AGRICULTURAL TRANSFORMATION IN SUB-SAHARAN AFRICA AND THE ROLE OF THE MULTIPLIER

A LITERATURE REVIEW

LEO
Leveraging Economic
Opportunities

REPORT NO. 4

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EXECUTIVE SUMMARY

In the coming decades, Sub-Saharan Africa (SSA) could see a major humanitarian crisis. If rapid population growth continues and agricultural productivity rises slowly or not at all, large increases in the working-age population and daunting problems of food supply, poverty, and underemployment will result. Lowered population growth, job creation, and higher agricultural productivity are all needed to avert impending disaster. If a way can be found to bring about substantial increases in small farm productivity, the crisis may be averted. Multiplier effects could increase the benefits that accrue to the rural economy.

Projections of food demand and supply for Africa are daunting. Demand for food is expected to rise by 2.9% a year from now to 2050, largely as a result of population growth that could expand the continent's population from 1.1 billion today to 2.4 billion by 2050. Yet productivity growth in agriculture averaged only 1% a year from 2001 to 2010. If that growth rate were to persist until 2050, Africa would be able to meet only 25% of its total food demand in that year. Obviously, greatly reduced fertility (the average woman gives birth more than five times) and much faster growth in agricultural productivity are both needed.

Economic growth has resumed in the past 20 years in many SSA countries and several positive signs of change have emerged, but the kind of far-reaching economic transformation that accompanied long-term economic development in other world regions is not yet apparent. To avert catastrophe over the coming decades, SSA must undergo radical economic transformation. Its economic future must be very different from its past. At the macro-economic level, the relative importance of the agricultural sector in both GDP and employment must decline sharply while the corresponding shares of manufacturing, construction, and high-value services rise.

Yet it will be a long time before SSA's economic structure is so radically transformed. What happens in agriculture and the rural economy more generally will continue to be of great importance for decades to come. Agriculture must grow to feed the rising population, earn foreign exchange, supply labor to expand employment in the industrial and service sectors, and provide a market for growing manufacturing output. To do all these things, the sector itself must be transformed. Agricultural technology must be modernized, commercialization increased, and non-agricultural rural activities made more productive so that they can provide a rising share of income for rural households.

In low-income countries, such as most of those in Sub-Saharan Africa, development can be described as agriculture-based. Agriculture's contributions to development are enhanced by the multiplier effect. Studies using varied methodologies have placed the average value of the multiplier in SSA around 1.5. That is, a $1 increase in agricultural income—brought on, say, by an investment or technological change—can raise national (or in some studies, non-farm rural) income by $1.50.

The multiplier has three components: an initial stimulus to income growth, a transmission mechanism, and a final impact. In the setting of SSA, possible initiating stimuli include technological change and investment, including infrastructural investment, private investment, and investment in human capital. Transmission works through several demand and supply mechanisms that are described in this paper. In terms of impact, while some aspects of the demand-side mechanism may weaken as countries develop, others will remain and supply-side mechanisms involving linkages and spillovers

will still be important. The multiplier effect can help raise income levels in rural SSA and strengthen the "pull" effect on rural non-agricultural enterprise.

The existence of the multiplier effect strengthens the case for investing in agriculture and removing any remaining urban bias in government policies. It is important to realize, however, that much of the multiplier's power depends on boosting demand for locally produced products and services that are non-tradable—either inherently (like construction and many services) or effectively (like basic foodstuffs because of high transportation and marketing costs). As markets broaden and trade with other regions and countries becomes easier, the demand-side mechanism driving the multiplier effect may weaken. Even so, the potential for positive externalities will remain. In the longer run, attention to linkages and spillovers is likely to be the most important policy implication of the multiplier effect. This requires improvements in features of the commercial environment for agriculture such as better communications, improved ways of doing business, and heightened trust among participants in commercial transactions. It also requires strengthened linkages between farmers and global value chains, as well as domestic and foreign investors.

There has been much debate over appropriate strategies for agricultural development in SSA, including whether a Green Revolution strategy to achieve dramatic increases in per hectare grain yields is feasible. Although this effort faces many difficulties, alternative approaches (such as primary reliance on commercial agriculture or extensive transfer payments to relieve rural poverty) appear to pose problems that are at least as great.

I. INTRODUCTION

Drawing on an extensive and rapidly growing literature, this paper explores the concept of the multiplier and its relationship to agricultural development in Sub-Saharan Africa, and thus to national economic development and poverty alleviation.

AIMS OF THE PAPER

The paper aims to:

- Consider the nature of the multiplier concept, and how it relates to agricultural transformation in SSA and the sector's role in rural and national economic development.
- Review measures of the multiplier in African agriculture that researchers have derived, and the factors that affect its magnitude.
- Weigh changing and competing concepts about how agriculture contributes to economic development and poverty amelioration.
- Consider the implications of these findings for the development of agriculture, the rural economy in general, and the national economies of SSA in their current circumstances.
- Weigh the implications of these findings for the amelioration of poverty in the countries of SSA.
- Discuss possible strategies, interventions, and lessons learned about how to accelerate or maximize multiplier effects to promote economic development and poverty alleviation in SSA.

METHODOLOGY AND LIMITATIONS

The paper reviews the relevant literature to develop an understanding of these issues that is securely founded on research findings. The scope of the literature review is constrained, however, by the time and energy available for this exercise. The issue of the multiplier is embedded in much larger issues concerning the role of agriculture in economic development and poverty alleviation. The relevant literature, covering the topic in general, and its application to SSA in particular, is vast and complex, comprising hundreds of articles and books. Although it would not be practical for a reviewer to read everything in this voluminous literature, 74 writings, listed in the bibliography at the end of this paper, were consulted. These works seem especially pertinent and among them cover all the major issues. While a still broader reading of the vast literature might have added details and altered shadings, it probably would not have fundamentally altered the basic understanding presented here.

II. CONCEPT OF THE MULTIPLIER

Wikipedia defines the term *multiplier*, as used in economics, as "any measure of the proportional effect of an exogenous variable on an endogenous variable." Less abstrusely and more specifically, it defines the *fiscal multiplier* as "a term that measures how much aggregate demand changes in response to a change in spending." The concept of the multiplier originated in analyses of the economic depression in the United States during the 1930s. Since the early 1980s, it has periodically been applied to agriculture and its role in economic development.

Two American economists, Alvin Hansen and Paul Samuelson, first proposed the idea of the multiplier in the late 1930s. Drawing on the revolutionary economic theory of John Maynard Keynes, they used the concept to show how government spending could help ameliorate the disastrous effects of the Great Depression. The idea was that if the federal government increased its expenditure and did not match this increase with an increase in its revenues, aggregate demand would grow by some multiple of the original increase in government expenditure.[1] The multiplication would occur as those who received the additional government expenditure themselves spent more, in turn increasing other people's incomes, and so on through succeeding rounds of spending. The size of the multiplier would be determined by the fraction of additional income that each successive income recipient spent, as opposed to saving: the higher the percentage spent, the larger the multiplier.

The well-known policy implication of the multiplier as originally expounded was that in the depression of the 1930s, when vast labor and capital resources sat idle because of weak aggregate demand, deficit spending could be used to put some of them to work and provide added income for those who were poor and unemployed. Keynes argued that any type of government expenditure would help, even hiring one group of workers to dig holes and another to fill them up (although more productive activities were in fact identified).

The strength of the multiplier as expounded by Hansen and Samuelson was determined by what economists call the marginal propensity to consume. "Leakages" in the rounds of successive spending weaken the multiplier effect. The principal form of leakage considered at the time was saving. The higher the fraction of additional income received that is saved rather than spent, the weaker the multiplier effect. For this reason, citizens were urged to set aside traditional values and spend their income rather than save it.

Another possible source of leakage would have been expenditure on imported goods and services, which would also fail to boost domestic demand and thus would dampen the multiplier. Since, however, the United States economy in the 1930s was virtually closed, with foreign trade making up only a tiny share of GNP, leakages of spending into imports were generally ignored.

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[1] A weaker multiplier effect, called the balanced-budget multiplier, comes into effect even if the increase in government expenditure is matched by an increase in revenues. This results from the expansion of the public sector.

A third type of leakage is taxation. To the extent that higher income leads to increased tax payments, the multiplier is weakened.

A critical condition for the multiplier to raise real income and employment is the presence of underutilized resources that can be mobilized relatively easily and cheaply in response to increased demand. If this condition is not met, the result of deficit spending is likely to be inflation and/or, in an open economy, rapidly growing imports leading to a trade deficit. Thus deficit spending in times of high unemployment can stimulate real GDP, but deficit spending in times of relatively low unemployment can cause inflation and trade deficits.

A related point is that the multiplier works only until the existing stock of underutilized resources is used up. In the longer run, increases in stocks of physical and human capital are needed to permit the supply capacity of the economy to grow in step with increasing demand. The implications of this condition for SSA are spelled out below.

III. THE MULTIPLIER AND AGRI-CULTURAL TRANSFORMATION

CONCEPTUAL BROADENING

For application to agricultural transformation in SSA, the multiplier concept must be generalized in at least three ways. First, alternative triggers for the multiplier effect must be considered. Increased government expenditure, whether consumption or investment, is not the only possible trigger. An exogenous increase in any other form of expenditure could also initiate a multiplier effect. The trigger might be private investment, which would have the dual advantage of increasing supply capacity as well as aggregate demand. It might also be dramatic technological change (e.g., a "Green Revolution"), or even a natural stimulus such as favorable weather that brings bumper crops. The basic requirement is some form of stimulus that raises the income of a particular group, which in turn spends money in ways that benefit other groups and leads through several rounds of spending to a benefit to society that is some multiple of the increase recorded by the initial beneficiaries. Note, however, that the presence of idle (or at least underutilized) resources is still required and that leakages into savings, imports, and taxes dampen the multiplier effect.

The applicability of the multiplier concept to the context of African agriculture is made plausible by the presence of underutilized (low-productivity) resources. Although the original context of the fiscal multiplier (Depression-era America) featured totally unemployed labor and capital, it is reasonable to think that successive rounds of expenditure could also create a multiplier effect by drawing resources from less productive uses into more productive uses.

The second form of generalization of the multiplier concept is the recognition that the multiplier can work through supply-side mechanisms as well as the demand-side mechanism postulated in the original formulation. Discussion of the multiplier effect in the context of agricultural transformation in SSA suggests that supply-side mechanisms—linkages and spillovers—can also contribute to a multiplier effect, helping to make the ultimate value of a positive income shock larger than the value of the shock itself.

Linkages are relationships between enterprises along a value chain. They can be divided into forward and backward linkages. From the point of view of a particular firm, a forward linkage is created by economic activity concerning its products, say processing, shipping, or marketing. A backward linkage is created by economic activity having to do with the firm's inputs, such as the supply of raw materials or production-related services. A boost in demand for any firm in a value chain can work through linkages to strengthen the supply capacity of other firms to which it is linked as either buyer or supplier.

Spillover effects are externalities of economic activity or processes that affect those who are not directly involved. An *externality* is the cost or benefit that affects a party who did not choose to incur that cost or benefit. Well-known examples of negative externalities are air pollution and smoking, both of which impose health costs on society. A relevant example of a positive externality would be an improved growing method that might be adopted by one farmer in a village and then copied by others. Economic theory presumes that producers ignore the external effects of their activities because they

do not affect their bottom line. This leads to a socially excessive supply of goods and services with negative externalities and a socially insufficient supply of goods with positive externalities (spillovers). The standard policy recommendation is to tax goods with large negative externalities and subsidize goods with large positive externalities.

The third and final point is that whereas the original multiplier was defined in national terms, applications to sub-national regions and sectors are also possible. In such cases, purchases from outside the region or sector could be regarded as imports and thus as leakages that weaken the multiplier. For this reason, the share of expenditure made that goes to purchase non-tradable goods and services, which must be produced locally, is a critical issue in calculating the strength of the multiplier.

ANALYZING AND MEASURING THE MULTIPLIER IN AGRICULTURAL DEVELOPMENT

Numerous studies going back to the 1980s have sought to analyze the multiplier effect in agricultural development and measure its magnitude. A review of these studies reveals a consensus that autonomous increases in agricultural income—that is, increases brought about by any of the positive stimuli noted earlier—do have a multiplier effect. There is less agreement on the exact value of the multiplier, the best way to calculate its value, its causal mechanisms, its impact on agricultural growth and poverty alleviation, or its implications for development planning and policy.

The appendix to this paper reviews 15 studies published between 1989 and 2014 that examined the role of the multiplier in agricultural, rural, and national development in SSA. Some of the most important conclusions to emerge from a review of these studies are:

- A stimulus to agricultural income does indeed have a significant multiplier effect on the rest of the economy, especially affecting rural services, construction, and commerce.
- The magnitude of this effect has been measured at various times in various African countries using differing economic models. As a broad average, rural or national income has been found to rise by about 1.3 to 1.5 times the initial stimulus. This is slightly less than estimates for Asia (1.6 to 1.8) and similar to those made for Latin America.
- The multiplier is likely to be weaker in smaller and thus more open economies than in larger economies.
- The multiplier works mainly through successive rounds of increased demand, but supply-side influences, involving both resource reallocation and more subtle non-market effects are also important.[2]
- The strength of the demand-driven portion of the multiplier effect depends on the extent to which increased spending is directed toward non-tradable goods and services.
- Some important commodities like basic foodstuffs are effectively non-tradable in many African settings at present because of high transportation costs and other market barriers; these

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[2] See the appendix for details, especially the discussion of Block and Timmer (1994), who suggest that learning by doing by both governments and firms, improved food security and political stability, greater efficiency in decision making, higher productivity of industrial capital, and higher labor productivity as nutritional standards improve may all contribute to the multiplier. A similar suggestion was made by Irz et. el. (2001).

goods may, however, become more tradable in the future as transportation and marketing costs decline.

- For this reason, one might expect the strength of the multiplier to decline over time, at least as far as the local economy is concerned. However, no study has postulated or attempted to measure such a trend so far.

- Multiplier effects increase the demand for unskilled labor to work in non-agricultural activities; this helps to ameliorate rural poverty.

The formula for calculating the value of the multiplier is $1/(1 - mpc)$, where the marginal propensity to consume (mpc) is the fraction of the additional income generated by a stimulus of some type that is spent on consumption of goods and services produced in the relevant country or region. For example, if three-quarters of the added income were spent on this form of consumption, the value of the multiplier would be four: the ultimate impact of an expenditure stimulus would be four times the value of the stimulus itself. Perhaps surprisingly, the finding of a multiplier value around 1.5 in most of the empirical studies reviewed here suggests that the mpc as just defined is only about one-third. This in turn implies that two-thirds of the additional income generated is either spent on imports (goods and services purchased from outside the relevant country or region) or goes into savings or taxes.

Much of the explanation for this low multiplier value may be unrecorded international trade, which is pervasive in SSA. Some of this trade involves high-value products such as diamonds, ivory, and cigarettes and another part consists of re-exports of items imported from outside SSA. The remainder involves locally produced goods and services. National boundaries in Africa are relics of European conquest during the colonial era and often disregard traditional residential and trading patterns, so logical trading partners may well lie outside the relevant national or regional boundaries. Recent government efforts to facilitate legal trade among countries in SSA may help to widen markets for agricultural commodities and livestock, but such markets already exist without legal or regulatory sanction. The multiplier for a given country or region is thus weakened by the fact that some of the additional expenditure generated goes for imports from other countries or regions.

The next section of this paper places the multiplier in the setting of agricultural development in SSA by reviewing the literature on agriculture's relationship to economic growth and poverty alleviation—both in general and within the specific conditions that prevail in SSA.

IV. AGRICULTURE AND ECONOMIC GROWTH

The exact role of agriculture in rural and national economic growth is an important, broad, and long-debated subject that extends far beyond the terms of reference for this paper. A comparatively brief review is needed, however, to provide context for the discussion of the multiplier that follows. The review begins by summarizing global and historical patterns and then proceeds to recent experience in Africa, which has thrown up some major challenges and prompted debate about the applicability of experience in Asia and elsewhere to the situation in SSA and appropriate strategies for transforming African agriculture.

THE GLOBAL PATTERN

One of the oldest and best-established empirical propositions in development economics is that the agricultural sector is the largest, and sometimes the only significant, sector in low-income countries but declines rapidly in relative significance as GDP per capita rises. In low-income countries its share of GDP is typically 60% or more, and its share of total employment is even larger. In middle- and high-income countries, the GDP and employment shares of agriculture are much smaller.

One basic cause of these empirical regularities has long been understood. Much of agriculture produces food and the income elasticity of demand for food is less than one. This means that when total income rises by X% the demand for food rises by less than X% as demand gradually shifts to non-food items. To permit labor to be transferred to non-food production, however, agricultural production must rise. This in turn means that, unless significant new land areas can be brought into agricultural production, agricultural output per unit of land must rise. Most likely, labor productivity in agriculture will also increase.[3]

Interpretations of this empirical pattern have been put forward and debated over many years. The famous growth model of W. Arthur Lewis (1954), "Economic Development with Unlimited Supplies of Labor," treated the agricultural sector as a huge reservoir of underutilized labor that the economy can draw on at little cost over a long period of time while building up the industrial sector. Early economic growth strategies like those propounded in the Soviet Union as well as in India soon after independence stressed industrialization and often repressed the agricultural sector in an effort to extract food and capital for use in industry. Although theorists who assigned agriculture to such a passive role in development did appreciate that agricultural productivity must rise to provide the needed food, governments pursuing rapid industrialization strategies often adopted incentives and investment patterns that failed to reflect this concern. Their policies often exhibited urban bias.

The tide began to turn in the early 1960s with the publication of a landmark paper by Bruce Johnston and John Mellor (1961) and a book by Theodore Schultz (1964) that propounded the rationality of

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[3] A comparatively minor exception to this scenario is the country with very rich mineral endowments, which can import a large share of the food it needs and where the agricultural sector may be small to begin with.

small-scale farmers within their highly constrained environments. Johnston and Mellor defined five contributions that agricultural production makes to economic growth:

1. Satisfying the growing demand for food and other agricultural products, without which economic growth can be seriously impeded.
2. Earning needed foreign exchange; agricultural products may provide the most promising export opportunities, especially in the early stages of development.
3. Providing most of the labor needed by manufacturing and other expanding sectors.
4. Contributing savings to finance investment.
5. Enlarging the market for industrial products as the net cash income of the rural population rises.

According to Johnston and Mellor, the structural shift away from agriculture is stimulated by the application of modern technology to manufacturing, power generation, and transportation, which reduces costs and prices and thereby encourages added consumption of these goods and services. Soon afterwards, however, the Green Revolution of the 1960s and early 1970s showed that similar gains could be realized in rice, wheat, and corn production in parts of Asia and Latin America. This transformed agriculture from a "traditional" sector to a "modern" sector and helped to create a more positive attitude about its role in economic development. However, the Green Revolution required not only the adoption of new technology and acceptance of risk by small-scale farmers but also complementary investments in irrigation and transportation as well as increased outlays by farmers for fertilizer and other inputs. The Green Revolution bypassed SSA and is now being regarded more critically on ecological grounds (e.g., because of pollution from fertilizer and insecticide run-off, also loss of biological diversity).

The Green Revolution dramatically revealed that the application of science-based technology adapted to a country's ecological conditions could transform agriculture and make it a dynamic sector.[4] It also showed that raising agricultural productivity requires fostering linkages between the agricultural and non-agricultural sectors. Growth in agriculture is not independent of growth in non-agricultural sectors, as some early theorists assumed.

Albert Hirschman (1958) had already introduced the idea that inter-sectoral linkages could be important drivers of the growth process. Hirschman emphasized the backward and forward linkages created by investments in the industrial sector, but Johnson and Mellor (1961) pointed to the existence of both production and consumption linkages within agriculture and between agricultural and non-agricultural sectors. Agricultural production generates forward production linkages when its outputs are supplied as inputs to non-agricultural production. Its growth can contribute to expanding agro-processing and processed food marketing, which provide new engines of growth and opportunities to substitute for imports. Agriculture also creates backward production linkages through its demand for inputs such as fertilizers and marketing services.

The consumption linkages generated by increased rural incomes are important in the early stages of the development process because rural households can provide a large and growing market for domestically produced manufactured goods and services. Surplus agricultural income finances invest-

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[4] The discussion in the next few paragraphs follows the excellent presentation in Diao et. al. (2007).

ment in both urban and rural areas. Lower food prices, stimulated by technological change in agriculture, maintain low real wages in industrial sectors and thus foster investment and structural transformation.

Discussion by agricultural economists in the 1980s and 1990s (Hazell and Roell 1983; Hazell and Haggblade 1991; Haggblade, Hammer, and Hazell 1991) suggested that rising agricultural productivity stimulates rural economies through production and consumption linkages at the regional level. These studies emphasized the importance of infrastructure in improving the responsiveness of the non-farm economy to increases in demand arising from rising agricultural income. Some regional studies also considered the formation of social capital, suggesting that increased interactions among farmers, input suppliers, processors, and banks might help generate the confidence and trust needed to initiate non-agricultural business and commercial agriculture (Irz et al. 2001).

Numerous empirical studies have examined the contribution of smallholder farming to agricultural growth and demonstrated that poor households with small farms can experiment with ways to improve their livelihoods and stay on their farms. By contrast, the trickle-down benefits from large-scale commercial agriculture are usually more limited. Household surveys have also shown that the expenditure patterns of farm households favor growth in the local nonfarm economy. These households spend higher shares of their incremental income on rural non-traded goods than do large-scale farmers, thereby increasing demand for locally produced, labor-intensive goods and services (Mellor 1976; Hazell and Roell 1983). Small farms also contribute to food security in rural areas where high transport and marketing costs can cause food prices to soar when there is a shortfall in local production.

The strong linkage effects of agriculture suggested to some unorthodox theorists that agricultural growth could lead to broader economic growth during the early stages of industrialization, even in more open countries. Hans Singer (1979) described a "balanced-growth" strategy that emphasized the "national development of agriculture as the primary sector and developing industries with strong emphasis on agriculture–industry linkages and interactions." Irma Adelman (1984) proposed an "agricultural-demand-led-industrialization" strategy that stressed the ability of increasing agricultural productivity to raise demand for intermediate and consumer goods produced by domestic industries and, in turn, help support the drive toward industrialization. Adelman also analyzed the distributional implications of agricultural development, arguing that broad-based participation in the growth process requires equitable ownership of productive assets, especially land, during the earliest stages of development.

More recently, the relationship between agriculture and broader economic growth has been examined using dynamic general equilibrium approaches. Theorists from this school develop theoretically consistent models in which agriculture and other sectors interact during the development process.

Debate continues about how investment should be allocated across agricultural and non-agricultural sectors, as well as what policies should be followed to develop agriculture. The World Bank reviewed these issues in its *World Development Report 2008. Agriculture for Development* (World Bank 2007). This report defined differing roles for agriculture in three broad types of economy: "agriculture-based," "transforming," and "urbanized." Countries in each group were said to face a characteristic set of challenges in policy-making and investment prioritizing. The agriculture-based economies are those in which agriculture makes a major contribution to GDP and in which the poor are concentrated in rural areas. These economies are located primarily in SSA and include most SSA countries.

In agriculture-based economies, the sector produces primarily non-tradable staple crops. Locally grown staples such as cassava, yams, sorghum, millet, and teff that are not traded internationally (but are sometimes traded regionally) often predominate in local diets. The domestic food economy is frequently insulated from global markets by high transport and marketing costs, especially in the rural hinterlands and in land-locked countries. The non-tradable staple crop sector is said by the Bank to represent as much as 60% of agricultural production in Malawi and 70% in Zambia and Kenya.

Gains in staple crop productivity increase the aggregate food supply and reduce food prices. That keeps the nominal wages of unskilled workers as well as the prices of all the inputs that have a large labor content at lower levels, helping to make the nonfood tradable sector competitive. It also relieves poverty and improves nutrition among farm families.

As for tradable agriculture in these countries, globalization and the entry of dynamic new producers (for example, Vietnam in coffee) have increased competition in traditional exports. But many African countries are competitive in primary agricultural commodities. New markets have also opened for traditional exports, such as premium coffees, as well as for nontraditional high-value agricultural products, such as vegetables from Senegal, fish from Uganda, and vegetables, fruits, and flowers from Kenya.

Tradable agriculture contributes to aggregate growth by earning foreign exchange that can finance imports of inputs and capital goods. Countries with mineral resources, like Zambia, depend less on agricultural exports, but most agriculture-based economies rely on agriculture for a large share of their foreign exchange.

The poverty-reducing effects of developing tradable agriculture depend on the participation of smallholders and poor households in production. Labor-intensive non-traditional exports can also have substantial local poverty-reducing effects by generating employment, as in Kenya and Senegal, despite the tightening food standards and more vertically integrated market chains that tend to favor medium-sized farms.

The World Bank report recognizes that in addition to its direct contributions to economic growth, agriculture in agriculture-based economies enhances growth in other sectors through consumption and production linkages. When agricultural incomes are spent on domestically produced, non-tradable goods and services, demand for domestic industry and services is stimulated. Forward production linkages foster growth in agro-processing and food marketing, and backward linkages increase demand for intermediate inputs and services. The availability of resources (entrepreneurship, excess capacity) and a favorable investment climate that allow a supply response from the nonagricultural sector are critical for realizing the advantages of such linkages.

The World Bank report cites empirical evidence that confirms these multiplier effects. Their strength depends in part on a country's economic structure. Small economies where tradable goods and services make up a large share of the economy (for example, Lesotho) have smaller multipliers than large economies with a high share of non-tradable agriculture and services (e.g., Cameroon, Nigeria, and Tanzania).

EXPERIENCE AND CHALLENGES IN SSA

The World Bank puts most countries of SSA in the "agriculture based" category, for which agriculture must play a large role in economic growth because these countries need to produce most of their

own food and are likely to retain a comparative advantage in agriculture at least in the medium term. In these countries, the demand for staple foods is driven by rapid population growth and a relatively high income elasticity of demand for food. With staples mostly non-tradable, and endemic shortages of foreign exchange for importing, food production in agriculture-based countries has to keep up with domestic demand.

Projections of food demand and supply for Africa are daunting. Demand for food is expected to rise by 2.9% a year from now to 2050, largely as a result of population growth that could expand the continent's population from 1.1 billion today to 2.4 billion by 2050. Yet productivity growth in agriculture averaged only 1% a year from 2001 to 2010. If that growth rate were to persist until 2050, Africa would be able to meet only 25% of its total food demand in that year.[5] Obviously, greatly reduced fertility (the average woman gives birth more than five times) and much faster growth in agricultural productivity are both needed.

Until the mid-1990s SSA was a lagging world region in terms of economic growth rates. As rapid population growth continued, income per capita stagnated. Beginning about 20 years ago, however, economic growth began to pick up and some views of Africa's development prospects took a more positive turn. Steven Radelet (2010), for example, identified 12 "emerging countries" in which per capita income grew by 2% or more per year between 1996 and 2008, as well as six other relatively promising "threshold countries."[6] He spoke of an "emerging Africa" with spreading democracy, improved economic management, better access to finance, and an ICT revolution. Others, however, point out that Africa continues to lag most other regions by most measures. Crucially, the kind of structural change in the economy that accompanied growth elsewhere has yet to materialize in SSA. Dani Rodrik (2013) asks whether Africa's recent performance can be sustained.

> "So far, growth has been driven by a combination of external resources (aid, debt relief, or commodity windfalls) and the removal of some of the worst policy distortions of the past. Domestic productivity has been given a boost by an increase in demand for goods and services (mostly the latter) and more efficient use of resources. Trouble is that it is not clear whence future productivity gains will come.
>
> The underlying problem is the weakness of these countries' structural transformation. East Asian countries grew rapidly by replicating, in a much shorter time frame, what today's advanced countries did following the Industrial Revolution. They turned their farmers into manufacturing workers, diversified their economies, and exported a range of increasingly sophisticated goods."

That defines Africa's basic development problem. Manufacturing has not grown, rapid urbanization has led to growing service and informal sectors, and except for apparel exports from Mauritius, and more recently from Kenya and Madagascar under preferential trade agreements (especially the U.S.

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[5] See Population Reference Bureau (2013), *World Population Data Sheet 2013;* Global Harvest Initiative (2013), *2013 Global Agricultural Productivity Report (GAP Report).*

[6] Radelet's "emerging countries" are Botswana, Burkina Faso, Ethiopia, Ghana, Lesotho, Mali, Mozambique, Namibia, South Africa, Tanzania, Uganda, and Zambia. The "threshold countries" are Benin, Kenya, Lesotho, Malawi, Senegal, and Sierra Leone. See Radelet (2010), p. 1.

African Growth and Opportunities Act), manufactured exports have not yet taken off. African exports are still concentrated in unprocessed primary products, in sharp contrast to the manufactured goods exported from the transforming countries of Asia. While part of that difference is related to macroeconomic and trade policies, the World Bank argues that the comparative advantage of most African countries has a large influence on this trade pattern. It therefore concludes that the growth strategy of agriculture-based economies for many years to come has to be anchored in improving agricultural productivity.

The 2014 *Africa Progress Report*, released earlier this year by the Africa Progress Panel headed by Kofi Annan, echoes the concern that Africa is growing rapidly but transforming slowly. Most workers who leave agriculture are going into service employment, usually in informal enterprises. Few enter manufacturing. SSA is actually less industrialized than it was in the 1980s, when import substitution strategies promoted industrialization behind protective walls.

SSA is a vast and ecologically varied area broken up into numerous countries, both small and large. Table 1 reproduces a typology of the region created by Diao et. al. (2007). Of the 42 countries included in the table, 34 are regarded as low-income. Twenty-six of these countries are considered by the Food and Agriculture Organization of the United Nations (FAO) to have relatively favorable agricultural potential. Of this total, ten countries are mineral-rich and thus able to grow to some extent without agricultural transformation. Of the remaining 16, ten countries are coastal and thus more open to international trade while the remaining six are landlocked. Eight low-income countries are regarded by the FAO as having less favorable agricultural potential.

Issues of agriculture's role in Africa's economic growth and structural transformation have been hotly debated. Characteristics of African agriculture and some recent events have created daunting challenges to agriculture-led development, at least as it was experienced in Asia. In recent work, Thom Jayne and associates[7] have identified several important facts and trends that will affect the future development of agriculture:

- Although SSA is land abundant in the aggregate, a large share of the population lives in densely populated areas and faces increasingly severe land constraints.
- 80% or more of uncultivated but arable land is located in eight countries, some of which are politically unstable.
- Many small-scale farming areas cannot expand because of land tenure issues in surrounding territory.
- Population growth in densely populated smallholder farming areas is intensifying the pressure on available land, shrinking average farm sizes, and contributing to unsustainable forms of agricultural intensification (e.g., reduced fallowing).

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[7] Jayne, Chamberlin, and Headly (n.d.); Jayne, Chamberlin, and Muyanga (2012); Jayne, Chamberlin, and Headly (2014); Jayne, Chamberlin, Sitko, Nkonde, Muyanga, and Chamberlin (2014).

Table 1. Typology of SSA Countries

		Low-income countries	Middle-income countries
More favorable agricultural potential	Coastal countries	• Benin • Cote d'Ivoire • Ghana • Guinea-Bissau • Kenya • Mozambique • Senegal • Tanzania • Togo	• Mauritius • South Africa
	Landlocked countries	• Burkina Faso • Ethiopia • Lesotho • Malawi • Uganda • Zimbabwe	• Swaziland
	Mineral-rich countries	• Angola • Cameroon • Central African Republic • Dem. Republic of Congo • Guinea • Nigeria • Rep. of Congo • Sierra Leone • Sudan • Zambia	• Equatorial Guinea
Less favorable agricultural potential		• Burundi • Chad • Comoros • Madagascar • Mali • Mauritania • Niger • Rwanda	• Botswana • Cape Verde • Gabon • Namibia

- "Land grabs" by large-scale commercial farms, including Chinese firms, have made headlines lately, but acquisition of medium-scale farms by urban and rural African elites including civil servants actually involves a larger area. Lands owned by members of the middle class are much less intensively cultivated than those worked by poor farmers. These trends in land ownership are making the distribution of land by farm size in smallholder farming areas more unequal.
- Participation in agricultural marketing is highly skewed. Perhaps only 5% of farmers (not counting large-scale commercial farmers) supply 50% of the marketed grain surplus. Meanwhile, half or more of rural farm households cannot produce enough food to meet their consumption needs and therefore must either buy grain if they can, or go hungry if they cannot.
- Public investments in roads, electricity, and water will generally be required to raise the economic value of potential farmland.

Rapid population growth and the slow growth of demand for non-agricultural labor exacerbate these problems, causing Jayne et. al.

"…to question whether the Asian Green Revolution mode of land intensification—featuring broadly-based smallholder-led agricultural growth driven by major increases in modern inputs per unit of land with broad access to water control—is still feasible in SSA…A looming policy question is, therefore, whether agricultural and land policy should focus on promoting efficiency and productivity in land use and seek to achieve poverty reduction goals through some other means (such as social protection and transfer programs) or whether agricultural policy should retain poverty reduction as a primary goal alongside productivity and national food security…"

Despite these environmental difficulties, some prominent writers (Dorosh and Mellor 2013; Mellor 2013) continue to press for agriculture-led growth in SSA. In a recent paper, Mellor (2013) notes the basic differences between the Asian countries that went through the Green Revolution and contemporary SSA: much greater diversity in the agrarian environment; greater importance of perennial export crops; less irrigation (but better rain-fed land); poorer physical infrastructure; political instability. These characteristics, he argues, require several kinds of major effort directed at small commercial farmers in areas of high population density:

1. Large investments in agricultural research, extension, and higher education.
2. Emphasis on tropical export commodities with large aggregate potential for growth, including oil palm, cocoa, coffee, and tea.
3. Government leadership in forming specialized agricultural finance systems to serve the small commercial farmer.
4. Massive investment in irrigation and rural physical infrastructure.

If significant progress can be made in each of these areas—without doubt a big "if"—Mellor believes that African agriculture can achieve growth rates comparable to those achieved in Asia.

Michael Lipton (2012) also considers smallholder development an indispensable factor in dealing with SSA's employment problem:

" 'Scientific smallholder intensification' in Africa is no easy path to development. From global evidence, we know it's possible. Is it necessary? Initially, yes. Farm development is

only the start of modernization away from agriculture. I'm no agricultural or smallholder fundamentalist. But I'm an income-from-work fundamentalist. [SSA] by 2050 will have 2.3 times today's population—but 3.7 times today's 15-64 year-olds. They need an affordable *initial* path to workplaces giving income and respect. Otherwise, potential demographic dividend will become demographic disaster. But, with half the people still in severe poverty and States cash-strapped too, what initial path is 'affordable'? One, trodden elsewhere, is scientific intensification of smallholder farms. If there's an alternative, what is it?"

Africa has a severe and potentially worsening employment problem. After reviewing the generally inadequate data on employment in SSA, Golub and Hayat (2014) summarize the situation as follows:

"African economies have picked up but structural transformation remains limited. In this setting, employment opportunities are barely keeping up with rapidly growing labor forces. In low-income countries, this translates into large and sometimes growing underemployment rather than open unemployment, as people are simply too poor not to work. The vast majority of the workforce remains in subsistence agriculture and, increasingly, the urban informal sector, with very low and uncertain incomes and no access to social insurance programs. Public sector jobs have dwindled since the era of structural adjustment in the 1980s and 1990s, and private formal sector employment growth has been too small and started from too low a base to make a significant dent in underemployment. With its rapidly growing populations, small enclaves of relatively well-paying modern sectors, and vast informal economies, Africa resembles the situation described by Arthur Lewis (1954) as 'unlimited supply of labor' more so today than at the time Lewis presented his classic analysis."

Golub and Hayat's paper documents and analyzes the predominance of informal employment in Africa and shows that weak demand for labor is the main reason for pervasive underemployment. The authors observe that:

"Integration into the global economy and exports of labor-intensive products are vital to boosting the demand for labor in Africa. Africa has some potential to become competitive in light manufacturing, but the most promising avenue for export-led growth of employment in many African countries is agriculture, including traditional cash crops such as cotton, coffee, cocoa, and groundnuts. Contrary to common perceptions, traditional cash crops, which are the source of livelihood for millions of Africans, have many of the features of manufacturing exports: high labor-intensity; potential for quality improvements through technological transfer; and quality-sensitive markets in developed countries. Improvements in the business climate are the key to boosting investment and technology transfer in labor-intensive tradable industries, and thus raising labor demand and employment."

Nagler and Naude (2014) derived important information about rural non-agricultural enterprises in six countries of SSA in 2005-2012 from a unique database generated by the World Bank. They found that:

"…rural non-farm enterprises are predominantly small, informal household enterprises, operating from the immediate surroundings of the household residence or in a traditional market, and providing mainly basic consumer goods and services to the local economy. The majority of rural non-farm enterprises do not operate continuously over the year, reflecting the impact of seasonality in agriculture on the allocation of household labor.

Rural households can either be "pulled" into non-agricultural activities by opportunities that offer higher returns than farming or "pushed" into them by the need to supplement inadequate incomes and food supplies and find some productive use for idle labor. Earnings from off-farm activities of the "push" variety are likely to be quite low. Nagler and Naude found that "push" and "pull" factors both matter for a household's decision to operate a non-farm-enterprise. The effects of external shocks, the experiencing of food shortages, the distance that households are located from major roads and cities, and the importance of gender and marital status all play a part in the decision, but the researchers found it difficult to generalize across the countries in their sample.

Nagler and Naude concluded that rural development policies in SSA have had little significant impact in fostering structural change in rural areas. Still largely an informal and survivalist sector, rural non-farm enterprises provide a risk-diversifying mechanism for households but do not contribute significantly to employment creation, rural development, or income growth.

> "The increase in the share of rural household income that emanates from this sector does not appear to be the outcome of successful policies, but the failure of policies to foster effective rural-urban migration and wage employment."

As Haggblade et. al. put it, the rural non-farm economy (RNFE) can be either a pathway out of poverty (when "pull" factors predominate) or a pathway in (when rural households are "pushed" into non-agricultural activity). Although most non-agricultural activity in SSA is currently of the "push" variety, the multiplier effect from agricultural transformation could potentially help alleviate poverty and unemployment by creating more "pull" opportunities. This potential can be realized by expanding entrepreneurial and employment opportunities for rural households. As Haggblade et. al. write,

> "Because of rapid changes in many rural supply chains, small farms and firms often need to change how they do business, switch marketing channels, and invest in equipment or organizational arrangements that enable them to access growing market niches. Given disparities in economic power and access to information, these changes frequently require collective action by alliances of small businesses or brokering by pro-poor and advocacy groups." (Haggblade et. al, 171)

For non-entrepreneurs, employment in growing segments of the labor market provides an alternative way of earning more income. However, Haggblade et. al. warn that available evidence does not suggest that rural non-farm growth will automatically lead to improved opportunities for the poor.

> "For the RNFE to offer a pathway out of poverty, policymakers will need to remove situation-specific economic and social barriers that currently limit entry by the poor into lucrative non-farm professions." (Haggblade et. al, 171)

V. AGRICULTURE AND POVERTY ALLEVIATION

Empirical analyses of agricultural development and poverty reduction generally find a strong positive relationship between the two. Most of the poverty in low-income countries is located in rural areas. Poor rural households rely heavily on agriculture, although they also engage in a variety of non-agricultural economic activities to an extent unsuspected until recently, and also in many cases receive remittances from urban areas or abroad. Specifically, research shows that rising output per unit of labor in agriculture is closely related to declines in the incidence of poverty.

The World Bank (2007) defines five distinctive livelihood groups in rural areas of low-income countries:

1. Market-oriented smallholders who derive most of their income from active engagement in agricultural markets.
2. Subsistence-oriented farmers, who use the majority of what they produce for home consumption.
3. Labor-oriented households, which earn most of their income by working in agriculture or non-farm activities.
4. Migration-oriented households that either migrate themselves or receive remittances from family members who have migrated.
5. Finally, many diversified rural households receive significant shares of their income from farming, off-farm labor, and migration.

In most countries, there is marked dualism between market-oriented or diversified smallholders, who are least likely to be poor, and the other three groups: subsistence farmers, those who live mainly by selling labor (who may be landless), and households that rely mainly on remittances.

The Bank report says that rural households have three basic ways of moving out of poverty: agricultural entrepreneurship; providing labor to the rural non-farm economy; and migration to towns, cities, or other countries. Many rural households pursue more than one of these pathways.

Since the 1990s, strong empirical evidence that growth in agriculture has a pro-poor bias has emerged (Ravallion and Datt 1996 and 2002; Ravallion 1999). A recent World Bank analysis (de Janvry and Sadoulet 2012) confirms the earlier findings but also indicates that while rural poverty reduction is associated with growth in both per hectare yields and labor productivity, the strength of those relationships varies across regions. On average, de Janvry and Sadoulet find that GDP growth originating in agriculture raises the incomes of the poorest 40% about three times as fast as growth originating in the rest of the economy. The power of agriculture, the authors note, comes not only from its direct poverty reduction effect but also from its potentially strong growth linkage effects on the rest of the economy. By the authors' estimates, more than half of the recent declines in poverty in developing countries can be attributed (directly or indirectly) to income growth in rural areas. Moreover, as the example of Vietnam shows, rapid growth in agriculture can open pathways out of poverty for farming households.

Christiaensen et. al. (2010) conducted an empirical analysis of the relationship between agricultural growth and poverty reduction. They find that the contribution of a sector to poverty reduction depends on its own growth performance, its indirect impact on growth in other sectors, the extent to which poor people participate in the sector, and the size of the sector in the overall economy. Bringing together these different effects using cross-country econometric evidence, they find that agriculture is significantly more effective than non-agriculture in reducing poverty among the poorest of the poor. It is up to 3.2 times better at reducing $1-day headcount poverty in low-income and resource-rich countries (including those in SSA), at least when societies are not highly unequal. However, when it comes to the slightly better off poor (reflected in the $2-day measure), non-agriculture has the edge. These results are driven by the much larger participation of poorer households in growth from agriculture.

Earlier analyses (Irz et. al. 2001; Lin et. al. n.d.) also found a strong relationship between agricultural growth and poverty reduction. Irz et. al. attributed much of this effect to a wide variety of possible linkages, as discussed above. Their empirical work shows that agricultural growth has strong poverty-alleviating effects. Remarkably, their estimates suggest that a yield increase of one-third might reduce the numbers in poverty by a one-fourth or more. It seems doubtful that any other kind of anti-poverty program could give comparable results. Lin et. al. reach similar results and extend the analysis to nutritional status.

VI. CONCLUSIONS AND IMPLICATIONS FOR TRANSFORMATION AND DEVELOPMENT

In the coming decades, Sub-Saharan Africa could see a major humanitarian crisis. Extrapolations of recent trends in population growth and agricultural productivity suggest sharply declining food self-sufficiency and possibly even "a slow march to starvation."[8] Large increases in the working-age population threaten to increase poverty and underemployment. Lowered population growth and higher agricultural productivity are both needed to avert impending disaster. If a way can be found to bring about substantial increases in small farm productivity, the crisis may be avoided and beneficial multiplier effects could accrue to the rural economy.

Growth is happening but transformation is not. Although economic growth has resumed in the past 20 years in many SSA countries, and several positive signs of change have emerged, the kind of far-reaching economic transformation that accompanied long-term economic development in other world regions is not yet apparent. To avert catastrophe over the coming decades, SSA must undergo radical economic transformation. Its economic future must be very different from its past. At the macro-economic level, the relative importance of the agricultural sector in both GDP and employment must decline sharply while the corresponding shares of manufacturing, construction, and high-value services rise.

Transformation is critical to averting significant food shortages. Yet it will be a long time before SSA's economic structure is so radically transformed. What happens in agriculture and the rural economy more generally will continue to be of great importance for decades to come. Agriculture must grow to feed the rising population, earn foreign exchange, provide labor to expand employment in the industrial and service sectors, and provide a market for growing manufacturing output. To do these things, the agriculture sector itself must be transformed. Agricultural technology must be modernized, commercialization increased, and non-agricultural rural activities made more productive so they can provide a rising share of income for rural households.

How can transformation be promoted? What does the research reviewed here tell us about the prospects for achieving these forms of transformation? How can they be promoted? And what is the role of the multiplier in bringing about the necessary changes? These are big questions and it would be naïve to expect that a review of the literature, however extensive and probing, would provide definitive answers. This literature review does, however, bring out several salient points.

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[8] A phase attributed to Thom Jayne.

In low-income countries like most of those in SSA, development can be described as agriculture-based. Agriculture's contributions to development are enhanced by the multiplier effect. Studies using varied methodologies have placed the average value of the multiplier in SSA around 1.5. That is, a $1 increase in agricultural income—brought on, say, by an investment or technical change—can raise national (or in some studies non-farm rural) income by $1.50. Boosting demand through successive rounds of spending is the most important multiplier mechanism but supply-side mechanisms including linkages and spillovers are also important.

Empirical analyses of agricultural development and poverty reduction generally find a strong positive relationship between the two. Most of the poverty in low-income countries is located in rural areas. Poor rural households rely heavily on agriculture, although they engage in a variety of non-agricultural economic activities to an extent unsuspected until recently and also in many cases receive remittances. Specifically, research shows that rising output per unit of labor in agriculture is closely related to declines in the incidence of poverty.

The existence of the multiplier effect strengthens the case for investing in agriculture and removing urban bias from government policies. It is important to realize, however, that much of its power arises from market imperfections and the presence of underutilized resources. As economies become better integrated and markets improve, the value of the demand-side portion of the multiplier will probably decline. However, supply-side mechanisms such as linkages and spillovers will still be important. In the longer run, therefore, attention to these positive externalities is likely to be the major policy implication of the multiplier effect. Realizing this potential will require improvements in features of the commercial environment for agriculture and the industries to which it is linked, including better communications, improved ways of doing business, and heightened trust among participants in commercial transactions. It will also require strengthened linkages between farmers and global value chains as well as domestic and foreign investors.

The agenda for agricultural development is large and challenging, involving investments in agricultural research, extension, and higher education, as well as large outlays for irrigation and rural physical infrastructure and the development of financial systems. Mellor, the World Bank, and others advocate greater attention to tradable (export-oriented) agricultural products, which can make significant contributions to poverty alleviation when there is broad-based participation by small farmers. This contribution is boosted when labor-intensive production methods are used and linkages are formed with staple crop production.

We have seen that the multiplier has three components: an initial stimulus to income growth, a transmission mechanism, and a final impact. Findings of this literature review have implications for all three components.

Initial income stimulus: The multiplier effect begins with some type of stimulus that boosts producer income and may at the same time expand productive capacity. In the spirit of Keynes's remark about hiring some workers to dig holes and others to fill them up again, the initial stimulus could be a simple income transfer to agricultural producers. As in the 1930s, however, far more productive types of stimulus are possible. In several Asian countries, a technological revolution in the production of rice and other grains that dramatically increased per hectare yields was the initiating force. Research to develop varieties that give higher yields in African conditions has been underway for several years. Judging whether anything comparable to Asia's Green Revolution is achievable in SSA is beyond the

capacity of this paper. Some authorities argue that such a goal is feasible, while others will remain skeptical until more evidence is gathered.[9]

A different kind of policy to raise yields would be to deal somehow with the problem of urban and local elites acquiring arable land and then underutilizing it. Developed countries address this kind of problem through land taxation that encourages landowners to use their holdings productively.

In addition to boosting yields per hectare, agricultural production can also be increased by bringing more land into cultivation. Jayne et. al. point to several obstacles to this kind of change, but given the severity of SSA's food problem, serious efforts to overcome these challenges appear warranted.

Investment is the other important form of stimulus for the multiplier effect. Investment can be private or public and can take the form of directly productive facilities or supportive infrastructure. Three types of investment seem particularly pertinent.

First, all accounts of agricultural development in SSA stress the inhibiting effect of poor public infrastructure—particularly roads, power, irrigation, and extension services. Far more investment in rural infrastructure is clearly needed to raise physical and financial returns to agriculture and institute a multiplier effect.

Second, private investment can raise local incomes, both directly and indirectly through linkages and spillovers. Investors should be encouraged to give more emphasis to such positive externalities. Commercial agriculture can be an efficient way to grow export crops and some food crops, and it does create employment, but it typically uses land less intensively than small-scale farming and has fewer linkages and a weaker impact on rural poverty. When permitted, commercial agriculture should be encouraged to provide linkages and spillovers to local farmers and entrepreneurs.

Third, far greater investment in human capital through health and education programs is needed, not only to raise worker productivity in agriculture and other rural pursuits, but also to prepare youth for productive participation in the urban economy.

Transmission mechanisms: The classic multiplier works through aggregate demand, and studies have shown that most of the multiplier effect created by agricultural development in SSA is transmitted in this way. The strength of the transmission of demand through successive rounds of spending depends on how much impact is lost through leakages. If producer incomes are boosted by any of the stimuli just discussed, the important question is what is done with the added income. Savings, added tax payments, and spending on imported goods and services are the possible forms of leakage. In terms of impact on the rural economy, where most poverty is concentrated, expenditure on goods and services purchased from cities counts as a leakage. The most favorable situation is when demand is directed toward non-tradable goods and services produced locally. It is unclear what can be done

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[9] Pedro A. Sanchez of The Earth Institute, Columbia University, wrote in *Nature Geoscience* in 2010 that "the goal of an African green revolution can be quantified as increasing cereal grain yields from one to three tons per hectare by 2020, primarily through the use of mineral and organic fertilizers and high-yielding crop cultivars, and by empowering farmers with the latest agronomic knowledge and enabling them to sell their produce profitably. Proof that a green revolution can be achieved in Africa is evident on two scales: in the 80 Millennium Villages spread throughout tropical Africa, and in one entire country." Malawi, according to Sanchez, was the first African country to implement a green revolution strategy on a national scale. The Earth Institute is a sponsor of the Millennium Villages project. No rigorous evaluation of the project has been undertaken.

to channel more of the increased demand in this direction. In fact, if transportation improves access to goods produced in urban areas or imported from abroad, the improvements are likely to divert consumer expenditure away from local purchases. Yet improved transportation can also significantly increase opportunities for non-agricultural earnings by rural households.[10]

Final impact: Initiated by one or more of the stimuli just discussed, and transmitted through both demand- and supply-side mechanisms, the multiplier effect can help to raise income levels in rural SSA. It can also contribute to easing the already massive employment challenge, which will intensify as the working-age population grows. If ways can be found to increase the dynamism of the agricultural sector, the multiplier mechanism can strengthen the "pull" effect on rural non-agricultural enterprise.

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[10] In densely populated Java, Indonesia, where land holdings are very small and rural families rely heavily on income from non-agricultural sources, public investment in road improvement was complemented by private investment in low-cost vehicles (a so-called "Colt Revolution") that were used to move goods and services from rural areas to more lucrative urban markets. This made a large contribution to alleviating rural poverty.

VII. PROGRAMMATIC IMPLICATIONS

HOW TO ACHIEVE AN INCOME STIMULUS

Focus on countries and regions with more favorable agricultural potential. Much land in SSA is poorly suited for agricultural development. Future production increases can be expected to come primarily from the higher-potential areas.

Promote three types of investment.
- *Investment in public infrastructure.* All accounts of agricultural development in SSA stress the inhibiting effects of poor public infrastructure—particularly roads, power, irrigation, communication, and extension services. Far more investment in rural infrastructure, especially in the high-potential areas, is clearly needed to raise physical and financial returns to agriculture and institute a multiplier effect.
- *Private investment.* Private investment can raise local incomes, both directly and indirectly through linkages and spillovers. Investors should be encouraged to give more emphasis to such positive externalities. Commercial agriculture can be an efficient way to grow export crops and some food crops, and it does create employment, but it typically uses land less intensively than small-scale farming and has fewer linkages and a weaker impact on rural poverty. When permitted, commercial agriculture should be encouraged to provide linkages and spillovers to local farmers and entrepreneurs. Private investment in rural non-agricultural activities will also have multiplier effects through both demand and supply mechanisms, and thus should be encouraged. In general, private investment in SSA economies has been very limited, a problem that warrants more attention to investment incentives.
- *Investment in human capital.* Far greater investment in human capital through health, education, workforce development, and entrepreneurship programs is needed, not only to raise worker productivity in agriculture and other rural pursuits, but also to prepare youth for productive participation in the urban economy.

Address unequal land distribution and low-intensity farming. A different kind of policy to raise yields would be to find a way to deal with the problem of urban and local elites acquiring arable land and then underutilizing it. Developed countries address this kind of problem through land taxation that encourages landowners to use their holdings productively.

Find ways to bring more land, suitable for agricultural production, into cultivation. In addition to boosting yields per hectare, agricultural production can also be increased by opening more land to cultivation. Jayne et. al. point to several obstacles to this kind of change, but given the severity of SSA's food problem, serious efforts to overcome these challenges appear warranted.

Go beyond the analysis in this paper to deal with other important issues:
- Which commodities or combination of commodities will have greatest impact on poverty, the multiplier, and ultimately transformation? Which non-tradables should be promoted?
- Which countries and regions have the highest agricultural potential?

- What are the specific under-utilized resources in Africa that can be mobilized?
- How can donors invest most effectively in non-agricultural and agricultural sectors? Which investments would have the greatest impact on poverty, the multiplier, and ultimately transformation?
- What linkages are most effective in amplifying the multiplier?
- How important are rural non-farm enterprises to poverty reduction, the multiplier, and ultimately transformation?

HOW TO STIMULATE TRANSMISSION MECHANISMS

Encourage consumption of local products and services. When producer incomes are boosted by any of the stimuli, the next question is what is done with the added income. The most favorable situation is when demand is directed toward non-tradable goods and services produced locally. We have seen that an average multiplier value of 1.5 implies that a relatively small share of additional income is so directed at present. It is unclear what can be done to channel more of the increased demand toward local products. In fact, if transportation improves access to goods produced in urban areas or imported from abroad, the improvements are likely to divert consumer expenditure away from local purchases. Yet improved transportation can also significantly increase opportunities for non-agricultural earnings by rural households.[11]

HOW TO STIMULATE FINAL IMPACT

Increasing the stimuli of investment and technological change in agriculture and if possible strengthening the multiplier will produce a larger final impact for African economies. Investment in agriculture and the rural sector can contribute greatly to the economic transformation that SSA needs to avert a population-food crisis. Complementary actions will also be required. Integration into the global economy and increased exports of labor-intensive products, both agricultural (including traditional cash crops) and manufactured, are key to the transformation that is needed. New business models and more competitive marketing channels will be required to achieve this objective.

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[11] In densely populated Java, Indonesia, where land holdings are very small and rural families rely heavily on income from non-agricultural sources, public investment in road improvement was complemented by private investment in low-cost vehicles (a so-called "Colt Revolution") that were used to move goods and services from rural areas to more lucrative urban markets. This made a large contribution to alleviating rural poverty.

APPENDIX: LITERATURE ON MULTIPLIER AND AGRICULTURAL DEVELOPMENT

In the early 1980s, researchers began to draw on the linkage ideas suggested by the literature and apply the multiplier concept to studies of the Green Revolution in Asia. Rangarajan (1982) built a model that suggested that a 1% increase in agricultural income in India would lead to a 1.5% increase in industrial output and a 1.7% increase in overall national income. Bell and Hazell (1980) and Bell, Hazell, and Slade (1982) developed semi-input-output models to analyze the effect of the Muda River irrigation project in Malaysia on the local non-agricultural economy. They estimated that for every $1 of income generated by intensified rice production, an additional $0.80 of non-agricultural income would be realized through indirect spending linkages. Haggblade, Hammer, and Hazell (1991) reviewed these studies and questioned their assumption that the supply of non-tradable goods is perfectly elastic, with output constrained only by demand. Hazell and Haggblade (1990) used a cross-section econometric analysis to recalculate the multiplier in India. They found that on average for all of India, 100 rupees of additional income from agriculture generates 64 additional rupees of income in non-agricultural activities.

After reviewing estimates made for Asia, Haggblade, Hazell, and Brown (1989) applied a model that Hazell had developed for Asia to African data and found an average multiplier value of about 1.5, slightly lower than earlier findings for Asia. They conceded that the limited availability of data on rural consumption patterns restricted the confidence that could be placed in their estimates but felt justified to conclude that the existence of a multiplier effect in African agriculture showed that agricultural growth was essential for rural development.

Haggblade, Hammer, and Hazell (1991) made a major methodological contribution. They argued that variations in prior estimates of the multiplier were explained not only by circumstances in the areas studied but also by the models used to make the estimates. Claiming that estimates that relied on social accounting matrices[12] overstated the value of the multiplier by 10-25%, they introduced a model that allowed for endogenous price adjustments.

A USAID-sponsored study by Block and Timmer (1994) estimated multipliers for agricultural and non-agricultural income growth in Kenya. This study found that $1 worth of agricultural growth produced $0.63 worth of growth in the rest of the economy. Conversely, $1 worth of growth outside agriculture produced only $0.23 worth of growth in agriculture. The difference provided a rationale for emphasizing agricultural development in Kenya. A major contribution of this paper was to broaden

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[12] "A social accounting matrix (SAM) represents flows of all economic transactions that take place within an economy (regional or national). It is at the core, a matrix representation of the national accounts for a given country, but can be extended to include non-national accounting flows, and created for whole regions or areas. SAMs refer to a single year providing a static picture of the economy." (Wikipedia)

the conceptual model of the multiplier by adding "Timmer linkages" to the earlier "Lewis linkages" and "Johnston-Mellor linkages."[13]

According to this analysis, multipliers work through three types of linkage (Block and Timmer 1994, pp. 2-15 to 2-18):

- "Lewis linkages" speed factor accumulation for industrial growth, provided that the industrial sector has higher productivity than the agricultural sector; if this is not the case, the resource transfer cannot be a source of growth.
- "Johnston-Mellor linkages" "allow a set of market-mediated, input-output interactions between the two sectors based on agriculture supplying raw materials to industry, food for industrial workers, markets for industrial output, and the foreign exchange needed to import capital goods." They cannot be a source of growth if all input and output markets function perfectly;[14] market bottlenecks or constraints are needed for these linkages to stimulate faster growth in the non-agricultural economy as agricultural productivity rises. [This does not seem a difficult condition to satisfy in a developing economy.]
- In addition to these linkages, which are postulated in most studies, additional "Timmer linkages" could also be important contributors to the multiplier effect. These linkages, which "are driven explicitly by the types of externalities and market failures that provide the analytical rationale for endogenous growth theory," are "somewhat nebulous and hard to measure." They include:
  - Learning by doing by both governments and firms;
  - Improved food security and political stability;
  - Greater efficiency in decision making as rural enterprises claim a larger share of output;
  - Higher productivity of industrial capital as urban bias is reduced; and
  - Higher productivity of labor as nutritional standards improve.

In a major study, Delgado and associates (1994; 1998) recalculated the multiplier in African agriculture using data on rural consumption and incomes collected by IFPRI (the International Food Policy Research Institute) and collaborating national bodies in Burkina Faso, Niger, Senegal, Zambia, and Zimbabwe during the mid to late 1980s. Their results

> "suggest that household spending of higher rural incomes from increased exports has the potential to greatly stimulate further rural income increases, on a scale that even surpasses experience in Asia. Central to this is the claim that many of the goods and services that figure heavily in rural consumption patterns in Sub-Saharan Africa are non-tradables at current transport costs and prices. These include perishable fruits, vegetables, animal products, and prepared foods, services of all kinds, local handicrafts, and some bulky local starches of too low value to bear the cost of importing or exporting." (Delgado el al. 1998, p. vii)

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[13] These terms refer to the classic analyses of W. Arthur Lewis (1954) and Bruce Johnston and John Mellor (1961).

[14] Bigsten and Collier (1995) pointed this out, arguing that Kenyan agriculture had large pecuniary linkages but much smaller real ones. "Perfect markets" are a construct of economic theory that assumes economically rational behavior, perfect competition, a free flow of information, non-intervention by governments, no barriers to entry or exit, and no externalities.

The extent of non-tradable goods and services in rural consumption patterns is important for multiplier estimates because, unlike tradable goods that can be imported or exported, the demand for non-tradables can only be satisfied locally. Increased demand therefore raises the incomes of those who supply these goods and services. Their high estimate of the role that non-tradables played in local consumption led Delgado et. al. to calculate very high values for the multiplier in the countries they studied.

> "Overall, the report finds that adding US$1.00 of new farm income potentially increases total income in the local economy—beyond the initial $1.00—by an additional $1.88 in Burkina Faso, by $1.48 in Zambia, by $1.24 to $1.48 in two locations in Senegal, and by $0.96 in Niger." (Delgado et. al. 1998 p. xii)

These are higher values than other researchers have obtained. The authors concede that:

> "Given the methodology used, these are upper bounds of the potential gains. Actual gains may be as much as 30% less, due to possible rigidities in the supply responsiveness of non-tradables to price rises under African conditions. Even so, the results are substantial, suggesting that $1.00 of initial growth in rural agricultural incomes leads to an additional $1.00 on average of income from production of rural non-tradables. This implies that the overall benefit of finding a way to boost rural incomes (from additional exports, say) on the supply side is probably twice as high as the immediate return from the activity that was promoted in the first place." (*Ibid.*)

De Janvry (1994) criticized their formulation for relying on the questionable assumption that most food items are non-tradable as a consequence of low market integration and low substitutability between domestic and imported foods. He suggested estimating a multimarket model and emphasized the need to simultaneously raise the production of tradables and increase the supply elasticity of non-tradables.

Dorosh and Haggblade (2003) provide additional multiplier estimates for eight countries in SSA. Using both SAM and computable general equilibrium (CGE)[15] methodologies, they measured the indirect effects of investment-induced growth, finding them to be nearly as large as the direct effects. The authors comment that:

> "These second round linkage effects occur because of the existence of underutilized resources, particularly unskilled labor, which is made more productive as increased effective demand for goods and services translates into greater labor demand and utilization. The scale of these linkage effects suggests that in evaluating investment opportunities, policymakers will need to consider not only direct effects of the investment, but also indirect linkages stimulated in other sectors of the economy."

The Dorosh-Haggblade study found variations in the size of the multiplier that provide insights into both causal factors and effects. In small, open economies like Lesotho, increased demand led to

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[15] "A CGE model consists of (a) equations describing model variables and (b) a database (usually very detailed) consistent with the model equations. The equations tend to be neo-classical in spirit, often assuming cost-minimizing behavior by producers, average-cost pricing, and household demands based on optimizing behavior. However, most CGE models conform only loosely to the theoretical general equilibrium paradigm." (Wikipedia)

greater net imports instead of substantial increases in production. Where non-tradable goods and services were more important (as in Cameroon, Nigeria, and Tanzania) the multiplier was larger.

Although Dorosh and Haggblade found that while investments in food crops, export crops, and manufacturing produced similar multipliers, investments in agriculture benefit the poor more than non-agricultural investments. While the rural poor benefit directly from agricultural growth, the urban poor also benefit indirectly through lower food prices.

Haggblade, Hazell, and Dorosh (2007) considered growth linkages between agriculture and the rural non-farm economy through a global cross-section study. Comparing SSA to other regions, they comment that:

> "Africanist scholars appear generally optimistic that agricultural growth linkages do exist in rural Africa, albeit at levels lower than those found in Asia. Both agricultural specialists and students of the RNFE express confidence in the importance of agricultural stimulus to rural nonfarm activity…Perhaps because of the prevalence of local beer brewing from millet, sorghum, and maize, many observers readily acknowledge that the bulk of rural nonfarm activity is, in fact, agriculturally based. For Africanists, growth linkages clearly exist. The hard question is how to trigger agricultural growth in the first place." (Haggblade et. al. 2007, p. 165)

Based on the full body of research covering all world regions, Haggblade et. al. offer six important generalizations:

- Growth linkages frequently prove substantial. Measures for SSA are lower than those for Asia but higher than those for Latin America. Differences among available estimates "emerge because of differing types of agriculture, economic and social settings, units of analysis, and modeling assumptions…Best guess generalizations probably lie in the range of 1.6 to 1.8 for Asia and 1.3 to 1.5 in African and Latin America." (p. 167)
- Consumption linkages dominate. "A predominance of empirical studies in the developing world suggests that consumer spending accounts for about 80% of agricultural demand linkages, while production linkages account for the remainder…" (pp. 167-168)
- Rural services and commerce account for the majority of rural non-farm linkages. Within the RNFE, manufacturing is vulnerable to competition from urban goods but rural services such as housing, education, transport, health, and personal services are largely insulated from outside competition and grow briskly in response to increased demand.
- Labor market linkages strongly influence the growth and composition of the RNFE. But their impact is ambiguous because while some forms of employment grow, others (e.g., low-wage activities such as basket-weaving and pottery-making) tend to decline.
- Capital flows are important, though imperfectly understood. It is unclear whether capital tends to flow from agriculture to the RNFE, or vice versa.
- Productivity linkages are probably important but largely unmeasured. "The large body of microeconomic literature linking food prices, nutrition, human learning, and productivity provides the strongest available evidence of these productivity linkages. Given growing concern about poverty, this feature of agricultural growth linkages will require further work." (p. 169)

Haggblade et. al. also provide important observations on conditioners of agricultural growth multipliers. First, it matters who receives the initial income shock. This impinges on debates about which kinds of farmers should be the main focus of development efforts. The authors conclude by saying that "resident farmers who consume and send their children to school in rural areas generate the largest rural nonfarm consumption linkages." (p. 169)

The second issue concerns the supply response of rural nonfarm producers. This depends on several factors:

- The distribution of needed entrepreneurial and technical skills across locations. Ethnicity, caste, historical specialization, and features of the local educational system all play a role here, as do the distribution of political power, social capital, and the degree of trust across ethnic groups.
- The quality of rural infrastructure and the degree of integration and openness of the rural economy matter a lot.
- Population density and distribution govern the cost, profitability, and minimum effective scale of rural production. In general, higher population density favors local production.
- Aspects of the policy environment, such as taxation, interest rates, and labor regulation, all influence the size and location of nonfarm activity.
- Per capita income affects the demand for different non-food consumption items. Richer regions typically have more demand for high-value and processed foods as well as non-food items. (p. 171)

All these factors influence the value of the multiplier found in various studies.

A recent World Bank study (Farole and Winkler 2014) provides an in-depth examination of spillovers from foreign direct investment (FDI) in SSA. It gives no quantitative estimates but concludes that while FDI can lead to restructuring of whole industries and create opportunities for better-performing local firms over time, in the short run spillovers from FDI are not necessarily positive. The willingness and capacity of foreign firms to support spillovers varies hugely across sector and firms. Linkages between foreign and domestic firms, especially local sourcing, can become channels through which knowledge and technology are transferred. However, many of the flaws in the business operating environment that constrain the growth of local firms also block greater linkages from being achieved. These barriers include inadequate infrastructure, low-quality and high-cost utilities, regulatory barriers, and lack of access to affordable finance. Global value chains offer expanded opportunities to attract FDI but can actually raise greater barriers to spillovers, depending on the structure of value chain governance.

This report deals primarily with spillovers to local industrial and service enterprises, but it includes a sector study on agribusiness. It finds that investment in the agribusiness global value chain offers a significant opportunity to raise productivity levels by adopting new knowledge, technology, and techniques, from farming through processing and manufacturing.

> "Overall, the level of supply chain, labor market, and other network linkages between foreign investors and the local economies are relatively higher in agriculture than in other value chains, driven by the fundamental requirement of sourcing domestic agricultural inputs. Yet significant differences exist across countries, particularly in the processing and manufactur-

ing stages of the chain…The increasing importance of global standards and certification appears to be a major catalyst for supporting knowledge transfer between foreign firms and domestic actors. Efforts to promote spillovers, particularly through input provision, financing, and technical support, are extensive throughout most countries. These include efforts that are government driven, foreign direct investment driven, and multi-stakeholder—many good sector-specific models appear to be available. However, their sustainability is less certain, underscoring the importance of complementary and crosscutting policies to improve skills and address supply-side constraints to competitiveness in the sector. " (Farole and Winkler 2014, p. 163)

The matrix below summarizes the main characteristics and conclusions of the studies reviewed in this appendix.

MATRIX OF MULTIPLIER STUDIES: ESTIMATES AND SURVEYS

STUDY	ESTIMATES		METHOD	CAUSAL MECHANISMS	ENVIRON-MENTAL VARIATIONS	POLICY IMPLI-CATIONS
	CITED	MADE				
Haggblade, Hazell & Brown (1989) (SSA)	Asian studies; earlier Hazell estimates; lower Rogers estimate for Africa	Around 1.5 (about 60% of Asia)	Hazell model from Asia; limited data on rural consumption patterns	Capital flows; labor flows; production linkages; consumption links	Sierra Leone lower than Nigeria because of smaller industrial sector	Ag. growth essential for rural development
Haggblade, Hammer & Hazell (1991) (global)	Prior estimates vary widely, partly because fixed price models use differing assumptions	Finds prior estimates overstate by 10-25%	Introduces price-endogenous model			
Block & Timmer (1994) (Kenya)		In Kenya, $1 of ag. growth generates $0.63 outside ag.; $1 of non-ag. growth generates only $0.23 outside non-ag.	Expanded conceptual model	Adds non-market-based inter-sectoral linkages to market-based linkages studied earlier		
Delgado, Hazell, Hokins & Kelly (1994) (SSA)		Estimates for Burkina Faso, Niger, Senegal & Zambia	Uses household budget data collected by IFPRI	Stresses demand-side linkages	Estimates similar multipliers for increased income from tradables & non-tradables	Tradables must lead agricultural development

De Janvry (1994) (SSA)	Criticizes estimates by Delgado et. al.					Need to raise production of tradables *and* increase supply elasticity of non-tradables
Delgado, Hopkins & Kelly (1998) (SSA)	Says past estimates under-allowed for non-tradables	New estimate gives higher multiplier; actual gains could be up to 30% less due to rigidities in supply response of non-tradables in African conditions; even so, overall benefit of boosting rural incomes (e.g. from exports) is probably twice the original increase	Same as above		$1 of new farm income generates $1.80 additional income in Burkina Faso, $1.48 in Zambia, $1.24-1.48 in Senegal & $0.96 in Niger	Does not discuss, but notes new external funds needed (e.g. from ag. exports)
Irz, Lin, Thirtle & Wiggins (2001) (global)	Reviews estimates by Haggblade, Delgado et. al.; notes criticism			Catalogs consequences of ag. growth		Linkages give ag. strong potential to reduce poverty
Dorosh & Haggblade (2003) (SSA)		Measures investment-led growth in 8 countries; average multiplier 2	Uses semi-input-output & CGE models; multipli-	Main driver is increased use of unskilled labor	Multiplier weaker in small open economies like Lesotho; larger non-tradable sectors	Investment appraisal should include indirect benefits

		with most benefit going to the poor	ers large regardless of methodology		produce larger multipliers in Cameroon, Nigeria & Tanzania	
Dorosh, Niazi & Nazli (2003) (Pakistan)		3.9% ag. growth would boost rural non-farm income by only 2.9%, implying per capita income growth of less than 1%	Uses SAM-based SIO model	Skewed land ownership kept landless laborers from benefiting from ag. growth		Added measures needed to reduce poverty, e..g. livestock development, expansion of rural non-farm economy; targeted interventions for poor rural households
Tacoli (2004) (global)		Qualitative discussion with no estimates		Strength of rural-urban linkages is determined by the nature of economic, social & cultural transformations at the global, national & local levels		
Diao, Hazell, Resnick & Thurlow (2007) (SSA)	Discusses past measures of intersectoral linkages; says consumption linkages strongest; even in open economies, ag. has stronger linkages	Analyzes Ethiopia, Ghana, Rawanda, Uganda & Zambia in depth; says ag. dev. Involving smallholders important de-	Uses CGE models to measure contributions of ag.		Includes typology of nations based on stage of dev., ag. conditions, natural resources & location	To help farmers escape poverty, need improved infrastructure & education, distribution of key technologies & inputs & promotion of producer & marketing

	than non-ag. because of non-tradable goods & imperfect substitutability of domestic & imported goods; discusses ag. impact on rural dev., family vs. commercial farms	spite recent skepticism; no multiplier estimates				organizations that link farmers to markets; says "hands off" approach ignores market & institutional failures
Haggblade, Hazell & Dorosh (2007) (global)		Discusses linkages between ag. & rural nonfarm economy" consumption, factor market, productivity & reverse linkages	Discusses pros & cons of different models		Compared to other regions, Africa specialists believe in linkages (perhaps because of prevalence of local beer brewing); problem is how to accelerate ag. growth	Ag. growth should target farmers who shop in rural areas; rural infrastructure enhances linkages; ag. growth requires concerted effort
Schneider & Gugerty (2011) (global)	Literature review of ag. productivity & poverty; discusses multipliers					
[Gray] (2013) (Ethiopia)	Some past analyses produced ambiguous results	Analyzes "push/pull hypothesis" that ag. growth will improve the welfare of poor households by raising	Uses economic analysis + focus group discussions		Looks at fast-growing & lagging ag. growth environments	Long list of recom-mendations

		demand for goods, labor & services; concludes targets based on unrealistic assumptions				
Farole & Thomas (2014) (SSA)		Spillovers from FDI generally modest	Mixed comparative analysis	Spillovers depend on investors & local agents, take 3 channels: supply chains; labor markets; competition, demonstration & collaboration effects. Kenya, Lesotho & Swaziland have FDI strategies that severely limit spillovers		Suggests roles for investors, governments & local private sector to promote linkages & spillovers

BIBLIOGRAPHY

Adelman, Irma (1984). "Beyond Export-led Growth." *World Development.*

Africa Progress Panel (2014). *Grain, Fish, Money. Financing Africa's Green and Blue Revolutions.*

Atwood, David A. (2012). "Can an FTF Focus on Smallholder Farmers Achieve Transformational Growth and Change?" June 7. Early draft – not for distribution.

Barrett, Christopher B., Thomas Reardon, and Patrick Webb (2001). "Nonfarm Income Distribution and Household Livelihood Strategies in Rural Africa:Concepts, Dynamics, and Policy Implications." *Food Policy* 26/4: 315-331

Bell, C. L. G. and P. B. R. Hazell (1980). "Measuring the Indirect Effects of an Agricultural Investment Project on its Surrounding Region." *American Journal of Agricultural Economics* 62 (February).

Bell, C. L. G., P. B. R. Hazell, and R. Slade (1983). *Project Evaluation in Regional Perspective.* Baltimore: Johns Hopkins University Press.

Benjamin, Nancy, Stephen Golub, and Ahmadou Aly Mbaye. "Informality, Regional Integration, and Smuggling in West Africa." World Trade Organization.

Bigsten, Arne and Paul Collier (1995). "Linkages from Agricultural Growth in Kenya." In J. W. Mellor (ed). *Agriculture on the Road to Industrialization.*

Block, Steven and C. Peter Timmer (1994). "Agriculture and Economic Growth: Conceptual Issues and the Kenyan Experience." Development Discussion Paper No. 408, Harvard Institute for International Development. November.

Christiaensen, Luc, Lionel Demery, and Jesper Kuhl (2010). "The (Evolving) Role of Agriculture in Poverty Reduction. An Empirical Perspective." Working Paper No. 2010/36. UN-WIDER.

Collier, Paul and Stefan Dercon (2009). "African Agriculture in 50 Years: Smallholders in a Rapidly Changing World?" Paper submitted to Expert Meeting on How to Feed the World in 2050. FAO.

de Janvry, Alain (1994). "Farm-Nonfarm Synergies in Africa: Discussion." *American Journal of Agricultural Economics* 78:5.

de Janvry, Alain and Elisabeth Sadoulet (2009). "Agricultural Growth and Poverty Reduction: Additional Evidence." *World Bank Economic Observer.*

Delgado, Christopher L., Peter Hazell, Jane Hopkins, and Valerie Kelly (1994). "Promoting Intersectoral Growth Linkage in Rural Africa through Agricultural Technology and Policy Reform." *American Journal of Agricultural Economics* 78:5.

Delgado, Christopher L., Jane Hopkins, and Valerie A. Kelly (1998). "Agricultural Linkages in Sub-Saharan Africa." Research Report 107/ International Food Policy Research Institute.

Diao, Xinshen, Peter Hazell, Danielle Resnick, and James Thurlow (2007). "The Role of Agriculture in Development. Implications for Sub-Saharan Africa." Research Report 153. International Food Policy Research Institute.

Donor Committee for Enterprise Development (2014). "Latest Research & Evidence on PSD." May.

Dorosh, Paul A. and Steven Haggblade (2003). "Growth linkages, Price Effects and Income Distribution in Sub-Saharan Africa." *Journal of African Economies* 12: 2.

Dorosh, Paul A., Mohammed Khan Niazi, and Hina Nazli (2003). "Distributional Effects of Agricultural Growth in Pakistan: A Multiplier Analysis." *Pakistan Development Review* 42:3. Autumn.

Dorosh, Paul A. and James Thurlow (2012). "Can Cities or Towns Drive African Development? Economy-wide Analysis for Ethiopia and Uganda." Working Paper No. 2012/50. UNU-WIDER.

Dorosh, Paul A. and John W. Mellor. (2013) "Why Agriculture Remains a Viable Means of Poverty Reduction in Sub-Saharan Africa: The Case of Ethiopia." *Development Policy Review* 31:4.

Ellis, Frank (2005). "Small Farms, Livelihood Diversification, and Rural-Urban Transitions: Strategic Issues in Sub-Saharan Africa." Paper presented at Research Workshop "The Future of Small Farms," Wye, UK (June 26-29).

Fan, Shenggeng, Joanna Brzeska, Michiel Keyzer, and Alex Halsema (2013). "From Subsistence to Profit. Transforming Smallholder Farms." Food Policy Report. IFPRI.

Farole, Thomas and Deborah Winkler (eds.) (2014). *Making Foreign Direct Investment Work for Sub-Saharan Africa. Local Spillovers and Competitiveness in Global Value Chains.* Washington: World Bank.

Gebreselassie, Samuel (2006). "Intensification of Smallholder Agriculture in Ethiopia: Options and Scanarios." Draft paper prepared fro the Future Agricultures Consortium Meeting at the Institute of Development Studies 20-22 March.

Golub, Stephen and Faraz Hayat (2014). "Employment, Unemployment, and Underemployment in Africa." WIDER Working Paper 2014/014. World Institute for Development Economics Research. January.

Gray, George (n.d.). "Assessment of the Push/Pull Hypothesis." Draft Report for USAID.

Haggblade, Steven, Peter Hazell, and James Brown (1989). "Farm-Nonfarm Linkages in Rural Sub-Saharan Africa." *World Development* 17:8.

Haggblade, Steven, Jeffrey Hammer, and Peter Hazell (1991). "Modeling Agricultural Growth Multipliers." *American Journal of Agricultural Economics* 73:2.

Haggblade, Steven, Peter Hazell, and Thomas Reardon (2005). The Rural Nonfarm Economy: Pathway Out of Poverty or Pathway In?" Paper presented at Research Workshop "The Future of Small Farms," Wye, UK (June 26-29).

Haggblade, Steven, Peter Hazell, and Paul Dorosh (2007). "Sectoral Growth Linkages between Agriculture and the Rural Nonfarm Economy." In S. Haggblade, P. Hazell and T. Reardon (eds), *Transforming the Rural Nonfarm Economy- Opportunities and Threats in the Developing World.* Baltimore: The Johns Hopkins University Press.

Hazell, Peter and A. Roell (1983). "Rural Growth Linkages: Household Expenditure Patterns in Malaysia and Nigeria." Research Report 41. Washington: IFPRI.

Hazell, Peter and S. Haggblade (1990). "Rural-urban Growth Linkages in India." Working Paper No. 430. Washington: World Bank.

Hazell, Peter and Xinshen Diao (2005). "The Role of Agriculture in Economic Development." Paper presented at Research Workshop "The Future of Small Farms," Wye, UK (June 26-29).

Hirschman, Albert (1958). *The Strategy of Economic Development*. New Haven: Yale University Press.

Irz, Xavier, Lin Lin, Colin Thirtle, and Steve Wiggins (2001). "Agricultural Productivity Growth and Poverty Alleviation." *Development Policy Review*, 19(4), 449-466.

Jayne, T.S., Jordan Chamberlin, and Derek Headly (n.d.). "Land Pressures, Agricultural Intensification and Structural Transformation in Africa." *Food Policy.*

Jayne, T. S., D. Mather, and E. Mghenyi (2005). " Smallholder Farming in Difficult Circumstances: Policy Issues for Africva." Paper presented at Research Workshop "The Future of Small Farms," Wye, UK (June 26-29).

Jayne, T. S., Antony Chapato, and Jordan Chamberlin (2011). "Strengthening Staple Food Markets in Eastern and Southern Africa: Toward an Integrated Approach for CAADP Investment Plans." Policy Synthesis Number 89 for Cooperating USAID Offices and Country Missions. September.

Jayne, T.S., Jordan Chamberlin, and Milu Muyanga (2012). "Emerging Land Issues in Africa: Implications for Food Security and Poverty Reduction Strategies." Paper submitted to Stanford Symposium Series on Global Food Policy ad Food Security in the 21st Century. January.

Jayne, T.S., A. Chapoto, N. Sitko, M. Mayanga, C. Nkonde, and J. Chamberlin (2014). "Africa's Changing Farm Structure and Employment Challenge. " Policy Synthesis Number 91 for Cooperating USAID Offices and Country Missions. April.

Jayne, T. S., Jordan Chamberlin, and Derek Headly (2014). "Land Pressures, the Evolution of Farming Systems, and Development Strategies in Africa: A Synthesis." Draft.

Jayne, T.S., Antony Chapoto, Nicholas Sitko, Chewe Nkonde, Milu Muyanga, and Jordan Chamberlin (2014). "Is the Scramble for Land in Africa Foreclosing a Smallholder Expansion Strategy?" Article submitted to the *Journal of International Studies*, Spring issue on Food Security.

Johnston, Bruce F. and John W. Mellor (1961). "The Role of Agriculture in Economic Development." *American Economic Review.*

Lewis, W. Arthur (1954). "Economic Development with Unlimited Supplies of Labor." *Manchester School.*

Lin Lin , Victoria McKenzie , Jenifer Piesse and Colin Thirtle (n.d.). "Agricultural Productivity and Poverty in Developing Countries." Extensions to DFID Report No. 7946

Lipton, Michael (2012). "Income from Work: The Food-Population-Resource Crisis in the 'Short Africa'." Leontief Prize Lecture, Tufts University. April.

Masters, William A., Agnes Andersson Djurfeldt, Cornelis De Haan, Peter Hazell, Thomas Jayne, Magnus Jirstrom, and Thomas Reardon (2013). "Urbanization and Farm Size in Asia and Africa: Implications for Food Security and Agricultural Research." *Global Food Security* 2, pp. 156-165.

Masters, Will (2014). "Urbanization and Farm Size in Asia and Africa: Implications for Ag R&D." Presentation to USAID Bureau of Food Security, Office of Agricultural Research and Policy, 3 April. PowerPoint.

Meijerink, Gerdien & Pim Roza (2007). "The Role of Agriculture in Economic Development." Markets, Chains and Sustainable Development Strategy & Policy Paper 4. Wageningen. April.

Mellor, John W. (2001), "Employment Multipliers from Agricultural Growth and Poverty Reduction." *Pakistan Development Review* 40:4. Winter.

Mellor, John W. (2013), "High Rural Population Density in Africa – Agricultural Growth, Poverty Reduction, and the Economic Transformation." Draft for *Food Policy*. October.

Nagler, Paula and Wim Naude (2014). "Non-Farm Entrepreneurship in Rural Africa: Patterns and Determinants." Discussion Paper No 8008. Institute for the Study of Labor (IZA), Bonn. February.

Perkins, Dwight H., Steven Radelet, and David L. Lindauer (2006). *Economics of Development,* 6th edition., Chapter 16. "Agriculture."

Radelet, Steven. 2010. *Emerging Africa. How 17 Countries are Leading the Way.* Washington: Center for Global Development.

Ragarajan, C. (1982). "Agricultural Growth and Industrial Performance in India." Research Report No. 33. Washington: IFPRI.

Ravallion, Martin and Gaurav Datt (1996). "How Important to India's Poor is the Sectoral Composition of Economic Growth?" *World Bank Economic Review* 10:1.

Ravallion, Martin (1999). "When is Growth Pro-poor? Evidence from the Diverse Experiences of India's States." Policy Research Working Paper No. 2263.

Ravallion, Martin and Gaurav Datt (2002). "Why has economic growth been more pro-poor in some states of India than others?" *Journal of Development Economics* 68.

Regional Network of Agricultural Policy Research in East and Southern Africa (ReNAPRI) (2014). "Africa's Changing Farm Structure and Employment Challenge." Policy Brief 1. April.

Rodrik, Dani. 2013. "Africa's Structural Transformation Challenge." *Wall Street Journal,* December 13.

Sanchez, Pedro A. (2010). "Tripling Crop Yields in Africa." *Nature Geoscience* 3.

Schneider, Kate and Mary Kay Gugerty (2011). "Agricultural Productivity and Poverty Reduction: Linkages and Pathways."

Schultz, Theodore (1964). *Transforming Traditional Agriculture.*

Singer, Hans (1979). "Policy Implications of the Lima Target." *Industry and Development.*

Tacoli, Cecelia (2004). "Rural-Urban Linkages and Pro-Poor Agricultural Growth: An Overview." Paper prepared for OECD DAC POVNET Agriculture and Pro-Poor Growth Task Team Helsinki Workshop, 17-18 June.

USAID? (n.d.) "The Potential for Agricultural Transformation to Eradicate Extreme Poverty."

Valdes, Alberto and William Foster (2010). "Reflections on the Role of Agriculture in Pro-Poor Growth." *World Development* 38:10.

Weatherspoon, Dave D. and Thomas Reardon (2003). "The Rise of Supermarkets in Africa: Implications for Agrifood Systems and the Rural Poor." *Development Policy Review* 21/3: 333-355.

Wiggins, Steve (2009). "Can the Smallholder Model Deliver Poverty Reduction and Food Security for a Rapidly Growing Population in Africa?" FAC Working Paper No. 8. July. FAO.

Winterbottom, Robert, Chris Reij, Dennis Garrity, Jerry Glover, Debbie Hellums, Mike McGahuey, and Sara Scherr (2013). "Improving Land and Water Management." Installment 4 of "Creating a Sustainable Food Future." Working Paper. World Resources Institute.

Wise, Timothy A. and Sophia Murphy (2012). *Resolving the Food Crisis: Assessing Global Food Programs since 2007*. Institute for Agriculture and Trade Policy, Tufts University.

Woodhouse, Philip (2009). "Productivity Constraints in African Agriculture." Paper presented to Il Conferencia do IESE: Dinamicoas da Padroes de Acumulacao em Mocambique." Maputo. April.

World Bank (2007). *World Development Report 2008. Agriculture for Development.* Chapters 1 ("Growth and Poverty Reduction in Agriculture's Three Worlds") and 3 "Rural Households and their Pathways out of Poverty"). Washington.