6

Agriculture's Role in Ending Extreme Poverty

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Roughly 80 percent of the world's extremely poor people are estimated to live in rural areas, and around 60 percent work in agriculture (Olinto and others 2013).[1] As of late 2014 it remains difficult to translate these proportions into precise headcount figures, but a reasonable approximation suggests that approximately 800 million extremely poor people live in rural areas, and more than 600 million are engaged in agriculture.[2] Amidst the world's extraordinary recent declines in extreme poverty, the foremost last mile challenge of

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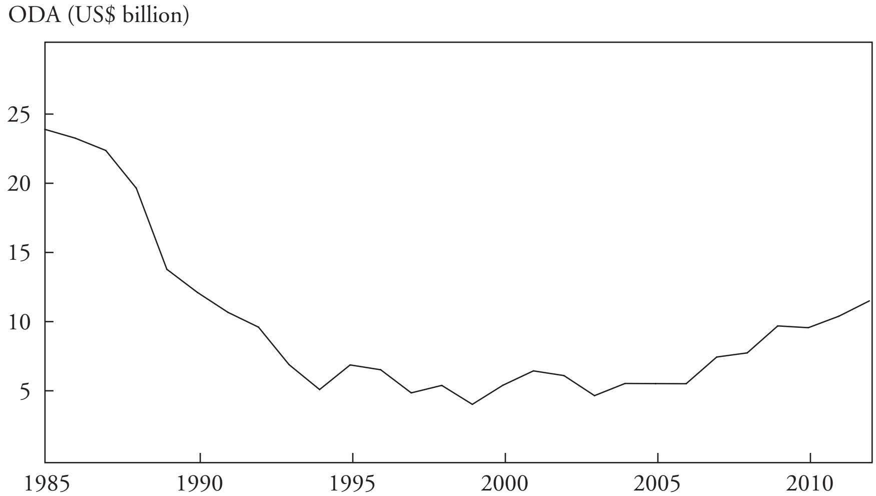
1. These researchers estimate that, as of 2010, 77.8 percent of people living on less than US$1.25 a day were living in rural areas and that 62.8 percent of the same group worked in agriculture.

2. In April 2014 the International Comparison Program published new global purchasing power parity (PPP) estimates for the baseline year 2011 (ICP 2014). These estimates represented a major update from the 2005 PPP benchmarks previously used to calculate extreme poverty globally. In October 2014 the World Bank announced that the new PPP data would not be incorporated into global poverty estimates until 2015. In the meantime, the World Bank and IMF's October 2014 *Global Monitoring Report 2014/2015* estimate that 1.01 billion people were living in extreme poverty as of 2011. The figures in this paragraph thus represent best estimates, with acknowledged imperfections, based on available data.

Figure 6-1. *Official Development Assistance to Agriculture, Forestry, and Fishing, 1985–2012*[a]



Source: OECD (2014).
a. Data presented in constant 2012 US$.

eliminating extreme poverty by 2030 will be to ensure that these farm families and local economies can reliably boost their incomes for the long term.

Fortunately, agriculture has enjoyed a renaissance of attention and global public resources in recent years. This has included a doubling of official development assistance for the sector since 2006, reversing a trend of long-term decline and stagnation. However, as shown in figure 6-1, the recent aid levels of more than US$11 billion still represent (in real terms) less than half the amount invested in agriculture in the mid-1980s. By historical standards the renaissance remains in its early stages.

Increased attention to agriculture has also reinvigorated debates around the sector's role in economic growth and poverty reduction. At one end of the spectrum, scholars downplay agriculture and instead emphasize the "pull" mechanisms of higher value added sectors like manufacturing and services as the key to economic growth. At the other end of the spectrum, scholars emphasize the central role agricultural productivity plays in feeding societies, keeping real wages competitive, and freeing up labor for other sectors.

In its simplest form, the last mile for agriculture hinges on whether it is easier to boost incomes on the farms where 600 million poor people already live or to create long-lasting, higher-wage, off-farm jobs to support all the same people. One central theme of this chapter is that each economy's agricultural circumstances are unique. But the bulk of the evidence suggests that—absent natural resource discoveries or other windfall opportunities—agriculture will continue to play a pivotal role in eliminating extreme poverty.

The Last Mile's Agricultural Contours

Aggregate assessments of agriculture can be difficult to penetrate because the term *agriculture* itself encompasses such a vast array of crop dynamics, ranging from storable grains like rice and maize, to highly perishable foods like apples and tomatoes, to stimulants like coffee and tea, to industrial inputs like cotton and rubber. Some crops are planted and harvested on a seasonal basis. Others grow on trees that only become productive after multiple years required to reach minimum maturity. And unlike other economic sectors, agricultural technologies are not universally diffusible, since most plants grow under particular conditions. This is the opposite of, say, mobile phone technology, which applies consistently across the planet. Coffee and rubber grow only under certain circumstances. Wheat is broadly diffusible across temperate but not tropical climates. Maize has localized germinating properties that are extremely difficult to transplant across geographies—quite different, for example, from paddy rice's relative adaptability across similar growing environments.

Since agriculture's products, investments, and local system dynamics are highly plant and place specific, the first step in a last mile strategy is to specify the relevant locations. While potentially significant revisions to global poverty estimates remain pending at the time of writing, a reasonable proxy of country-by-country poverty levels can be taken from purchasing power parity (PPP) adjusted "actual individual consumption" (AIC) data that were published in April 2014 (ICP 2014). The indicator assesses the mean value of household-level goods and services consumed in each country, incorporating both those purchased in private markets and those provided through government programs. The AIC measure is thereby a useful approximation of average material well-being in each country, even if it does not provide information on within-country distributions.

Table 6-1 lists the sixty-one countries with reported annual AIC of less than $5,000 in PPP terms. Note that this is not a comprehensive list of countries with extreme poverty, since AIC data are not available for all economies, such as Afghanistan, Papua New Guinea, South Sudan, and Timor-Leste. Nonetheless, for the purposes of this chapter the countries with relevant AIC data are separated into two categories. Group 1 includes the poorest thirty-one economies, with AIC of less than $2,000. These countries have a population of 550 million altogether. Group 2 includes twenty-eight countries with AIC values between $2,000 and $5,000. These countries have an aggregate population of 1.2 billion.

Table 6-1. *Annual Actual Individual Consumption (AIC per Capita), Sixty-One Focus Countries, 2011*

US$ (PPP)

Group 1: AIC per capita < $2,000			*Group 2: $2,000 < AIC per capita < $5,000*		
Country	*Region*	*AIC per capita*	*Country*	*Region*	*AIC per capita*
Dem. Rep. Congo	SSA	447	Nigeria	SSA	2,075
Liberia	SSA	606	Mauritania	SSA	2,089
Comoros	SSA	621	Bangladesh	SA	2,138
Burundi	SSA	648	Ghana	SSA	2,242
Niger	SSA	719	Myanmar	EAP	2,273
Guinea	SSA	789	Cambodia	EAP	2,277
Central African Rep.	SSA	869	Cameroon	SSA	2,297
Mozambique	SSA	890	Sudan	SSA	2,309
Guinea-Bissau	SSA	928	Lao PDR	EAP	2,341
Burkina Faso	SSA	953	Lesotho	SSA	2,524
Ethiopia	SSA	979	Yemen	MENA	2,762
Malawi	SSA	1,006	Vietnam	EAP	2,991
Tanzania	SSA	1,029	Tajikistan	ECA	3,025
Mali	SSA	1,047	Sao Tome and Principe	SSA	3,340
Togo	SSA	1,193	Kyrgyz Republic	ECA	3,506
Sierra Leone	SSA	1,194	Nicaragua	LAC	3,587
The Gambia	SSA	1,221	Bolivia	LAC	3,661
Rwanda	SSA	1,293	Honduras	LAC	3,748
Madagascar	SSA	1,332	Maldives	SA	3,883
Zimbabwe	SSA	1,349	Pakistan	SA	3,926
Uganda	SSA	1,390	Bhutan	SA	3,998
Benin	SSA	1,473	West Bank and Gaza	MENA	4,070
Chad	SSA	1,476	Morocco	MENA	4,309
Congo	SSA	1,513	Angola	SSA	4,319
Haiti	LAC	1,688	Philippines	EAP	4,490
Djibouti	MENA	1,719	Cape Verde	SSA	4,747
Zambia	SSA	1,778	Indonesia	EAP	4,805
Nepal	SA	1,848	Equatorial Guinea	SSA	4,916
Senegal	SSA	1,923			
Kenya	SSA	1,937	*Uniquely large countries*		
Côte d'Ivoire	SSA	1,979	India	SA	3,023
			China	EAP	4,331

Source: ICP (2014).

EAP = East Asia Pacific; ECA = East Central Asia; LAC = Latin America/Caribbean; MENA = Middle East North Africa; PPP = purchasing power parity; SA = South Asia; SSA = Sub-Saharan Africa

China and India would fall into group 2 based on their AIC levels, but in light of their uniquely large populations, they are listed separately.

Some geographical trends stand out in table 6-1. Twenty-eight of the thirty-one group 1 countries are located in sub-Saharan Africa, according to World Bank regional designations. The other three are Djibouti, Haiti, and Nepal. Group 2 countries are more geographically dispersed, including six in East Asia Pacific, four in South Asia, three in Latin America and the Caribbean, three in the Middle East and North Africa, two in Central Asia, and ten in sub-Saharan Africa.

Table 6-2 presents a range of population-weighted average economic and demographic indicators for the two groups of countries. Group 1 is estimated to have half of its population living in extreme poverty, compared to slightly less than a quarter of group 2. Although many individual countries' headcount assessments have been questioned under the outgoing 2005 PPP standards, the weighted aggregates should provide a reasonable overall approximation of the extent of poverty in the two groups. One implication is that the total number of people living in extreme poverty is similar across the two categories, at roughly 275 million in group 1 and roughly 320 million in group 2.

Other similarities between the groups are limited. Group 2's average per capita income is four times higher than group 1's. Moreover, group 2's real annual per capita growth rates averaged 4.0 percent between 2000 and 2010, compared to only 2.5 percent for group 1. Over the course of a decade this implies a cumulative 20-percentage-point difference in economic outcomes. The population in the lower AIC group is also significantly more rural, averaging 72 percent, while that portion is 58 percent in group 2.

Group 1's average fertility rates are dramatically higher, at 5.3 children per woman, compared to 3.3 in group 2. This helps drive group 1's much faster overall population growth, at 2.7 percent annually, compared to 1.7 percent for group 2. At first glance a 1-percentage-point variation in population growth might not appear significant, but it represents the difference between a population doubling in only twenty-six years and one doubling in forty-one years. Fast population growth in the poorest countries helps to explain why they also have the fastest urban growth rate, at 4.2 percent a year, much higher than even China's 3.2 percent.

The table 6-2 indicators for China and India reflect rapidly shifting economies. Poverty estimates for these two countries of course have major consequences for global aggregates, especially the 25 percent figure indicated for India, which might be as much as 10 percentage points too high (Chandy and Kharas 2014). Other indicators highlight structural differences between the two countries, in addition to the well-known fact of China's much faster long-term economic growth rates. In particular, India's population remains significantly more rural,

Table 6-2. *Population-Weighted Averages by Country Group: Economic and Demography Indicators*[a]

Group	N	(1) Total population, 2010 (million)	(2) AIC per capita ($ 2011 PPP)	(3) Extreme poverty rate in 2011 (2005 PPP) (%)	(4) GNI per capita, 2010 ($ 2011 PPP)	(5) Growth in GNI per capita, annual rate, 2000-10 (LCU %)	(6) Population in rural areas (%)	(7) Total fertility rate, 2010 (%)	(8) Population growth rate, 2010 (%)	(9) Urban growth rate, 2010 (%)
1	31	551	1,185	50	1,289	2.5	72	5.3	2.7	4.2
2	28	1,180	3,363	24	5,015	4.0	58	3.3	1.7	2.9
India	1	1,210	3,023	25	4,589	6.0	69	2.6	1.3	2.4
China	1	1,340	4,331	6	9,187	9.9	51	1.6	0.5	3.2

Sources: World Bank (2014a, 2014c); ICP (2014).

a. Not all countries have data for all variables.

even with China's policy restrictions on rural-urban labor mobility. India also has a much higher population growth rate. This is linked to a higher total fertility rate, although that has declined to 2.6 children per woman on average. India's urban population is also growing quickly, at 2.4 percent annually, although much slower than urban growth in China and than the averages for groups 1 and 2.

Table 6-3 presents a variety of population-weighted agricultural indicators. The first fundamental distinction across country groups lies in the labor force structures. More than 70 percent of group 1 countries' employment is in agriculture, compared to 42 percent of group 2 countries. Agriculture's overwhelmingly dominant role in group 1 underscores the fact that, if those countries are to eliminate extreme poverty in the near future, they require either a major boost in agriculture incomes or a major boost in off-farm rural income opportunities.

Agricultural value added per worker also differs tremendously between the two groups, averaging $399 for group 1 and $1,592 for group 2, nearly four times higher. This is a product of much slower recent growth rates for group 1, at 1.2 percent, versus 3.7 percent for group 2. It is something of a puzzle why China's value added per worker remains so low relative to its much higher average incomes, but this might be linked to low domestic crop prices and excess rural labor due to migration restrictions.

The poorest economies are expanding agricultural area harvested at the fastest rate. The thirty-one group 1 countries saw farmland increase by an average of 30 percent over only ten years. This compares to 16 percent for group 2, 9 percent for India, and 7 percent for China. The differences are likely driven partly by differences in population growth rates and partly by group 1's persistently low yields per hectare, which are reflected in column 5. Group 1 countries still have average cereal yields of only 1.5 tons a hectare, compared to 3.2 for group 2, 2.7 for India, and 5.5 for China. From 2000 to 2010, yields grew at an average of more than 2 percent annually across both groups, a positive signal of general progress although not enough to close the gap between countries.

The variation in yields is highly correlated with differences in input intensity. Group 1 countries still have average fertilizer use of a minuscule 13 kilograms a hectare, which is functionally close to zero. Meanwhile, group 2 countries are an order of magnitude more intensive in their fertilizer usage, at 134 kilograms a hectare on average. These are both significantly lower than India's use of 179 kilograms a hectare and China's 548. Column 8 provides a potential explanation for low fertilizer use (discussed further below). Group 1's average value of indexed distance to fertilizer plants suggests some of the world's highest transport costs in accessing fertilizer. The distance values can be roughly interpreted as cost-adjusted kilometers across land and sea. The final column shows the limited average presence of cash crops across the full sample, although group 2 has roughly twice the relevant share of area harvested as group 1.

Table 6-3. *Population-Weighted Averages by Country Group: Agricultural Indicators*[a]

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Group	*N*	*Employment in agriculture, 2010 (%) FAO*	*Agricultural value added per worker, 2010 ($ 2011)*	*Agricultural value added per worker, annual growth, 2000–10 (%)*	*Growth in area harvested, 2000–10 (%)*	*Cereal yield, 2010 (t/ha)*	*Growth in cereal yield, annual rate, 2000–10 (%)*	*Fertilizer use, 2010 (kg/ha)*	*Distance to fertilizer (index)*	*Area harvested to cash crops (%)*
1	31	71	399	1.2	30	1.5	2.1	13	9,650	8
2	28	42	1,591	3.7	15	3.2	2.2	134	6,030	15
India	1	54	723	2.0	9	2.7	1.6	179	3,235	10
China	1	36	764	4.3	7	5.5	1.5	548	4,695	6

Sources: FAO (2014); World Bank (2014a); McArthur and McCord (2014); National Bureau of Statistics of China (2013).
a. Not all countries have data for all variables.

Academic Debates

Debates on agriculture's role in economic growth and poverty reduction have a long tradition in the economics literature, dating back at least to the seminal arguments advanced by Johnston and Mellor (1961) and Schultz (1968). Scholars like de Janvry and Sadoulet (2009, 2010) argue that agriculture's role in promoting growth in other sectors was widely forgotten or misunderstood in the latter part of the twentieth century, and causality was too often misinterpreted to take place in the other direction. Analysts have apportioned responsibility for agriculture's neglect across a variety of stakeholders, ranging from developing country governments themselves to the international development agencies that set policy advice and implicit policy standards (for example, Bates 1981; World Bank 2007; Anderson, Rausser, and Swinnen 2013).

A significant body of empirical research has helped inform the conceptual arguments. For example, Bourguignon and Morrisson (1998) present evidence suggesting that increasing agricultural productivity is the most efficient path to decreasing poverty. Gollin, Parente, and Rogerson (2002) estimate that 54 percent of developing country poverty reduction from 1960 to 1990 was directly attributable to agriculture and a further 29 percent was indirectly attributable, as increased agricultural productivity freed up labor to shift to higher productivity sectors. Loayza and Raddatz (2010) suggest similarly strong links between labor-intensive agriculture and poverty reduction. Meanwhile, Christiaensen, Demery, and Kuhl (2011) find that agricultural growth has particularly powerful effects in reducing $1 per day poverty, although its record in reducing $2 per day poverty is not as strong.

Policy barriers have historically impeded many countries' agricultural progress, although Anderson, Rausser, and Swinnen (2013) show that many of the distortions have converged toward zero over recent decades. Bates and Block (2013) suggest that African economies saw improved gains in underlying agricultural productivity when political institutions were reformed to be more responsive to rural voters. However, a number of countries with significant poverty still had negative price-distorting policies as of 2005–10, including Bangladesh, Côte d'Ivoire, Ethiopia, Kenya, Mozambique, Tanzania, Uganda, and Zimbabwe. India and Indonesia also have aggregate negative policy assistance for agriculture, even while the two countries continue to provide significant input subsidies (Anderson, Rausser, and Swinnen 2013).

The world's most prominent case of rapid poverty reduction, China, has its own strong roots in agriculture. Ravallion and Chen (2007) estimate that agricultural growth played the dominant role in the country's unprecedented poverty reduction from 1981 to 2000. Christiaensen, Pan, and Wang (2010) also find that boosting lagging regions' agricultural labor productivity had important poverty-reducing effects during the early 2000s.

At the other end of the spectrum, sub-Saharan Africa remains the region to have seen the least progress in poverty reduction and the least progress in boosting agricultural productivity. Diao and others (2006) cite Africa's lack of progress as a key reason that the region has not yet experienced greater long-term economic growth and poverty reduction. The mainly rain-fed nature of the region's agriculture also presents a special challenge. For example, Barrios, Bertinelli, and Strobl (2006, 2010) show that long-term declines in rainfall have contributed to Africa's uniquely increased rates of rural-urban migration and lower long-term economic growth patterns. This is consistent with de Janvry and Sadoulet's (2010) evidence that Africa's rural sector was key to any poverty reduction over the 1993–2002 period but that migration to urban areas was not.

In simple macroeconomic terms, boosting agricultural productivity can support the end of extreme poverty through at least three channels. One is a direct income effect for households primarily engaged in agriculture. More profitable farms mean higher incomes for farmers. A second channel takes shape if increasing food productivity to meet minimum aggregate food needs frees up labor to engage in higher productivity sectors. A third takes shape if a country is predominantly rural and its food production is primarily consumed domestically as a relatively nontraded good. Then boosting food sector productivity can lower the real price of food and thereby lower the real wage, contributing to a more competitive real exchange rate and supporting export-oriented sectors like manufacturing (for example, McArthur and Sachs 2013). Some researchers emphasize the special importance of staple food sector productivity in affecting long-run economywide outcomes (for example, Gollin, Parente, and Rogerson 2007; Restuccia, Tao Yang, and Zhu 2007).

Diao and others (2012) present a variety of case studies indicating that agriculture is more effective for reducing extreme poverty than is growth originating in other sectors and that agricultural growth also makes significant indirect contributions to aggregate growth. However, they stress that the nature of agricultural productivity gains plays an important role in determining its economywide implications and that the broader consequences for growth and poverty reduction are affected by linkages with other sectors. Meanwhile, McArthur and McCord (2014) present evidence indicating that increased agricultural input intensity is linked to higher yields, higher GDP per capita, higher movement of labor to nonagricultural sectors, and higher rates of nonagricultural value added per worker across developing countries. Even though these results suggest a likely role for public investment in agriculture, the evidence remains highly imperfect regarding the specific causal pathways among public investment, agricultural growth, and poverty reduction (see de Janvry and Sadoulet 2009).

The uncertain pathways and opportunity costs of public investment to promote agriculture have prompted caution from some researchers, who argue that agriculture can play an important role in promoting growth and poverty reduction but that other sectors might be more effective in promoting these goals in many countries (Collier and Dercon 2013; Dercon and Gollin 2014). A relevant typology by Dercon (2009) asserts that landlocked countries without major mineral endowments might be well suited to prioritize agriculture but that coastal economies are better suited to promote trade infrastructure, investment climate, and efficient labor markets as a path to competing in global markets. A recent strand of evidence by McMillan and Rodrik (2011) and Rodrik (2013), finding global unconditional convergence in manufacturing productivity, further prompts some analysts to consider that sector to be the key to long-term economic growth and structural transformation. But even here, there is growing evidence that boosting agricultural productivity, especially in countries with a high degree of nontradability of food, might be a key to decreasing real wages and making labor more globally competitive in manufacturing (Gelb, Meyer, and Ramachandran 2013).

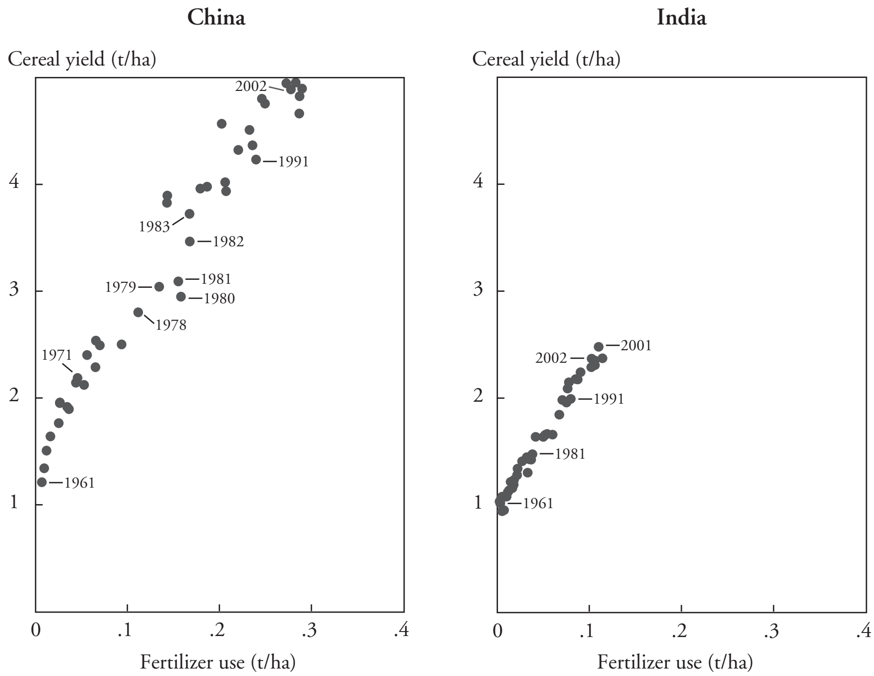
The key difference in views seems to hinge on whether agriculture is a *necessary* component of aggregate growth and poverty reduction versus whether it is *sufficient* to achieve economywide goals. Emphasizing agriculture might be less appropriate, for example, in countries with little arable land and whose extractive industries engage the majority of the labor force. And few argue that agricultural investments are always sufficient for promoting widespread growth and poverty reduction throughout a country, especially if infrastructure is sparse and other sectors do not provide enough labor demand to absorb low-skilled workers from rural areas. However, there does seem to be an argument on the extent to which agricultural investments are a necessary priority for public resources in those low-income countries in which agriculture represents the largest share of the labor force.

Overall, the evidence to date indicates that boosting agricultural productivity plays an important role in reducing extreme poverty in rural areas and, in the presence of adequate labor mobility and economic links to other sectors, in promoting structural transformation toward higher-productivity sectors. This does not imply a one-size-fits-all agricultural policy. Quite the opposite: even strong advocates of agriculture emphasize the importance of country-specific strategies, which account for local crop mix, the nature of linkages with other key sectors, and the degree of connectivity with global markets. The key priority is therefore to identify each country's crop-specific opportunities and constraints and how these link with other sectors.

Historical Context

The term *green revolution* was coined after South Asia's rapid increases in cereal yields in the late 1960s and 1970s. The words are typically used to describe

Figure 6-2. *Fertilizer Use and Cereal Yield, China and India, 1961–2002*
Tons per hectare



Source: World Bank (2006); McArthur (2013).

the early stage when yields jump from roughly one ton per hectare to two or more tons per hectare. Figure 6-2 shows the history of cereal yields and fertilizer input use in China and India from 1961 to 2002, the full period for which consistent data are available (following McArthur 2013, which draws from World Bank 2006). Cereal yield comparisons are informative because they include the major crops of maize, rice, and wheat, which all have similar yield profiles and responsiveness to fertilizer. Figure 6-2 shows two distinct agricultural productivity histories, which are important for understanding the two countries' respective histories in poverty reduction. Both started the 1960s with cereal yields of roughly one ton per hectare, although China had already developed relatively high-productivity and resource-intensive rice agriculture in its southern regions, well before the 1949 change in political regime.

By the late 1960s, following the staggering human losses during the Great Leap Forward, China was already surpassing two tons per hectare. Then, by the time of Deng Xiaoping's famous market-led agricultural reforms in 1978–79, average yields had reached nearly three tons per hectare, and input use was well over 150 kilograms per hectare. The graph shows a visible vertical jump between data points in the early 1980s, as market reforms took hold. The reforms undoubtedly boosted economic activity, but China was already a relatively highly productive and input-intensive rural economy. In some ways the reforms were tantamount to lifting the lid off an already boiling pot.

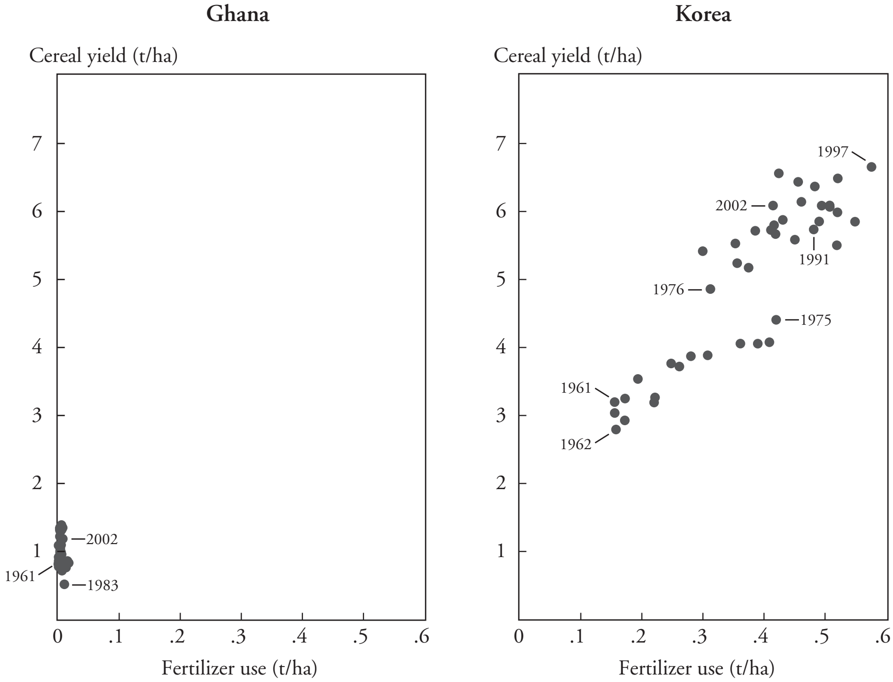
Meanwhile, India's green revolution took hold in the years after 1965, first with the advent of high-yield wheat in the temperate zones of Punjab and Haryana and then with the diffusion of high-yield rice throughout the country. India's input intensity and yield metrics have grown steadily in subsequent decades, but as of the early 2000s yields were only roughly 2.5 tons per hectare, less than China had achieved before its late-1970s market-oriented reforms. India has made tremendous long-term advances in agriculture, but when one considers its land productivity graph next to China's, it is not surprising that the latter has experienced more extensive poverty reduction.

Of course, these graphs present a simplified and only partial view of the complexities of agricultural development. Absent are measures of labor intensity per hectare or modern variety seed adoption. Also missing are China's and India's high levels of government-led investments in energy and irrigation, all of which made possible the successful deployment of modern variety, fertilizer-responsive seeds. Large-scale fertilizer use certainly had mixed environmental consequences, including significant problems with runoff into water systems (see Pingali 2012). But examining those variables does not change the fundamental story that China's rural productivity, measured by food production, followed a much more accelerated path than India's for many decades.

Figure 6-3 presents a second important comparison, challenging the long-standing myth that Ghana and Korea started their development trajectories from the same starting point in 1961. Through the period shown in the figure, Ghana had cereal outputs consistently in the range of one ton per hectare, with almost no fertilizer use. Korea's yields, as of 1961, were already more than three tons per hectare, with more than 150 kilograms per hectare of fertilizer use. Note that even the vertical and horizontal axes need to be adjusted from figure 6-2—to eight tons per hectare and 600 kilograms per hectare, respectively—in order to capture the full extent of Korea's agricultural development in subsequent decades.

Korea's starting point of yield and fertilizer use in 1961 was in fact still higher than any mainland sub-Saharan African country had achieved as of 2013, excluding South Africa. The country had already undergone its green revolution in the 1920s and 1930s as part of a policy of research- and infrastructure-driven rice intensification implemented under Japanese colonial occupation. The long-term trends provide important context for Korea's extraordinary postwar

Figure 6-3. *Fertilizer Use and Cereal Yield, Ghana and Korea, 1961–2002*
Tons per hectare



Source: World Bank (2006); McArthur (2013).

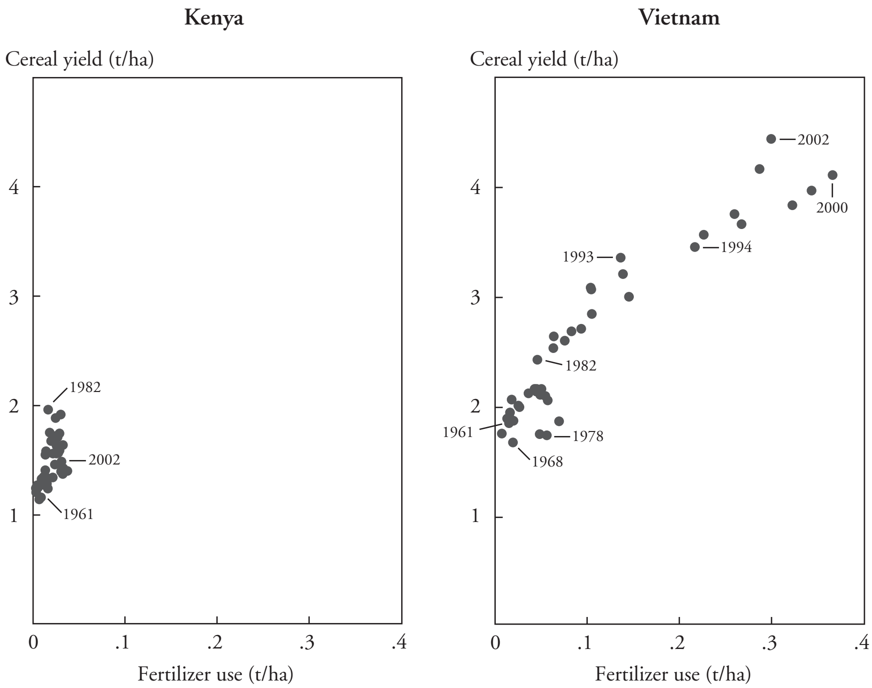
accomplishments in economic growth and poverty reduction—and a view of history contrary to the claim that Korea did not invest in agricultural productivity in the period leading up to its industrialization (see, for example, Dercon 2009).

Figure 6-4 compares the same variables for two other coastal African and Asian countries, Kenya and Vietnam. Kenya began the period with yields near one ton per hectare and grew over time to two tons per hectare with modest increases in fertilizer use (approaching roughly twenty-five kilograms per hectare). (Note that the axis scales are again the same as in figure 6-2.) Vietnam began the 1960s at two tons per hectare. Vietnamese farmers were enthusiastic adopters of the famed IR-8 breed developed by the International Rice Research Institute in 1966, although the Vietnam War undoubtedly disrupted productivity gains in many dimensions. Nonetheless, as of the 1980s, the country was on a rapid path of input intensification and yield improvements.

Interestingly, the Vietnam graph shows a horizontal jump around 1994, a critical year of market reforms. Liberalization seemed to lead to increased input

Figure 6-4. *Fertilizer Use and Cereal Yield, Kenya and Vietnam, 1961–2002*

Tons per hectare



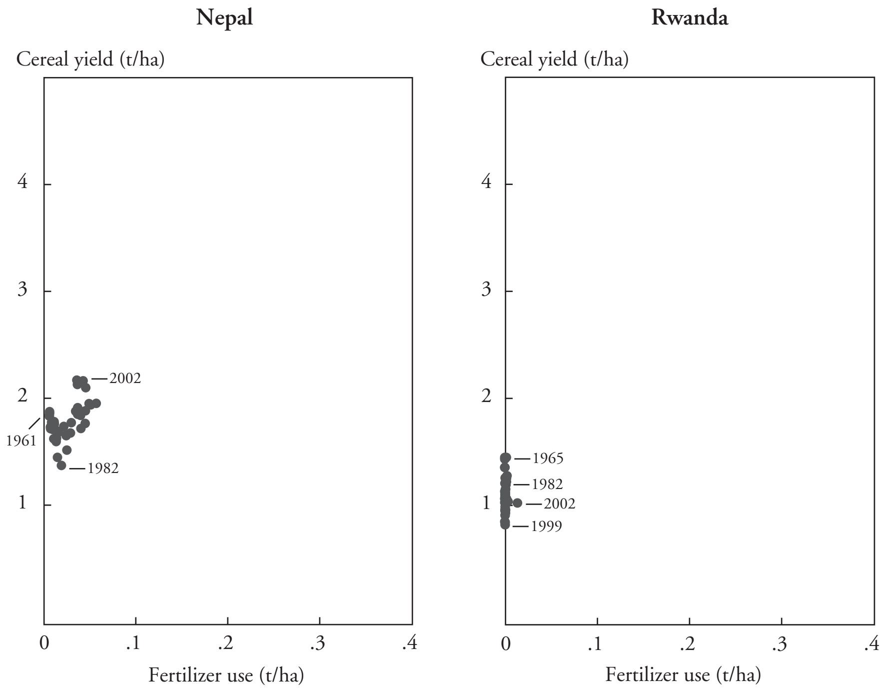
Source: World Bank (2006); McArthur (2013).

use, although not necessarily immediately increased yields, which were already at approximately 3.5 tons per hectare. More broadly, as with China and Korea, the long-term agricultural productivity history provides key insights for understanding Vietnam's remarkable long-term reductions in extreme poverty.

Finally, figure 6-5 presents data for Nepal and Rwanda, two landlocked countries that have historically struggled with agricultural productivity, extreme poverty, and domestic conflict. Nepal has slightly higher yields, but neither country was successful over the period in achieving systematic intensification of inputs or yields. Long-term yield stagnation is particularly notable in Rwanda, which has one of the highest population densities and smallest average farm sizes of any country in the world. If ever there were a test of Boserup's (1965) scarcity-induced land intensification hypothesis, Rwanda would be it. And there the hypothesis fails.

A major challenge for Nepal and Rwanda is that their relative remoteness from the sea means that they face a double-transport cost burden to boosting

Figure 6-5. *Fertilizer Use and Cereal Yield, Nepal and Rwanda, 1961–2002*
Tons per hectare



Source: World Bank (2006); McArthur (2013).

agricultural productivity. On one side, fertilizer prices are significantly heightened as a multiplier on overland transport. On the other side, farm gate crop sale prices are suppressed when products must incur heavy costs to reach markets. A landlocked farm therefore faces much lower marginal return to inputs compared to one growing an equivalent crop with low-cost coastal access. This provides important context as to why both Nepal and Rwanda still have such low levels of agricultural productivity and high levels of extreme poverty.

Agricultural Geography

Each country has its own unique agricultural geography, meaning not just its location in global markets but also its domestic mix of current crops and agronomic potential. In practical terms, farms need adequate access to relevant high-potential seeds, water, and plant nutrients, plus low-cost market access for reliably buying inputs and selling outputs. Market access is usually driven by transport costs, which are generally determined by the extent of the road network.

Crop-Level Arithmetic for Three Illustrative Farmers

Much of the last mile agricultural challenge boils down to location-specific options for maximizing value added on a given farm. Each crop has its own physical yield profile, market price per ton, and responsiveness to inputs like fertilizer. To illustrate, consider two farmers in two respective countries, each with 0.5-hectare farms. Farmer A has the opportunity to grow food crop X, with a yield potential of 5 tons per hectare if she uses US$50 of fertilizer and a likely market price of $300 per ton. If she needs 1 ton of output to feed her family, then she can sell 1.5 tons (= 5 × 0.5 – 1) for a profit of $400 (= 300 × 1.5 – 50). Farmer B has the opportunity to grow food crop Y with a market price of $150 per ton and a yield potential of 3 tons per hectare if she uses $50 worth of fertilizer. If she likewise needs 1 ton of output to feed her family then she can sell 0.5 tons (= 3 × 0.5 – 1) for a profit of only $25 (= 150 × 0.5 – 50).

However, if Farmer A lives in a coastal economy and Farmer B lives in a landlocked economy (say across a border and far from the coast), the two farmers will probably face different fertilizer prices. The fertilizer cost for Farmer B is likely to be $75 or more, implying zero profit. In this case Farmer B will unlikely bother to use fertilizer, due to climate and broader crop risks. Subsistence farmers facing climate risk do not use fertilizer even when it is expected to be profitable on average, since they cannot afford the losses of a drought year (for example, Dercon and Christiaensen 2011). Farmer B therefore uses no fertilizer and gets a much smaller yield, perhaps 1.5 tons per hectare, which produces only 0.75 tons and is inadequate to feed the family. The household needs to supplement its harvest in order to survive; it therefore pursues some combination of informal side enterprises, or one of its members migrates to a nearby town in a search for employment.

Now imagine Farmer C, who has a 0.5-hectare plot that is entirely dedicated to growing coffee, which yields 0.5 tons per hectare at a predicted global market price of $2,000 per ton. In the absence of severe drought or comparable disasters, the farmer has an anticipated harvest income of $500. The net income might adjust for fertilizer costs. But since the coffee will be sold to reliable wholesale purchasers for the global market, the farmer has both a physical asset (coffee trees) and a tradable, foreign-currency-based income stream with relatively inelastic global demand. Together these provide significant collateral and opportunities for borrowing to invest in farm improvements, including the planting of new coffee trees that will bear fruit after three to five years. The farmer's need to purchase food for the household also provides demand for other food producers, creating spillovers between the local cash crop and food crop farmers.

Although these calculations are only illustrative, they underscore the crop-specific calculus that poor households face across geographies. Farmers A, B, and C each control 0.5-hectare plots, but they face entirely different economic decisions based on expected marginal products per hectare and the nature of their income stream. Their example highlights why strategies to support subsistence farmers across countries need to respect highly localized crop arithmetic. They also help explain why it is so difficult to generalize the lessons from site-specific randomized control trials focused, for example, on fertilizer use, when the marginal products of input use vary so dramatically by crop, time, and geography.

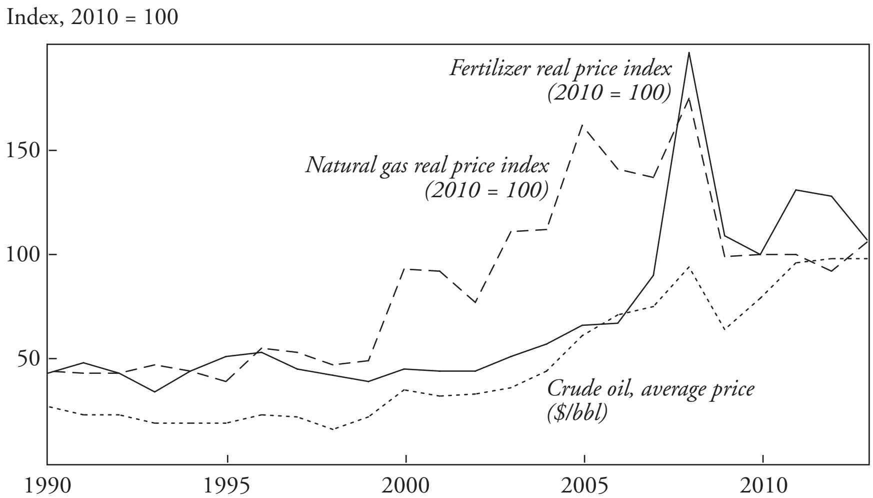
Geography-Linked Profitability of Inputs

The simple calculations above also help illustrate the importance of year-to-year price volatility. Figure 6-6 shows the changing real price of fertilizer since 1990, alongside price variations for natural gas and crude oil, key inputs to fertilizer production and transportation. As of the early 2000s, a conventional wisdom had taken hold presuming the long-term secular decline of fertilizer prices. The graph shows that fertilizer prices had indeed been steady for more than a decade until the early 2000s, but then they shot up over the course of the mid-2000s. Notwithstanding a huge price shock in 2009, real prices now seem to have normalized at levels more than twice as high as a decade ago.

Recent global commodity price volatility has been manifest within the food sector. Figure 6-7 shows variation in real prices for rice, wheat, and maize, the three most prominent global cereals. The first thing to note in this graph is that global food prices have tended to increase significantly since the early 2000s. The second thing to note is the ongoing relative ranking of prices per ton: rice is more expensive than wheat, which is more expensive than maize. This is important because, as mentioned earlier, the three crops have similar physical yield profiles and similar responsiveness to fertilizer. Thus for a given amount of fertilizer and a corresponding amount of crop harvested, rice is more profitable than wheat on global terms, and wheat is in turn more profitable than maize.

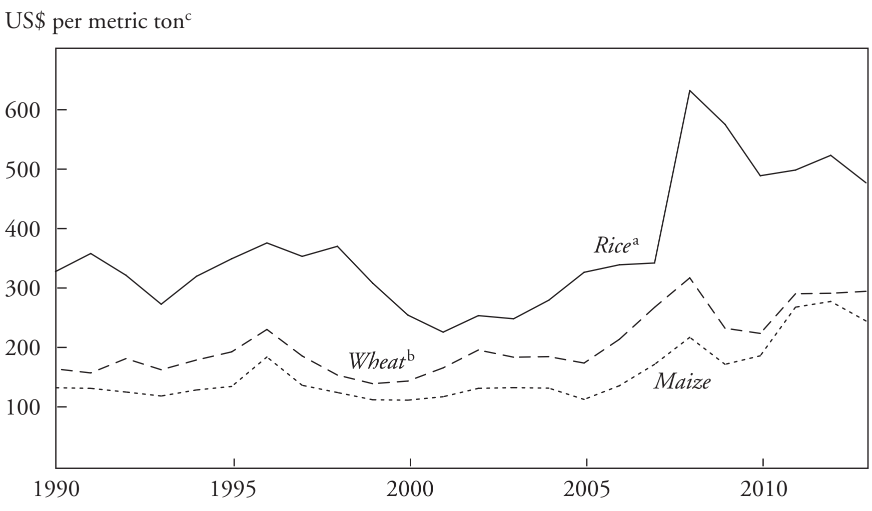
The information from figures 6-6 and 6-7 can be merged into a more representative indicator of crop profitability per unit of input. This is presented in figure 6-8, which shows relative crop-to-urea prices for rice, wheat, and maize. Urea is one of the world's most common forms of nitrogen fertilizer. Higher values on the graph suggest greater profitability. Again, the ratios are volatile, and rice tends to be roughly twice as profitable as maize, with wheat somewhere in between, although trending closer to maize. The graph shows that the increases in food prices have not been enough to compensate for the increases

Figure 6-6. *Real Price of Fertilizer, Natural Gas, and Crude Oil, 1990–2013*



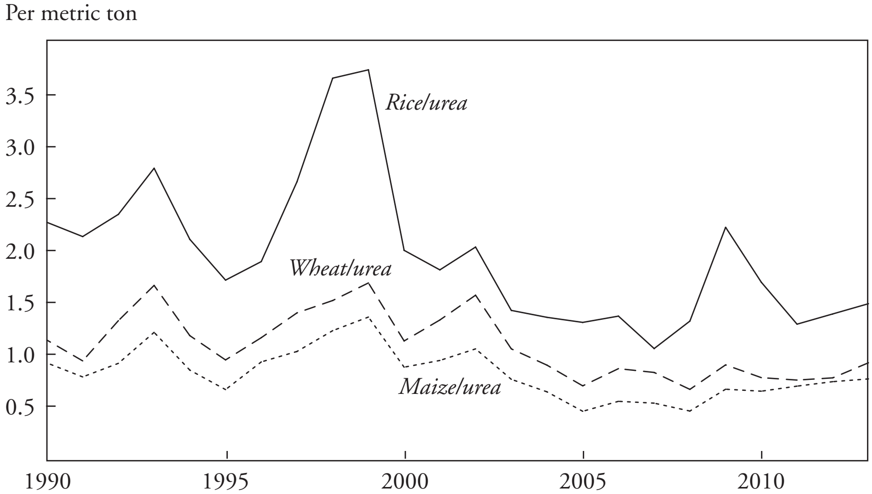
Source: World Bank (2014b).

Figure 6-7. *Real Price of Rice, Wheat, and Maize, 1990–2013*



Source: World Bank (2014b).
a. Thailand white rice, 5% broken.
b. U.S. hard red winter wheat, ordinary protein.
c. Data presented in constant 2010 US$.

Figure 6-8. *Ratio of Cereal Crop Prices to Urea Fertilizer Prices, 1990–2013*



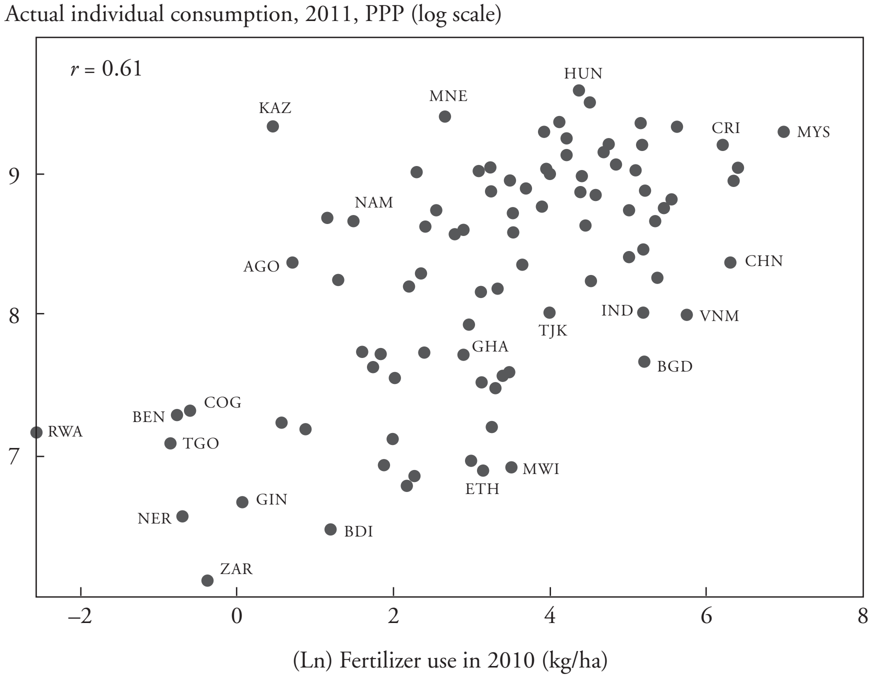
Source: World Bank (2014b).

in fertilizer prices. The relevant ratios are for the most part lower in recent years than throughout the 1990s and early 2000s.

These global price ratios provide important context for the last mile, but the localized and relatively nontradable nature of agriculture in many of the poorest countries adds major challenges. In those instances, farmers are likely to earn even less per ton of crop output, due to transport costs and market inefficiencies, and are likely to face even higher costs of accessing fertilizer. In inland areas with high transport costs, fertilizer prices can be multiples higher than in coastal locations. Unfortunately, there is not yet a robust global data set of location-by-location fertilizer costs around the world, so it is not possible to estimate the full variation in relevant prices within and across the poorest countries. However, it is possible to estimate the geographically driven elements of fertilizer prices, based on the approximate distance to the nearest fertilizer production facility.

McArthur and McCord (2014) have constructed such a measure as part of a cross-country econometric study of agricultural productivity and links to economic growth. The variable is calculated by estimating the land- and sea-based distance from each developing country's geographic agricultural center to the nearest urea fertilizer production facility, with land distances weighted more heavily than maritime distances. Fertilizer plants are generally built near liquid natural gas deposits, and most of them are located in developed countries. When

Figure 6-9. *Fertilizer Use and Actual Individual Consumption, Developing Countries, 2010*

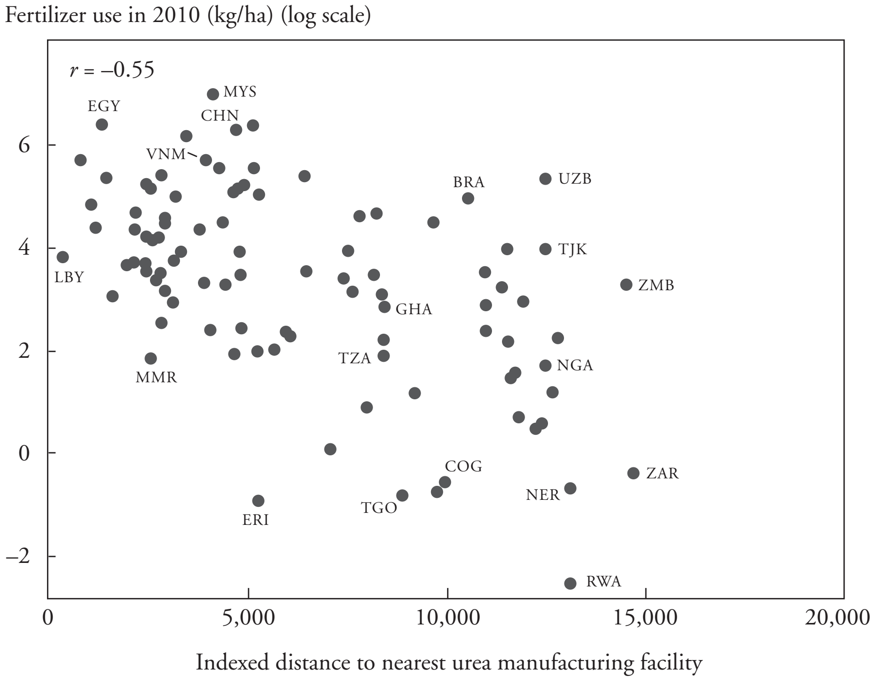


Source: World Bank (2014a); ICP (2014).

interacted with a global fertilizer price variation in recent decades, this distance index has a statistically robust correlation with historical changes in fertilizer use. It is independently significant as an explanatory variable for yields, alongside adoption of modern variety seeds and annual variations in precipitation.

To illustrate the problem, figure 6-9 shows a scatter plot of fertilizer use per hectare against actual individual consumption across ninety-four developing countries in 2010. The two variables have a strong positive correlation (r = 0.61). There is undoubtedly a degree of endogeneity between these two measures, since poor countries can afford less fertilizer and countries that use less fertilizer are less likely to achieve the agricultural productivity gains that help reduce poverty. However, figure 6-10 shows another scatter plot of the indexed distance to a fertilizer plant and average fertilizer use. There is a strong negative correlation between the two variables, with a coefficient of –0.55. It is therefore noteworthy that the correlation coefficient is –0.5 between actual individual consumption and the distance to a fertilizer plant within the same sample.

Figure 6-10. *Indexed Distance to Urea Manufacturer Compared to Fertilizer Use, 2010*



Source: McArthur and McCord (2014); World Bank (2014a).

Uneven Challenge of Land

Economists have long grappled with the relationship between farm size and productivity, especially the persistent puzzle of a negative relationship between the two variables (for example, Barrett, Bellemare, and Hou 2010; Eastwood and others 2010). The illustrative farmers A, B, and C above all faced half-hectare, fixed land constraints, but average farm sizes vary tremendously across low-income geographies. Farmers producing staples for own-use consumption in a region averaging 0.2 hectares per worker with no room for land fallow will have an entirely different optimization strategy than farmers in a region growing a mix of cash and staple crops across more than 2.0 hectares per worker and ample opportunities for crop rotation. Several parts of the developing world also still have the potential to expand area under cultivation. Deininger and others (2011) estimate that the developing world has approximately 400 million hectares of nonforestland that is suitable for crops. Roughly half of that total is in sub-Saharan Africa, and approximately 30 percent is in Latin America and the Caribbean. Less than 4 percent is in East and South Asia.

But sub-Saharan Africa's aggregate figures for land availability mask tremendous country-level variation. Countries with high population density like Burundi and Rwanda already have some of the smallest average farm sizes in the world, with minimal opportunities for expansion. Meanwhile, countries like Mozambique and Tanzania still have significant scope for expansion. In aggregate, the sixty-one focus countries are estimated to have expanded their area harvested by 14 percent between 2000 and 2010, from 640 million hectares to 726 million hectares (McArthur forthcoming). This came during a period when most developed countries saw their area harvested shrink by approximately 8 million hectares overall.

The majority of this expansion took place in only a handful of countries. India and China alone accounted for nearly a third of the growth, with 16 million new hectares (9 percent national growth) and 12 million new hectares (7 percent national growth), respectively. Six countries accounted for more than half of the rest of the growth: Indonesia (8.2 million hectares, or a 26 percent increase), Tanzania (6.2 million hectares, an 83 percent increase), Myanmar (5 million hectares, a 38 percent increase), Niger (4.6 million hectares, a 41 percent increase), Ethiopia (3.5 million hectares, a 32 percent increase), and Mozambique (3 million hectares, a 72 percent increase). Seven countries saw a decline in area harvested over the period. This includes Nigeria, which dropped from 41.6 million hectares to 40.5 million hectares.

The opportunity of land expansion must be understood as only applicable in some countries and only offering a temporary solution in those cases, especially when productivity remains low. Moreover, countries with available land are increasingly attractive to foreign investment and need to manage crucial sensitivities around accountability, transparency, and profit sharing, as exemplified by political unrest in Madagascar in recent years. A significant amount of area expansion has been driven by population pressures, and there is a natural limit to how much land is available in any country. The essential nature of biodiversity and ecosystem services only amplifies the need for limits to expansion. The short-term gains from "growing out" through new land harvested need to be complemented with more fundamental investments in "growing up," through higher yields per hectare.

A Snapshot of the Agricultural Last Mile

The crop area composition for each of this chapter's sixty-one focus countries is described in a series of tables presented in the appendix to this chapter. Table 6A-1 shows the share of each country's area harvested by major crop type, including cereals, oil crops, roots and tubers, pulses, fruits and vegetables, and key cash crops. Cereals are prominent across most countries. Weighted averages do not suggest major differences of crop type across groups 1 and 2, although group 1 countries do have a larger share of area harvested to roots and tubers (13 percent versus 6 percent) and a larger share allocated to pulses (11 percent versus 5 percent). These differences are driven somewhat by the dominance of African countries in group 1.

Table 6A-2 considers changes in crop mix between 2000 and 2010 and highlights the general stability in this regard. There is a small but potentially interesting difference between the country categories. Group 1 experienced a 1.1-percentage-point average increase in share of area harvested to cereals over the period and a 1.1-percentage-point decline in area harvest to cash crops. Meanwhile group 2 experienced a 1.9-percentage-point average decline in area harvested to cereals and a 1.9-percentage-point increase in area harvested to cash crops. These changes would be consistent with group 1 countries expanding food production to meet the basic needs of growing populations, while group 2 countries begin to diversify to higher-value-added crops.

The cross-country variation in cereal crop composition is amply demonstrated in table 6A-3. This shows the prevalence of rice in Asia, wheat in temperate countries, and maize in much of Africa and Latin America. A separate calculation of weighted averages indicates that group 2 countries have approximately 29 percent of area harvested to rice, 9 percent to maize, 8 percent to wheat, and 8 percent to other cereals. Meanwhile, group 1 countries have only 7 percent of area harvested to rice, 19 percent to maize, 3 percent to wheat, and 17 percent to other cereals.

Table 6A-4 then shows that only a small number of countries have a significant share of agricultural land (and presumably labor) allocated to cash crops. Only eleven of the sixty-one countries have more than 15 percent of area harvested to cash crops. Côte d'Ivoire has the most, at 44 percent, the majority of which is in cocoa. Liberia is the only other group 1 country with a sizable share of area in cash crops. In South Asia, Pakistan has the greatest share, at 16 percent, composed mostly of cotton and sugar. Indonesia is the highest in East Asia, at 34 percent, made up of coffee, cocoa, oil palm, rubber, sugar, tobacco, and other crops. Honduras has the greatest cash crop concentration in Latin America, at 39 percent, similarly driven largely by coffee, oil palm, and sugar.

Altogether, the crop mapping analysis underscores the fact that only a handful of countries have developed large cash crop sectors, and most of the poorest countries' agricultural sectors remain overwhelmingly focused on staple food production. Moreover, cash crop production forms no guarantee of long-term economic success: the correlation coefficient between focus countries' actual individual consumption and share of area in cash crops is only 0.17. A small amount of cash crop exports can bring significant economywide gains, but they are unlikely to provide the broad-based income or employment growth that is needed to help all rural households rise out of poverty. The last mile will therefore need to focus significantly on boosting staple crop productivity, with attention to each country's unique agricultural geography and the challenges to profitability for its current and potential crops.

Macroeconomic Context

In addition to the issues of crop composition, each country's last mile agricultural challenge needs to be appreciated for its macroeconomic context, demographic dynamics, and geographic situation. Appendix table 6A-5 presents a simple diagnostic framework for assessing each of this chapter's sixty-one focus countries across the relevant dimensions. Among macroeconomic factors, twenty-six of the thirty-one group 1 countries and five of the twenty-eight group 2 countries were still at official low-income status as of early 2014, implying only a limited domestic capacity to make public investments. Only eight of the thirty-one group 1 countries experienced at least 3 percent average per capita economic growth between 2000 and 2010, meaning that twenty-three of them are stuck in low-growth poverty situations. These could be considered the twenty-three highest priority cases for the world, although fast-growing countries like Liberia and Mozambique are still very poor, so their long-run success still requires support.

Seventeen of the group 1 economies are also officially fragile, according to recent World Bank official designations, so the political and institutional issues addressed in chapters 2 through 5 of this book remain crucial to their long-term success. The growing body of evidence (for example, Hsiang, Burke, and Miguel 2013) regarding causality from negative climate shocks to crop declines to conflict also suggests that investments in boosting agricultural productivity can be a fundamental strategy for minimizing the risks of fragility.

Natural resource revenues provide an important and complex source of revenue for many governments, frequently causing political strain and macroeconomic management problems like Dutch disease. For countries with relatively nontradable local food sectors, increasing staple crop productivity can play an important deflationary role to maintain relative price stability and thereby wage competitiveness for other industrial sectors. These issues will only become more common as recently discovered deposits come online for export in the near future. At the moment, natural resources play a major fiscal role in only three group 1 countries (Chad, Congo, and DR Congo), but they play at least some notable role in another three (Guinea, Mali, and Zambia). The International Monetary Fund (IMF 2012) estimates that seven more will soon have major resource revenues (CAR, Madagascar, Mozambique, Sierra Leone, Tanzania, Togo, and Uganda). Among group 2 countries, nine are already established resource exporters and three are scheduled to begin exporting soon.

In terms of demographics, agriculture is likely to play a proportionately larger role in national strategies for countries where the population and workforce are still predominantly rural. The flip side is that agriculture might play less of a priority role in countries with highly urbanized populations and also in small island economies, where other approaches to boosting marginalized populations' incomes might be more successful in the medium term. However, even in areas with low shares of the population in agriculture, if the relevant households are still stuck in extreme poverty, then a successful last mile strategy might still imply targeted support for boosting productivity among those households.

Population growth and fertility rates indeed remain a pressing concern for most of the focus countries, especially those in group 1. Eighteen of the thirty-one countries with AIC below $2,000 still have total fertility rates of 5 or greater, as do four group 2 countries. Only two group 1 countries, Haiti and Nepal, have fertility rates below 3.5, although nineteen group 2 countries have crossed the same threshold. For countries with persistently high population growth and fast-growing pressures on the agricultural environment, a voluntary reduction in fertility can be pursued through a combination of efforts to promote child survival, girls' secondary education, and access to family planning.

In terms of agricultural geography, eighteen group 1 countries are "far" from a urea fertilizer plant, measured as an indexed distance value of 8000 or greater, and thirteen countries are landlocked. The corresponding numbers for group 2 are ten and six countries, respectively. In terms of crop mix, table 6A-5 lists each country's staple crop with the largest share of area harvested. Lead crops across group 1 countries include cassava, rice, bananas/plantains, millet, maize, sorghum, teff, beans, and yams. A similarly diverse mix of lead crops emerges across group 2 countries.

The range of key staple crops does prompt caution for interpreting cereal yield as a benchmark of overall agricultural land productivity, but the measure offers the best cross-country proxy available and provides useful information. Only three group 1 countries had cereal yields of at least two tons per hectare as of 2010. The vast majority still require major boosts in agricultural productivity. Meanwhile, twelve group 2 countries were still below the two tons per hectare threshold. Fertilizer use still remains below twenty-five kilograms per hectare in eighteen group 1 countries and twelve group 2 countries.

Some General Priorities

One central implication of this chapter is that there is no one-size-fits-all last mile strategy, since there are many components to agricultural systems and their nature differs tremendously across economies. Nonetheless, some general priorities can be identified, especially for the African countries that make up the majority of the poorest countries that constitute group 1. A proper multi-pronged strategy needs to address priorities like rural health systems and universal access to secondary education, which will promote productive labor forces and a smooth demographic transition. The following are some priorities linked directly to agricultural productivity.

Transport Infrastructure

Little will do more to help the economics of smallholder agriculture than a major scale-up of investment in transport infrastructure. This is especially important in Africa, where baseline transport costs are so high that policymakers need to replace standard thinking around percentage improvements with new measures of percentage gaps. Landlocked areas have the most to gain in this regard, since the return on investment will be affected by the lower relative price of inputs and the higher profitability of outputs.

Public Assistance for Inputs, Targeted to the Poorest Households

One of the great global policy advances of the past decade has been a blunt recognition of the previous generation's failure adequately to support access to inputs, especially in Africa (World Bank 2007). The success of Malawi's initially controversial input voucher program played a seminal role in changing the debate. Carter and colleagues (2014) find evidence for persistent gains resulting from vouchers for fertilizer and improved seeds in a randomized experiment in Mozambique. However, some recent studies have raised concerns regarding efficiency (for example, Pauw and Thurlow 2011, and Pan and Christiaensen 2012) suggest that elite capture has been a problem with input voucher programs in Tanzania. In light of many countries' structural disadvantage in accessing the global fertilizer market, ongoing policy refinements will be needed to support profitable local price ratios for inputs.

Public Incentives for Warehousing and Pooling Sales

One of the major challenges in low-income agricultural environmental is the lack of infrastructure to help smallholders protect their product from postharvest losses, pool their sales to enhance market power, and time their sales in pursuit of optimal pricing across the calendar. Small differences in margins can have especially pronounced consequences among extremely poor farmers, so national and local governments need to promote the regulatory frameworks and warehousing facilities that allow farmers to benefit from scale economies.

Climate Insurance

Although subsistence farmers often avoid the cost of rainfall insurance (see, for example, Giné and Yang 2009), precipitation insurance mechanisms have made gains in recent years. For example, researchers at Columbia University's International Research Institute for Climate and Society reviewed historical precipitation data to measure probabilities of extreme weather events and created a real-time satellite-based vegetation measurement index that can be used to trigger a strike price on an options contract. Early field testing showed that the method was initially economically unviable in multiple rural African settings due to cost ratios for staple crop farmers, but it has since been successfully deployed by Oxfam and Swiss Re, working with coffee growers in Ethiopia. This represents an important early step toward broader market-priced risk management instruments for low-income agriculture.

The most obvious other mechanism to mitigate climate risk is groundwater-based irrigation, which can ensure a more reliable source of hydration for plants and support the introduction of multicropping, which is especially valuable in geographies with unimodal rainy seasons. The cost is generally modest, on the order of $3,000 per hectare, and typically has a high net present value for small-scale farmers. However, $3,000 is typically prohibitively expensive for farmers living in extreme poverty, and the high costs of rural loan administration tend to prevent commercial banks from entering the market. There is a "missing rural middle" in credit systems throughout rural Africa in particular.

Multilateral Agricultural Credit Facilities

To bridge the rural finance gaps, farmers require access to market-based credit on risk-adjusted terms. This needs to be structured over extended maturities to allow for season-to-season experimentation as farmers introduce new crops. Farmers also need to tackle scale economies in order to access inputs, credit, and market connections at manageable cost. This likely implies pooled efforts in the form of private cooperatives or farmers' associations. In practical terms, there needs to be a vehicle whereby smallholder farmers can coordinate to access "patient capital" loans of perhaps $25,000 to $100,000 at a time. A relevant financing facility could focus on the risk-adjustment component to incentivize private loans. A rough calculation suggests that sub-Saharan Africa's total international public financing requirements are $5 billion annually, which could allow private credit to reach 25 million farmers over five years (McArthur 2011).

National Investor Roundtables

One of the more promising initiatives in recent years has been the creation of country-by-country investor forums to bridge public and private capital. One of these has taken shape under the label Grow Africa, launched through a partnership of the World Economic Forum and the New Economic Partnership for African Development. Another, dubbed Grow Asia, is getting under way. It is too early to judge results, but to date the Africa roundtables are reported to have mobilized $7 billion in planned investments for ten African countries (Grow Africa 2014). It is crucial for such processes to be anchored in basic standards of public transparency and corporate accountability, including those embodied in the recently adopted Principles for Responsible Agricultural Investments. If these public-private approaches gain widespread citizen support, they can serve as an important contributor to reaching the last mile.

Public Research for Seed Varieties Resistant to Drought, Floods, and Pests

A growing body of scientific research is developing new disaster-resistant seed varieties for staple crops. Pest resistance is a challenge everywhere, especially in areas with soil nutrient depletion. In Asia some of the most exciting advances are in flood-resistant rice breeds, while in Africa a major initiative for drought-resistant maize is now under way. Although a considerable amount of relevant research is now pursued by private companies, the Consultative Group for International Agricultural Research and national agricultural research bodies have historically provided, and continue to provide, many of the frontline technological advances. Public funding and institutional support for these organizations remain essential.

Mobile Technology

Legal and regulatory frameworks need to ensure that advances in digital technology are translated into ever-greater support for farmers. Some of these will directly help farmers to become more productive. For example, in countries with inadequate agricultural extension staffing, entrepreneurs starting "m-farming" businesses (using mobile devices) can deliver wireless services like image-based or video-based technical support. Some advances will help with government program efficiency, such as digital tracking of vouchers or similar subsidies targeted to those with greatest need. Other advances could bypass agricultural technicalities and instead simply ensure minimum income standards for all farmers around the world, through, for example, unconditional cash transfers as pioneered by GiveDirectly. These transfers might be particularly impactful in fragile states, where infrastructure constraints and service delivery can be most challenging.

Conclusion

This chapter focuses on specifying the location-specific components of agriculture most pertinent to the last mile of ending extreme poverty. Anchored in historical context, it emphasizes the common challenges that apply across most of the poorest countries alongside the tremendous country-specific variations. These economies are predominantly still rural in nature, with high fertility rates, fast-growing populations, very small cash crop sectors, and very low and slow-growing staple crop productivity. The upshot is that efforts to boost farmers' staple crop productivity should be considered essential if several hundred million people are going to escape extreme poverty. In addition to the importance of each country's macroeconomic environment, returns on investment will be determined by geography-specific factors such as crop type, crop price, farm size, yield potential, input responsiveness, and forms of available irrigation. Moreover, many of the countries facing the greatest hurdles to boosting crop productivity—like distance-driven constraints to accessing global fertilizer markets—are also the poorest countries, so targeted approaches are required to help farmers surmount relevant market barriers, including physical barriers.

The chapter points to many topics that would benefit from more refined analysis and research. For example, what are the actual prices of fertilizer, seeds, and irrigation across the world's poorest farming areas? What crops are the poorest people within the poorest countries actually farming, and what higher-value-added crops are agriculturally and ecologically suitable to grow? What new public instruments could be designed to help the poorest farmers enjoy more advantageous price ratios between their inputs and their outputs?

A tremendous amount is also already known about what to do, and many policy efforts simply need to be scaled up accordingly. The poorest farmers need support for local agricultural system inputs, including germ plasm, fertilizer, irrigation, credit, insurance, and storage warehouses. As each link in the chain is addressed, and each country and farm community boosts its productivity and income incrementally, the distance to the last mile's goal line will shrink ever smaller. Within a generation, hundreds of millions of people could, and indeed should, literally be able to grow their way out of poverty.

Appendix 6A

Table 6A-1. *Share of Area Harvested, by Major Crop Groups, Sixty-One Focus Countries, 2010*[a]

Percent

Country	*Cereals*	*Oils*	*Roots and tubers*	*Pulses*	*Fruits and vegetables*	*Cash crops*	*Other*
Sub-Saharan Africa							
Angola	41	8	27	17	6	2	
Benin	37	15	15	5	4	7	17
Burkina Faso	59	15		17	1	7	
Burundi	19	2	18	22	35	4	
Cape Verde	49	3	2	40	4	2	
Cameroon	30	12	10	10	16	22	
Central African Republic	21	29	34	3	8	5	
Chad	66	21	3	5	1	4	
Comoros	20	32	15	13	11	9	
Congo, Rep.	9	16	43	4	16	13	
Congo, Dem. Rep.	32	11	35	7	8	7	
Côte d'Ivoire	11	5	17	1	10	44	12
Equatorial Guinea		4	53		14	28	
Ethiopia	65	6	6	10	3	6	3
Gambia	63	32	1	2	1	1	
Ghana	25	7	24	4	7	32	1
Guinea	56	8	6	2	14	14	
Guinea-Bissau	31	9	4	2	6	3	45
Kenya	49	5	5	25	6	9	1
Lesotho	84		3	9	4		
Liberia	44	3	13	1	10	29	
Madagascar	53	3	20	3	8	12	1
Malawi	48	11	10	18	5	7	
Mali	75	12		5	2	5	
Mauritania	61	1	1	34	3		
Mozambique	38	16	20	17	3	5	2
Niger	62	6		31	1		
Nigeria	38	11	20	7	9	13	1
Rwanda	21	5	26	20	25	3	
Sao Tome and Principe	3	29	10		15	43	
Senegal	50	39	1	5	3	2	1
Sierra Leone	43	8	29	8	6	6	
Sudan (former)	70	22	1	3	3	1	

(*continued*)

Table 6A-1 (*continued*)

Country	*Cereals*	*Oils*	*Roots and tubers*	*Pulses*	*Fruits and vegetables*	*Cash crops*	*Other*
Sub-Saharan Africa (continued)							
Tanzania	40	18	13	12	9	6	2
Togo	49	9	13	12	2	14	1
Uganda	21	16	14	15	27	7	
Zambia	53	20	12	3	3	9	
Zimbabwe	62	18	2	2	2	13	
South Asia							
Bangladesh	80	3	3	2	6	6	1
Bhutan	61	2	7	4	20	4	2
India	49	20	1	13	7	10	1
Maldives	2	24	11	2	52		10
Nepal	70	9	4	6	8	3	1
Pakistan	56	15	1	7	5	16	
East Asia and Pacific							
Cambodia	81	4	7	2	4	2	
China	51	16	5	2	20	6	
Indonesia	43	11	4	1	4	34	3
Lao PDR	73	4	2	1	13	6	
Myanmar	48	21		21	4	4	1
Philippines	51	26	3	1	14	6	
Vietnam	64	4	5	3	10	11	3
Middle East and North Africa							
Djibouti				53	44		3
Morocco	72	12	1	5	7	1	2
West Bank and Gaza	18	56	1	2	18	1	3
Yemen	71	4	2	4	14	6	
Latin America and Caribbean							
Bolivia	30	42	7	2	7	10	1
Haiti	42	3	20	10	14	10	
Honduras	41		1	11	8	39	
Nicaragua	46	4	2	25	5	19	
Europe and Central Asia							
Kyrgyz Republic	63	9	9	3	11	4	1
Tajikistan	42	18	3	2	17	17	1

a. Figures are rounded to nearest percentage point. Values less than 0.5 percent not included.

Table 6A-2. *Change in Share of Area Harvested, by Major Crop Groups, Sixty-One Focus Countries, 2000–2010*

Percent

Country	*Cereals*	*Oils*	*Roots and tubers*	*Pulses*	*Fruits and vegetables*	*Cash crops*
Sub-Saharan Africa						
Angola	–0.05	0.03	–0.03	0.06	0.01	–0.02
Benin	0.03	–0.05	0.01	0.00	0.00	–0.08
Burkina Faso	–0.06	0.02	0.00	0.04	–0.01	0.01
Burundi	0.01	0.01	–0.01	–0.03	0.03	0.00
Cape Verde	0.05	0.00	0.00	–0.07	0.01	0.01
Cameroon	0.10	–0.03	–0.01	0.02	–0.01	–0.06
Central African Republic	0.02	0.00	0.03	0.00	0.00	–0.04
Chad	0.10	–0.06	0.00	0.00	0.00	–0.05
Comoros	0.03	–0.01	0.01	0.00	–0.01	–0.03
Congo, Rep.	0.03	–0.03	0.02	–0.01	–0.01	0.00
Congo, Dem. Rep.	–0.01	0.00	0.00	0.01	0.00	0.00
Côte d'Ivoire	–0.01	–0.02	0.03	0.00	–0.03	–0.07
Equatorial Guinea	0.00	0.01	0.21	0.00	0.05	–0.27
Ethiopia	–0.03	0.02	0.00	–0.01	0.01	0.01
Gambia	0.15	–0.12	–0.01	–0.02	0.00	0.00
Ghana	–0.01	0.01	0.00	0.01	–0.02	0.00
Guinea	0.10	–0.01	–0.01	–0.01	–0.04	–0.03
Guinea-Bissau	–0.04	0.03	0.01	0.01	0.00	0.00
Kenya	0.04	0.00	0.00	–0.02	0.00	0.00
Lesotho	–0.04	0.00	0.01	0.01	0.01	0.00
Liberia	0.14	–0.01	–0.02	0.00	–0.03	–0.08
Madagascar	0.04	–0.01	0.01	0.00	0.00	–0.04
Malawi	–0.04	0.04	–0.02	0.02	0.00	0.00
Mali	0.14	–0.06	0.00	–0.03	0.00	–0.05
Mauritania	–0.01	–0.01	0.00	0.04	–0.01	0.00
Mozambique	–0.06	–0.02	–0.04	0.12	0.01	0.00
Niger	–0.05	0.03	0.00	0.02	0.01	0.00
Nigeria	–0.04	0.02	0.02	–0.02	0.00	0.01
Rwanda	0.03	0.02	–0.01	–0.01	–0.03	0.00
Sao Tome and Principe	0.01	0.03	0.02	0.00	0.03	–0.09
Senegal	0.01	–0.01	0.00	0.00	0.01	0.00
Sierra Leone	–0.03	0.01	0.19	–0.04	–0.06	–0.07
Sudan (former)	0.08	–0.09	0.00	0.01	0.01	–0.01
Tanzania	0.08	0.01	–0.03	–0.03	–0.02	–0.01

(*continued*)

Table 6A-2 (*continued*)

Country	*Cereals*	*Oils*	*Roots and tubers*	*Pulses*	*Fruits and vegetables*	*Cash crops*
Sub-Saharan Africa (continued)						
Togo	0.04	–0.05	0.01	0.03	–0.01	–0.01
Uganda	0.00	0.02	–0.01	0.02	–0.01	–0.02
Zambia	0.01	0.03	–0.04	0.00	–0.01	0.01
Zimbabwe	0.07	–0.05	0.00	0.00	0.00	–0.03
South Asia						
Bangladesh	–0.01	–0.01	0.01	–0.02	0.03	0.00
Bhutan	–0.08	–0.04	0.02	0.02	0.07	0.00
India	–0.06	0.01	0.00	0.02	0.02	0.01
Maldives	0.00	–0.39	–0.07	0.01	0.41	0.00
Nepal	–0.03	0.00	0.01	0.00	0.02	0.00
Pakistan	0.02	–0.01	0.00	0.00	0.01	–0.02
East Asia and Pacific						
Cambodia	–0.05	0.01	0.06	0.01	–0.02	–0.01
China	–0.02	–0.01	–0.01	–0.01	0.04	0.01
Indonesia	–0.05	–0.03	–0.01	0.00	0.00	0.10
Lao PDR	–0.03	0.01	0.00	0.00	0.01	0.01
Myanmar	–0.06	0.03	0.00	0.03	0.00	–0.01
Philippines	–0.02	0.00	0.00	0.00	0.02	0.00
Vietnam	–0.05	0.00	0.01	0.00	0.01	0.02
Middle East and North Africa						
Djibouti	0.00	0.00	0.00	–0.08	0.07	0.00
Morocco	–0.03	0.03	0.00	0.00	0.01	0.00
West Bank and Gaza	0.02	0.02	0.00	–0.01	–0.03	0.00
Yemen	0.05	–0.02	0.00	–0.01	–0.01	–0.01
Latin America and Caribbean						
Bolivia	–0.04	0.05	–0.01	0.01	–0.03	0.01
Haiti	0.00	–0.01	0.03	0.00	–0.04	0.02
Honduras	–0.06	0.00	0.00	0.00	0.00	0.06
Nicaragua	–0.02	0.00	0.01	0.00	0.00	0.00
Europe and Central Asia						
Kyrgyz Republic	–0.01	–0.01	0.02	0.02	0.01	–0.03
Tajikistan	0.06	–0.05	0.01	0.01	0.04	–0.06

Table 6A-3. *Share of Area Harvested to Major Cereal Crops, 2010 (3 year period average)*[a]

Percent

Country	*Rice*	*Maize*	*Wheat*	*Other*	*Total*
Sub-Saharan Africa					
Angola	1	36	0	5	41
Benin	2	30	0	5	37
Burkina Faso	2	11	0	47	59
Burundi	2	10	1	6	19
Cabo Verde	0	49	0	0	49
Cameroon	2	14	0	14	30
Central African Republic	2	13	0	6	21
Chad	3	6	0	57	66
Comoros	18	2	0	0	20
Congo, Rep.	1	4	0	5	9
Congo, Dem. Rep.	7	24	0	1	32
Côte d'Ivoire	5	4	0	2	11
Equatorial Guinea					
Ethiopia	0	13	11	41	65
Gambia	15	9	0	38	63
Ghana	3	15	0	7	25
Guinea	25	14	0	17	56
Guinea-Bissau	20	3	0	8	31
Kenya	0	39	3	7	49
Lesotho	0	63	9	12	84
Liberia	44	0	0	0	44
Madagascar	45	8	0	0	53
Malawi	2	43	0	3	48
Mali	13	10	0	52	75
Mauritania	6	6	0	49	61
Mozambique	3	24	0	10	38
Niger	0	0	0	62	62
Nigeria	6	11	0	21	38
Rwanda	1	10	2	7	21
Sao Tome and Principe	0	3	0	0	3
Senegal	5	5	0	40	50
Sierra Leone	37	2	0	5	43
Sudan (former)	0	0	2	68	70
Tanzania	8	23	1	9	40

(*continued*)

Table 6A-3 (*continued*)

Country	*Rice*	*Maize*	*Wheat*	*Other*	*Total*
Sub-Saharan Africa (continued)					
Togo	3	30	0	17	49
Uganda	1	13	0	7	21
Zambia	1	47	1	4	53
Zimbabwe	0	45	0	16	62
South Asia					
Bangladesh	76	1	3	0	80
Bhutan	23	26	2	10	61
India	21	4	14	10	49
Maldives	0	1	0	1	2
Nepal	31	18	15	6	70
Pakistan	11	4	38	3	56
East Asia & Pacific					
Cambodia	75	6	0	0	81
China	17	18	14	2	51
Indonesia	33	10	0	0	43
Lao PDR	59	15	0	0	73
Myanmar	43	2	1	2	48
Philippines	32	19	0	0	51
Vietnam	55	8	0	0	64
Middle East & North Africa					
Djibouti	0	0	0	0	0
Morocco	0	3	40	28	72
West Bank & Gaza	0	0	12	6	18
Yemen	0	4	11	55	71
Latin America & Caribbean					
Bolivia	6	11	6	7	30
Haiti	4	28	0	10	42
Honduras	1	35	0	5	41
Nicaragua	8	34	0	4	46
Europe & Central Asia					
Kyrgyz Republic	1	8	41	13	63
Tajikistan	1	1	33	7	42

a. Figures are rounded to nearest percentage point. Crop values less than 0.5 percent not included.

Table 6A-4. *Share of Area Harvested by Major Cash Crops, 2010 (3 year period average)*[a]

Percent

Country	*Cocoa*	*Coffee*	*Oil palm*	*Rubber*	*Cotton*	*Sugar*	*Tea*	*To-bacco*	*Other*	*Total*
Sub-Saharan Africa										
Angola	0	1	1	0	0	0	0	0	0	2
Benin	0	0	1	0	6	0	0	0	0	7
Burkina Faso	0	0	0	0	6	0	0	0	0	7
Burundi	0	2	1	0	0	0	1	0	0	4
Cabo Verde	0	0	0	0	0	2	0	0	0	2
Cameroon	11	3	2	1	2	2	0	0	0	22
Central African Republic	0	1	0	0	2	1	0	0	0	5
Chad	0	0	0	0	4	0	0	0	0	4
Comoros	0	1	0	0	0	0	0	0	8	9
Congo, Rep.	1	3	3	1	0	5	0	0	0	13
Congo, Dem. Rep.	0	1	3	1	1	1	0	0	0	7
Côte d'Ivoire	31	6	3	2	2	0	0	0	0	44
Equatorial Guinea	9	13	4	0	0	0	0	0	2	28
Ethiopia	0	3	0	0	1	0	0	0	2	6
Gambia	0	0	1	0	0	0	0	0	0	1
Ghana	25	0	6	0	0	0	0	0	0	32
Guinea	1	2	9	0	1	0	0	0	0	14
Guinea-Bissau	0	0	2	0	1	0	0	0	0	3
Kenya	0	3	0	0	1	1	3	0	1	9
Lesotho	0	0	0	0	0	0	0	0	0	0
Liberia	8	1	3	13	0	5	0	0	0	29
Madagascar	0	4	0	0	0	3	0	0	4	12
Malawi	0	0	0	0	2	1	1	4	0	7
Mali	0	0	0	0	5	0	0	0	0	5
Mauritania	0	0	0	0	0	0	0	0	0	0
Mozambique	0	0	0	0	3	1	0	1	0	5
Niger	0	0	0	0	0	0	0	0	0	0
Nigeria	3	0	8	1	1	0	0	0	0	13
Rwanda	0	2	0	0	0	0	1	0	0	3
Sao Tome and Principe	39	0	4	0	0	0	0	0	0	43
Senegal	0	0	0	0	1	0	0	0	0	2
Sierra Leone	3	1	2	0	0	0	0	0	0	6
Sudan (former)	0	0	0	0	1	1	0	0	0	1
Tanzania	0	1	0	0	3	0	0	1	1	6

(*continued*)

Table 6A-4 (*continued*)

Country	*Cocoa*	*Coffee*	*Oil palm*	*Rubber*	*Cotton*	*Sugar*	*Tea*	*To-bacco*	*Other*	*Total*
Sub-Saharan Africa (continued)										
Togo	8	2	1	0	4	0	0	0	0	14
Uganda	1	4	0	0	1	1	0	0	0	7
Zambia	0	0	0	0	5	1	0	3	0	9
Zimbabwe	0	0	0	0	9	1	0	3	0	13
South Asia										
Pakistan	0	0	0	0	12	4	0	0	0	16
India	0	0	0	0	6	2	0	0	1	10
Bangladesh	0	0	0	0	0	1	0	0	4	6
Bhutan	0	0	0	0	0	0	0	0	3	4
Nepal	0	0	0	0	0	1	0	0	1	3
Maldives	0	0	0	0	0	0	0	0	0	0
East Asia & Pacific										
Indonesia	4	3	14	9	0	1	0	1	2	34
Vietnam	0	4	0	3	0	2	1	0	1	11
Lao PDR	0	4	0	0	0	1	0	1	1	6
Philippines	0	1	0	1	0	3	0	0	1	6
China	0	0	0	0	3	1	1	1	0	6
Myanmar	0	0	0	1	2	1	0	0	0	4
Cambodia	0	0	0	1	0	0	0	0	0	2
Middle East & North Africa										
Yemen	0	3	0	0	2	0	0	1	0	6
Morocco	0	0	0	0	0	0	0	0	1	1
West Bank & Gaza	0	0	0	0	0	0	0	0	0	1
Djibouti	0	0	0	0	0	0	0	0	0	0
Latin America & Caribbean										
Honduras	0	22	9	0	0	6	0	0	0	39
Nicaragua	1	11	0	0	0	5	0	0	1	19
Haiti	2	6	0	0	0	1	0	0	1	10
Bolivia	0	1	0	0	4	5	0	0	0	10
Europe & Central Asia										
Tajikistan	0	0	0	0	17	0	0	0	0	17
Kyrgyz Republic	0	0	0	0	3	0	0	0	1	4

a. Figures are rounded to nearest percentage point. Values less than 0.5 percent not included.

Table 6A-5. *Macroeconomic Agricultural Diagnostics, Sixty-One Focus Countries, by Country Group*

	Poverty	*Macroeconomic context*				*Demography*			*Geography*		*Agriculture*			
	AIC (PPP 2011)	*Income group*	*Growth in GNI pc, 2000–10*	*Resource revenues*	*Fragile situation*	*% Pop. in rural areas*	*% Labor in agric (FAO)*	*Total fertility rate, 2010*	*Land-locked*	*Dist. to fertilizer plant*	*Lead staple crop (% of area harvested)*	*Cash crop role*	*Cereal yield, 2010*	*Fertilizer use, 2010*
Group one														
Congo, Dem. Rep.	447	LIC		M	F	R	57	V high		Far	Cassava (31)		Low	Low
Liberia	606	LIC	Fast		F	M	62	V high			Rice (41)	Major	Low	
Comoros	621	LIC			F	R	69	High			Rice (18)		Low	
Burundi	648	LIC			F	R	89	V high	L	Far	Bananas (29)		Low	Low
Niger	719	LIC				R	83	V high	L	Far	Millet (44)		Low	Low
Guinea	789	LIC		L		R	80	V high			Rice (25)	Mid	Low	Low
Central African Republic	869	LIC		*	F	R	63	High	L	Far	Cassava (24)		Low	
Mozambique	890	LIC	Fast	*		R	81	V high		Far	Maize (24)		Low	Low
Guinea-Bissau	928	LIC			F	M	79	V high			Rice (20)		Low	
Burkina Faso	953	LIC				R	92	V high	L	Far	Sorghum (27)		Low	Low
Ethiopia	979	LIC	Fast			R	77	High	L		Teff (18)		Low	Low
Malawi	1,006	LIC			F	R	79	V high	L	Far	Maize (43)		Low	
Tanzania	1,029	LIC	Fast	*		R	76	V high		Far	Maize (23)		Low	Low
Mali	1,047	LIC		L	F	R	75	V high	L	Far	Millet (29)		Low	Low
Togo	1,193	LIC		*	F	R	53	High		Far	Maize (30)	Mid	Low	Low
Sierra Leone	1,194	LIC	Fast	*	F	R	60	High			Rice (37)		Low	
Gambia	1,221	LIC				M	76	V high			Millet (30)		Low	Low
Rwanda	1,293	LIC	Fast			R	89	High	L	Far	Plantains (18)		Low	Low
Madagascar	1,332	LIC		*	F	R	70	High			Rice (45)	Mid		Low
Zimbabwe	1,349	LIC			F	R	56	High	L	Far	Maize (45)	Mid	Low	

(*continued*)

Table 6A-5 (*continued*)

	Poverty	*Macroeconomic context*				*Demography*			*Geography*		*Agriculture*			
	AIC (PPP 2011)	*Income group*	*Growth in GNI pc, 2000–10*	*Resource revenues*	*Fragile situation*	*% Pop. in rural areas*	*% Labor in agric (FAO)*	*Total fertility rate, 2010*	*Land-locked*	*Dist. to fertilizer plant*	*Lead staple crop (% of area harvested)*	*Cash crop role*	*Cereal yield, 2010*	*Fertilizer use, 2010*
Uganda	1,390	LIC	Fast	*		R	75	V high	L	Far	Plantains (22)		Low	Low
Benin	1,473	LIC				M	44	V high		Far	Maize (30)		Low	Low
Chad	1,476	LIC	Fast	H	F	R	66	V high	L	Far	Millet (25)		Low	
Congo, Rep.	1,513	LMIC		H	F		32	V high		Far	Cassava (39)	Mid	Low	Low
Haiti	1,688	LIC			F	M	59				Maize (28)	Mid	Low	
Djibouti	1,719	LMIC					74	High			Beans (53)		Low	
Zambia	1,778	LMIC		L		R	63	V high	L	Far	Maize (47)			
Nepal	1,848	LIC			F	R	93		L		Rice (31)			Low
Senegal	1,923	LMIC				M	70	V high			Millet (34)		Low	Low
Kenya	1,937	LIC				R	71	High			Maize (39)		Low	
Côte d'Ivoire	1,979	LMIC			F	M	38	High		Far	Yams (11)	Major	Low	
Group Two														
Nigeria	2,075	LMIC	Fast	H		M	25	V high		Far	Sorghum (12)	Mid	Low	Low
Mauritania	2,089	LMIC		L		M	50	High			Sorghum (46)		Low	
Bangladesh	2,138	LIC	Fast			R	45				Rice (77)			
Ghana	2,242	LMIC	Fast	*		M	54	High		Far	Maize (15)	Major	Low	Low
Myanmar	2,273	LIC			F	R	67				Rice (43)			Low
Cambodia	2,277	LIC	Fast			R	66				Rice (75)			Low
Cameroon	2,297	LMIC		M		M	48	V high		Far	Maize (14)	Major	Low	Low
Sudan	2,309	LMIC	Fast	H	F	R	47	High		Far	Sorghum (50)		Low	Low
Laos	2,341	LMIC	Fast	L		R	75		L		Rice (59)			
Lesotho	2,524	LMIC				R	39		L	Far	Maize (63)		Low	

Yemen	2,762	LMIC		H	F	R	39	High			Sorghum (41)		Low	Low
Vietnam	2,991	LMIC	Fast			R	63				Rice (55)	Mid		
Tajikistan	3,025	LIC	Fast			R	27	High	L	Far	Wheat (32)	Mid		
Sao Tome and Principe	3,340	LMIC		*			57	High			Bananas (11)	Major		
Kyrgyz Republic	3,506	LIC		*		R	21		L	Far	Wheat (41)			Low
Nicaragua	3,587	LMIC				M	15				Maize (34)	Mid		
Bolivia	3,661	LMIC		M			41		L	Far	Maize (11)			Low
Honduras	3,748	LMIC				M	24				Maize (35)	Major	Low	
Maldives	3,883	UMIC	Fast			R	15				Vegetables (35)			Low
Pakistan	3,926	LMIC				R	39				Wheat (38)	Mid		
Bhutan	3,998	LMIC	Fast			R	93		L		Maize (26)			Low
West Bank and Gaza	4,070	LMIC			F		8	High			Wheat (12)		Low	
Morocco	4,309	LMIC	Fast			M	25				Wheat (40)		Low	
Angola	4,319	UMIC	Fast	H		M	69	V high		Far	Maize (36)		Low	Low
Philippines	4,490	LMIC				M	34				Rice (32)			
Cape Verde	4,747	LMIC	Fast				17				Maize (49)		Low	
Indonesia	4,805	LMIC	Fast			M	41				Rice (33)	Major		
Equatorial Guinea	4,916	HIC	Fast	H		R	64	V high		Far	Cassava (25)	Major		
India	3,023	LMIC	Fast			R	54				Rice (21)	Mid		
China	4,331	UMIC	Fast			M	36				Maize (18)			

Sources: FAOSTAT (2014); ICP (2014); IMF (2012); Government of Sudan (2012); UNCTAD (2014); World Bank (2014a).
Growth in GNI pc: “Fast” if >3% in constant LCU 2000–10
Resource revenues: “H” if >50% of fiscal revenues; “M” if 25–50%; “L” if <25% of fiscal revenues or if >20% of exports; “*” if prospective resource exporter; IMF (2012)
Fragile situation: World Bank list for FY2014
Population in rural areas: “R” if >60%; “M” if 40–60%
TFR: “V high” if >5; “High” if 3.5-5%
Distance to fertilizer plant: “Far” if index >8,000
Cash crop role: “Major” if >20% of harvest area; “Mid” if 10–20% of harvest area
Cereal yield: “Low” if <2 tons/ha
Fertilizer use: “Low” if <25 kg/ha

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