontier. Considerable diversity exists within villages much less among sub-regions and countries, some with too little land to feed their populations, while many of the most land-abundant nations are largely arid, with poor and degrading soil quality, or heavily forested with limited transport infrastructure. Soil quality throughout the region is generally poor and an estimated two-thirds of African land is already degraded, directly affecting about 65 percent of the population (UNECA 2007). A growing body of empirical evidence links low soil fertility to persistent rural poverty (Barrett and Bevis in press).

Meanwhile, median farm size is declining across SSA, with a growing share of farms too small to be commercially viable or to practice sustainable intensification such that very small farms are increasingly associated with lower, rather than higher, agricultural labor productivity that may be constraining structural transformation (Jayne *et al.* 2003; Jayne, Chamberlin and Headey 2014). While the best available evidence from SSA still indicates a strong inverse relationship between farm size and crop yields (Barrett, Bellemare and Hou 2010, Carletto, Savastano and Zezza 2013; Larson *et al.* 2014), this is perhaps best understood as an endogenous outcome of the various factor market imperfections that

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<sup>5</sup> Many of these studies were completed under the auspices of the World Bank's Agriculture in Africa: Telling Facts From Myths project (<http://www.worldbank.org/en/programs/africa-myths-and-facts>).

<sup>6</sup> This section draws significantly on Barrett and Upton (2013).

generate these patterns and not due to any intrinsic superiority of smaller farms per se, particularly not in enhancing labor productivity (Collier and Dercon 2014).<sup>7</sup> Indeed, some recent cross-country evidence suggests that policies meant to limit farm sizes may lead to productivity-reducing misallocation of land (Adamopoulos and Restuccia 2014).

The distribution and security of land rights also pose major challenges. The relatively rich agricultural lands of many countries, particularly in southern and eastern Africa, have been subject to insecure land rights, including expropriation by the state, or have remained in the hands of an elite minority. Both insecure land tenure and land exclusion limit agricultural productivity and on-farm investment, even when such investments enhance the security of rights over land (Deininger and Jin 2006; Pender and Fafchamps 2006; Dillon and Voena 2015). Proper land certification in some cases has positive impacts for smallholders, inducing them to maintain soils, make productive investments, and enhance land productivity (Holden *et al.* 2008).

Second, ***water resources*** are sharply limiting in most of the region. The aggregate abundance of water in the equatorial region, from Sierra Leone to Uganda, where countries average between 20 and 100,000 m<sup>3</sup> of renewable freshwater resource per capita per annum, stands in sharp contrast to the 70 percent of SSA countries that receive on average an order of magnitude less (World Bank World Development Indicators). Indeed, 43 percent of the SSA land mass ranges from semi-arid to hyper-arid (FAO). And even within the arid states, rain and water resources tend to be concentrated, leaving some subregions particularly arid and hence vulnerable to climate shocks and changes. Across SSA an estimated 60 percent of all land is at risk of desertification (FAO). Improved water and land management can help stem or even reverse those patterns, but climate change poses a serious threat in these regions (Barrett and Santos 2014). Agriculture accounts for more than 80 percent of water use, despite far less land suitable for irrigation or currently irrigated than any other world region (Bruinsma 2011). The most recent household survey data from across the continent show that less than five percent of farming households have any irrigation and less than two percent of cultivated land is irrigated (Sheahan and Barrett 2014). And rapidly growing cities are increasingly competing with agriculture for access to fresh water. Expanding the irrigated frontier is a major untapped source of agricultural potential, especially where it can be done economically using surface water or renewable energy resources to pump groundwater (Burney *et al.* 2009).

Third, ***weak human capital*** in rural areas limits agricultural labor productivity growth. Education and health levels remain low across the continent. SSA suffers by far the world's highest rates of under-five and maternal mortality and youth and adult illiteracy. The expected average number of years of education increased by only two years, from six to eight, between 1980 and 2000, with the education rates generally lower and illiteracy rates higher in rural areas. The dearth of educated, healthy farmers limits the capacity for internally driven innovation in the agricultural sector and challenges uptake of innovations developed through research and development or imported from abroad. The skilled human resources necessary for an effective agricultural R&D program remain scarce in SSA. For example, where low- and middle-income countries in Asia and Latin America routinely have dozens, if not hundreds, of agricultural researchers per million of population economically engaged in agriculture, the comparable number is less than 10 in 24 of the 33 SSA countries for which data are available (Alene *et al.* 2011). Extension services follow a similar pattern, with only one extension worker per thousand sub-Saharan African farmers, far less than the 1/200 farmers ratio in developed countries as a whole.<sup>8</sup> Although budgets for agricultural research and extension are slowly increasing in some countries, and there has been increased scientific staffing for food crop improvement in particular countries and crops (Alene *et al.* 2011), the scientific human resource base on which to build remains woefully insufficient.

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<sup>7</sup> Indeed, Foster and Rosenzweig (2011) suggest that, in India, once one values labor properly, small farms are typically less, not more, productive than farms of five or more acres.

<sup>8</sup> This estimate appears reasonably widely, for example at <http://allafrica.com/stories/201112221016.html>, but its original source is unclear.

Fourth, the ***institutional and physical infrastructure*** that underpins SSA food systems is relatively weak and expensive. Across SSA, insufficient transportation and communications infrastructure poses significant problems by impeding smooth market functioning for farmers trying to purchase inputs or sell surpluses as well as for post-harvest processors. Weak market integration commonly renders government macroeconomic and sectoral policies ineffective by impeding market transmission of economic signals related to policy change (Moser *et al.* 2009). Similarly, without good access to distant markets that can absorb excess local supply, adoption of more productive agricultural technologies typically leads to a drop in farmgate product prices, erasing many of the gains from technological change and thereby dampening incentives for farmers to adopt new technologies that can stimulate economic growth. Markets also play a fundamental role in managing risk associated with demand and supply shocks; good market integration facilitates adjustment in net export flows across space and time, thereby reducing price variability faced by consumers and producers, while poor market integration leads directly to price volatility.

A significant part of the problem is transport infrastructure. The arid countries with low population density, such as Mauritania and Niger, have the severest dearth of roads, with approximately 1 km of road for each 100 km<sup>2</sup> of area, against the low SSA average of about 20 km. While a few SSA countries have extensive networks of paved roads, only 25 percent of road distance is paved, on average. Poor transport infrastructure poses particular problems for the 17 land-locked African countries that face distances of 200-1500 km from their capital cities to the nearest seaports. All-season rural roads access appears a key means of overcoming spatial poverty traps, not least of which by encouraging greater market participation, input use, and agricultural specialization (Stifel and Minten 2008, Calderon 2009, Jacoby and Minten 2009, Gollin and Rogerson 2010). Indeed, transport costs are so considerable in land-locked regions, that global oil price shocks have a greater impact on local maize prices than do global maize price shocks (Dillon and Barrett in press).

Rail systems hold promise. However, World Bank data indicate that the modest total distance of active railway lines actually declined by about 30 percent between 1986 and 2009 (Barrett and Upton 2013). Crossing borders to reach ports leads to high costs beyond the burden of poor physical infrastructure. Border crossings often entail fees—both official and unofficial—that increase transaction costs and delay deliveries.

The spread of cell phone use has the potential to promote economic development, in particular by making agricultural markets more efficient and reducing price dispersion (Aker 2010, Aker and Mbiti 2010). Africa has become a pioneer in the development of mobile phone-based banking services and in crowd-sourcing of geospatially referenced information related to political unrest and natural disasters. Internet use is significantly less prevalent, but rising rapidly. The average penetration across sub-Saharan Africa is approximately 15 percent, with rates within countries ranging from near 1 percent (Ethiopia, Guinea, DRC) to 30 percent or more (Mauritius, Kenya, Nigeria; MMG 2012).

Fifth, African agriculture is especially exposed to ***uninsured risk*** as a result of weak infrastructure, limited water management, and its exceptionally high domestic orientation. Financial markets fail for the rural poor for a host of reasons (Besley 1995). The resulting lack of insurance and credit routinely trap poor agrarian households in low return, lower risk technologies, thereby perpetuating poverty and low productivity (Carter and Barrett 2006; Dercon and Christiaensen 2011; Barrett and Carter 2013). Financial market failures are directly associated with relatively anemic rates of development and uptake of modern agricultural inputs, in particular irrigation and machinery (Sheahan and Barrett 2014).

Finally, ***weak governance and political capture*** remains an important impediment to aggressive agricultural productivity growth. Shimeles, Gurara, and Tessema (2015), for example, show how fertilizer import prices across a large section of Africa cannot be explained by actual transport and finance costs, implying that market power fostered by government regulation drives high agricultural input prices, starting at import and continuing through the supply channel. Berhanu and Poulton (2014) show how the largest public agricultural extension program in SSA – run by the Ethiopian government – is implemented with election outcomes in mind, undermining its effectiveness as an agricultural productivity enabler. These demonstrations of the political capture of agricultural input systems that should directly translate

into agricultural productivity gains suggest structural features that thwart more aggressive and inclusive growth. At the same time, weak governance and planning could mean that economic systems change without the transformation necessary for job creation and robust productivity growth. Resnick and Thurlow (2014) detail how this scenario unfolded in Zambia, ultimately leading to the overthrow of the government.

#### **4. Advancing towards structural transformation in sub-Saharan Africa**

Despite substantial structural issues, the first decade of the 21<sup>st</sup> century brought significant progress in agricultural productivity growth in some parts of sub-Saharan Africa after decades of decline or stagnation (Block 2014), albeit with important divergence between countries (Barrett and Upton 2013). In spite of seemingly more frequent droughts and floods in the region, land productivity growth advanced significantly in each of sub-Saharan Africa's major regions between 2000 and 2009, with some increase in labor productivity, albeit not as rapid as yield growth.

Part of the accelerated productivity growth is attributable to renewed government commitments to promoting and improving the agricultural sector, as reflected in the CAADP goals related to promoting agricultural markets and regional integration, improving farmers' access to markets, combating inequality, and advancing agricultural technology. The largest strides have been made where concerted investments have taken place. For example, the New Rice for Africa (NERICA) program, led by Africa Rice, an international research center based in Benin, introduced and promoted new, interspecific cultivars of rice developed through tissue culture techniques to cross African and Asian varieties that do not naturally interbreed. The resulting varieties have generated significantly greater yields and spread widely in West Africa over a short period of time. Meanwhile, a global initiative successfully eradicated rinderpest, a disease that affects cattle and can be disastrous for sub-Saharan African pastoralists; the last outbreak was reported in 2001.<sup>9</sup> While private sector R&D has played a growing role, to date the vast majority of progress in developing improved plant and animal genetic material and natural resources management practices for sub-Saharan African agriculture have come from publicly or philanthropically funded national or international research efforts.

Fertilizer use has also expanded substantially in sub-Saharan Africa over the past decade, fueled in part by government subsidy programs and high-level attention afforded the subject by the 2006 Africa Fertilizer Summit in Abuja. While fertilizer application rates remain very low in many countries in the region, it has become substantial in several others (Sheahan and Barrett 2014). The release of new crop varieties and rates of farmer-level adoption of improved varieties also increased noticeably from 1997–98 to 2009–10, perhaps signaling some progress in agricultural R&D and its impacts in sub-Saharan Africa that bode well for the years ahead (Alene *et al.* 2011).

Population growth, urbanization, income growth, and increased connectivity have all fueled growing demand for food across Africa, and increased agricultural market integration, as food marketing channels are showing early signs of value chain transformations similar to what occurred in Latin America and East and Southeast Asia over the past 20 years (Reardon and Timmer 2007; Gómez *et al.* 2011). These food marketing channels are generally domestically oriented, however, in spite of the attention paid to export promotion. In part because of the high costs of commerce due to poor infrastructure, an unusually large share of food consumed in SSA is produced within the same country where it is eaten. Between 1980 and 2009 the share of domestic food production consumed at home routinely exceeded 90 percent and increased, on average, over the period. As global prices and sub-Saharan Africa food demand have increased, the region continues to rely heavily on its own output to feed its population. Net imports have increased slightly, but most of the region's added food demand has been met by expanded sub-Saharan Africa food production. The long-standing differences between coastal and land-locked countries have become more pronounced in the past decade, with the landlocked sub-Saharan Africa states now

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<sup>9</sup> The Global Rinderpest Eradication Programme report, [http://www.fao.org/ag/againfo/resources/documents/AH/GREP\\_flyer.pdf](http://www.fao.org/ag/againfo/resources/documents/AH/GREP_flyer.pdf).

obtaining up to 95 percent of total food from domestic production. The highly domestic orientation of SSA agriculture accentuates the necessity of structural transformation and of development of viable food value chains to efficiently move food from farms to growing cities. And as structural transformation trends continue to pick up in Africa, an impending *diet transformation* will quickly follow adding new jobs to the agri-business sector in turn (Tschirley *et al.* 2015).

### **Policy implications for stimulating agricultural and rural transformation in Africa**

Promoting the structural transformation of African agriculture and of the rural spaces within which most agricultural activities occur is essential to advance an inclusive growth agenda in Africa. But researchers have yet to convincingly identify precisely the reasons for sharp intersectoral productivity differentials that keep agricultural labor productivity so low in Africa. Most likely there are multiple reasons, each of which lends itself to distinct policy interventions. These policy priorities are best grouped into six distinct domains.

1. *Invest in physical and institutional infrastructure to remedy deficiencies that differentially penalize agriculture.* For decades, a deep urban bias led to a distorted pattern of investment in much of Africa, with too much public and private capital invested in urban areas and too little in rural areas. This was true for infrastructure, such as roads and water, for public services, such as education and police protection, and for private services, such as finance. In response, rural households and firms still hold too much capital in liquid and unproductive forms as a strategy to manage risk in the face of thin and highly imperfect credit and insurance markets, and invested too little in productivity-increasing capital, such as education, irrigation or machinery, and variable inputs, such as improved seed or fertilizer. SSA governments need to learn from the experience of countries that successfully launched shifted investment priorities in favor of rural growth and benefited from the pre-existing disequilibrium in rates of return, at least initially, as real value added per farm worker increased rapidly due to both increased factor productivity and to increased efficiency in factor allocation across sectors.
  - a. Reversing urban bias requires concerted, large-scale public (or philanthropic) *investment in village-level physical and institutional infrastructure* in order to crowd in private investment. But such investments need not be undertaken exclusively by government. Rural roads, electricity, telephone, internet, financial and agricultural extension services can all be delivered by private providers if offered adequate incentives. The state can play a valuable role by providing essential (especially transport) infrastructure and facilitating the emergence of networks of profitable private providers. The mobile telephony revolution that has swept SSA over the past generation serves as an important example to try to replicate, with private providers, supported by government, inducing a rapid increase in rural labor productivity and improvements in rural market performance and standards of living (Aker and Mbiti 2010, Aker and Fafchamps 2015).
  - b. Because structural transformation requires redirecting attention downstream, beyond farm-level production to post-harvest distribution and value addition, the other essential public goods required are *reliable and transparent contract law, grades and standards and police protection* that reduce the transactions costs that burden agricultural value chains and that lead to precautionary behaviors that significantly add to the costs of commerce in African agriculture (Fafchamps 2004).
2. *Address the water and soil constraints that hold back agricultural productivity.* Agricultural productivity depends uniquely on the productivity of the natural resource base on which the sector depends. As soils and water sources degrade, it undercuts growth in agricultural labor productivity and retards structural transformation.
  - a. SSA is by far the world's least irrigated agricultural region, largely because it remains too expensive for farmers to withdraw groundwater given the cost of fuel and limited access to credit to invest in pumps and pipes. But the physical potential is considerable. Emergent technologies, such as solar-powered methods for withdrawing abundant groundwater supplies during periods of maximal evapotranspiration (Burney *et al.* 2009) or treadle pumps (Kay and Brabben 2000),

- could prove transformative if cost-effective means of financing uptake and maintenance emerge. When irrigation becomes affordable, attention then needs to turn to the complementary infrastructure that is necessary to facilitate adoption (Gollin, Morris and Byerlee 2005).
- b. In a similar spirit, *integrated soil fertility management* methods to end or even reverse soil degradation could substantially increase yields without stimulating sharply increased reliance on unaffordable, imported fertilizers (Place *et al.* 2003; Sanginga and Woomer 2009; Vanlauwe *et al.* 2010). Efforts to promote the integrated use of agroforestry, fallows, inorganic fertilizers, legumes, and manure has the potential to fix carbon, restore soils, and even combat desertification but need explicit encouragement and investment.
  - c. African states need to *improve the security of resource tenure generally and the terms and transparency of land contracts and deals specifically*. Continued increase in external demand for land and water will spark further large-scale land acquisitions to bring more uncultivated arable land into production. These investments have the potential to boost agricultural productivity through judicious investments that might close yawning yield gaps in undercapitalized African agriculture and generate environmentally and socially sustainable food supplies for domestic and regional markets. But if land and water deals occur in a less than transparent fashion, with little or no objective monitoring and evaluation, and without increased safeguards on the tenurial security of traditional cultivators and herders, then legitimate concerns will build around dispossession of the rural poor and despoliation of increasingly fragile natural resources and the prospect of productivity-reducing and poverty-increasing social unrest will rise. Land deals and enhanced tenurial security may lead to farmland consolidation, which can help stem the growth in farms too small to be commercially viable and to effectively absorb surplus labor (Jayne *et al.* 2003; Adamopoulos and Restuccia 2014; Collier and Dercon 2014).
3. *Invest in the development and diffusion of new agricultural technologies appropriate to sub-Saharan Africa*. The yawning productivity gap between African smallholder agriculture and farmers elsewhere in the world offers the promise of productivity growth on the existing resource base. While price policies suffer from the food price dilemma—e.g., raising food prices to help farmers hurts consumers, and vice versa (Timmer, Falcon and Pearson 1983) — total factor productivity improvements improve farmer profitability while concentrating most welfare gains in the hands of poorer farm workers and consumers, who spend a large share of their meager incomes on food commodities (Minten and Barrett 2008). This will necessarily take a different form than the earlier Green Revolution in Asia, which developed and disseminated a few blockbuster improved seed varieties along with mass-produced inorganic fertilizers and standardized irrigation methods across vast homogeneous landscapes. The patchwork quilt of SSA’s heterogeneous agro-ecologies necessitates highly localized solutions. That will require sharply *expanded investment in local, national and regional agricultural research systems* that currently lack adequate scientific capacity to develop animal and plant genetic material and complementary inputs well-suited to local agro-ecologies and consumer tastes.
    - a. *Productivity improvements may be enhanced by enabling adoption of genetically modified (GM) foods*. It will also require *removing regulatory obstacles to the development of GM crops* designed to better withstand stresses like drought, pathogens, and pests. The use of GM crops requires adequate biosafety controls, but external political pressure has induced overreaction against GM seed adoption in SSA, with adverse consequences for the region (Paarlberg 2002). Thus far, although many SSA countries have active research programs of on-station or even on-farm research with GM varieties, South Africa, Burkina Faso and Sudan are the only SSA countries with open cultivation of GM crops, and GM food crops are commercially grown only in South Africa, as Burkina Faso and Sudan grow only GM cotton commercially (James 2013). The need for GM options will increase in the years ahead, especially in the face of climate change. Therefore SSA countries need to get responsible, rigorous but not onerous biosafety controls in place and ignore the external political pressures to pass on modern biological science.

- b. A related priority area for agricultural research is *animal disease management*, including of zoonotic diseases related to manure management that African governments have typically been unable to regulate effectively. If the African agricultural research and veterinary care community can contain poultry diseases and trypanosomiasis, thereby opening vast new areas for cattle, the impacts of reduced risk and adverse spillover effects could be considerable on productivity growth, as well as on animal-source food supplies and prices. Africa's land abundance and limited water control gives it comparative advantage in livestock production. And both herd sizes and animal product output have been increasing rapidly in SSA over the past decade.
4. *Focus as much on the post-harvest value chain and the rural non-farm economy as on farm-level production.* African smallholder farmers are generally 'poor but efficient' (Schultz 1964). But the traditional input systems that supply them and the value chains that evacuate, aggregate, process and distribute their harvests are demonstrably inefficient (Fafchamps 2004; Reardon *et al.* 2009). A growing body of evidence suggests that modern agricultural value chains effectively internalize many of the externalities that lead to inefficiency in traditional agriculture in SSA (Swinnen 2007; Reardon *et al.* 2009, Barrett *et al.* 2012). The appropriate mode of organization of the post-harvest value chain varies dramatically by crop and location, but whether it is vertical integration, coordination mechanisms through outgrower schemes or contract farming arrangements, or other forms, the emergence of new modes of linking farmers to consumers is slowly bearing fruit in African agriculture, not least of which by promoting uptake of modern inputs, innovation in natural resources management and post-harvest practices, and upgrading of quality control (Reardon and Timmer 2007; Swinnen 2007; Reardon *et al.* 2009). At the same time, the rapid expansion of telecommunications and electrification into secondary towns is stimulating robust growth in the non-farm sector that appears to have greater productivity boosting and poverty reducing effects than does rural-to-urban migration (Christiaensen and Todo 2014). Structural transformation will require accelerated expansion of downstream agricultural value chains and rural towns, as well as of nontraditional, higher-value agricultural products.
  5. *Encourage the emergence of rural financial institutions and products* to help African farmers and traders manage risk more efficiently. The agricultural sector is subject to far greater risks than are other sectors, especially in SSA (Hardaker *et al.* 2004). And the biological lags intrinsic to agricultural production, especially of higher-value perennials and livestock, create a significant delay between investment and payoff that commonly requires financial intermediation. So whether for credit or insurance, the agricultural sector commonly needs reliable access to financial services more per unit value added than do other sectors. Yet the continent's under-developed financial markets, especially in rural areas, differentially depress the productivity of labor and land inputs used in agriculture and discourage investment in costly inputs, like fertilizers or improved seeds, that might increase the risk farmers face (Dercon and Christiaensen 2011; Barrett and Carter 2013). Furthermore, when combined with the economies of scale intrinsic to financial products, the small scale of most SSA farms compounds the disadvantage of the agricultural sector (Carter 1988; Besley 1995). The multiple financial market failures that pervade rural Africa generate many 'displaced distortions' apparent in seemingly-irrational resource allocation patterns and poverty traps that perpetuate low productivity and ultra-poverty (Barrett 2007; Barrett and Carter 2013).
  6. *Build rural human capital through improved preventive and curative health care and primary and secondary education systems* that ensure a healthy and able workforce. Urban bias in the provision of such public goods has led to a concentration of the lowest ability workers in agriculture, which some analysts hypothesize accounts for the stark observed sector gaps in labor productivity (Lagakos and Waugh 2013). Furthermore, the intergenerational transmission of education and health status from parents to adult children is a well-established empirical regularity worldwide that tends to reproduce low agricultural labor productivity over time within rural communities (Ahlburg 1998; Black, Devereux and Salvanes 2005; Barrett and Carter 2013). Quite apart from the intrinsic benefits of improved current well-being, direct health and nutrition interventions among pregnant and lactating women and their young children offer well-documented high long-run returns, including in adult

labor productivity of affected children (Casasnovas, Rivera and Currais 2005; Hoddinott *et al.* 2008; Victora *et al.* 2008). A workforce with limited human capital has limited ability to innovate, to effectively deploy new technologies the effectiveness of which depends in part on skill, or to take advantage of emergent market opportunities. Rural nutrition, health and education investments are therefore essential complements to each of the other policy priorities discussed above.

## 5. Conclusions

We know from the development experiences of other regions of the world that rapid structural transformation from a poor agrarian economy to a high-income industrial one is feasible and can bring with it rapid, mass exodus from extreme poverty. Real agricultural output growth rates are accelerating in SSA, nearly doubling from the 1980s rate so that per capita output and agricultural labor productivity are growing again, helping reduce rural poverty rates and stimulate inclusive economic growth. Uptake of modern agricultural inputs, in particular inorganic fertilizers, improved seed and agro-chemicals, has increased sharply in several areas in the region, and modern agricultural value chains are likewise emerging. While Sub-Saharan Africa remains home to more than three-quarters of the world's ultra-poor, most of them concentrated in rural areas and dependent on agriculture, there are clear signs of progress that indicate the real prospect of structural transformation within the coming generation. The policy and donor communities are now appropriately focusing on how best to stimulate investment incentives, productivity growth, risk management and productive transitions that can accelerate the structural transformation of African agriculture and rural economies. These broad foci are appropriate and reasonably well-grounded in both theory and empirical evidence.

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