Research Journal of Agriculture
Volume 14, Number 5; May-2023;
ISSN: 2836-6050 | Impact Factor: 6.58
https://zapjournals.com/Journals/index.php/rja/index
Published By: Zendo Academic Publishing

SOWING PROGRESS: UNRAVELING THE INTERPLAY OF AGRICULTURE AND DEVELOPMENT THROUGH LITERARY INSIGHTS

Webb, P. and Reardon, T
Development Economics Department, the World Bank, Washington, DC, United States

Article Info

Keywords: agriculture, development, low-income countries, poverty reduction, food security, global crises, investment

Abstract

The agricultural sector stands as a vital catalyst for development, particularly in low-income nations where it assumes a prominent role in terms of collective income and the overall labor force. Although it was a central concern for developing nations, international donors, and the global community throughout the 1960s and 1970s, agriculture receded from the development spotlight during the 1980s and 1990s, only to reemerge in the early 21st century due to negligence and inadequate investment. Recent revival of interest in addressing sectoral challenges owes much to influential reports such as the World Development Report 2008, "Agriculture for Development" by the World Bank, and "Agriculture at a Crossroads" by the IAASTD. These reports, informed by consultations involving scientists, policymakers, and donor agencies, have reignited global awareness about the plight of the agricultural sector. Amidst concurrent global crises encompassing food scarcity, climate change, and financial instability, donor nations pledged substantial funds for agricultural investment, exemplified by the G8's commitment of $22 billion in 2009. Escalating food prices in conjunction with environmental catastrophes like droughts, fires, and floods have adversely affected crop yields and food security across countries, particularly in vulnerable, economically challenged regions, deepening hunger and susceptibility to poverty. Addressing these issues entails confronting two core challenges in agriculture. The first challenge pertains to enhancing food productivity and production in developing nations, with a specific focus on Sub-Saharan Africa and smallholder farmers. Resolving this demands a comprehensive approach encompassing property rights, research and development for seeds and inputs, irrigation, fertilizers, agricultural extension, credit access, rural infrastructure, storage, and market connectivity. The second challenge revolves around the volatility of food prices, often precipitated by extraneous factors beyond the control of impoverished nations. This paper aspires to review pertinent economic literature concerning agriculture, centering on factors pivotal to augmenting agricultural productivity and mitigating poverty. The initial section of this paper delves into the multifaceted role of agriculture in the developmental trajectory, elucidating its interactions with other economic sectors. Agriculture catalyzes both income growth and

poverty reduction, engendering economic opportunities and sustenance in rural areas while ensuring food affordability in urban zones. Particularly salient in low-income economies, the sector employs around 60 percent of the workforce and contributes to 25 percent of the GDP. Of the 5.5 billion inhabitants in developing countries, a staggering 3 billion reside in rural environs.

1. Introduction

The agricultural sector continues to play a crucial role for development, especially in low-income countries where the sector is large both in terms of aggregate income and total labor force. Having been a key preoccupation of developing country governments, donors and the international community during the 1960s and 1970s, agriculture disappeared from the development agenda in the 1980s and 1990s, only to reappear in the first decade of the 21st century because of neglect and underinvestment (see Fig. 1). There is renewed interest in the problems of the sector—not to a small extent thanks to the *World Development Report 2008, Agriculture for Development* (World Bank, 2007) and *Agriculture at a Crossroads* (IAASTD, 2009), both of which came from global consultative processes of scientists, decision makers and donor agencies.

Donor countries have pledged large sums for investment in agriculture—for example, the G8 countries promised $22 billion during their meeting in Aquila, Italy in 2009. These pledges were made in the aftermath of three simultaneous global crises—food crisis, climate crisis, and financial crisis— and their aftermath. Food prices have spiked twice in a period of 4 years: the United Nations Food and Agriculture Organization (FAO) food price index peaked in June 2008, then hit another record high in March 2011. Drought, fires, and monsoon floods have destroyed harvests in many countries from Russia to Pakistan. In poor countries, this has led to hunger, worsening food insecurity, and vulnerability to poverty.

There are two challenges related to agriculture. The first is the need to increase food productivity and production in developing countries, especially in Sub-Saharan Africa and with smallholder farmers. To achieve this, a number of problems need to be addressed: property rights, R&D for seeds and inputs, irrigation, fertilizer, agricultural extension, credit, rural infrastructure, storage, and connection to markets. The second problem is the volatility of food prices, often because of events outside the control of poor countries. An interconnected combination of steps could help ensure that the most vulnerable countries and people get the nutrition they need. The modest ambition of this paper is to review the economic literature on agriculture, focusing on the issues that are critical for agricultural productivity and poverty reduction.

In the first section of the paper, we discuss the role played by agriculture in the development process and the interactions between agriculture and other economic sectors. Agriculture contributes to both income growth and poverty reduction in developing countries—by generating income and employment in rural areas and providing food at reasonable prices in urban areas. The sector matters greatly in low-income countries, where about 60 percent of the labor force is employed in agriculture: it accounts for 25 percent of GDP (but only 9 percent in middle-income and 1 percent in high-income countries). Of the 5.5 billion people who live in developing countries, 3 billion live in rural areas.

Agriculture is the main source of livelihood for 86 percent of these rural households. Some 75 percent of poor people still live in rural areas and derive the major part of their income from the agricultural sector and related activities. Agriculture provides food, income, and jobs, and hence can be an engine of growth in agriculture-based developing countries and an effective tool to reduce poverty in transforming countries. Balancing agriculture and industry is an important—although difficult— dimension of development policy. Recently ‘‘agro-pessimist’’

views—based on the observation that agriculture in developing countries is often the least productive sector—have been voiced in the literature

In the second section, we look back on the determinants of the Green Revolution and discuss the foundations of agricultural growth. In developing countries that have experienced sustained increases in yields, the mode of agriculture has been intensive and has involved the adoption of new varieties by farmers, irrigation, and massive use of fertilizer (with predictable environmental consequences), which presupposes good institutions. In the coming decades, massive productivity increases in SubSaharan Africa will be necessary if the subcontinent is to catch up with the rest of the world. The challenge is thus of a different nature. Further cropland expansion (which was the basis for the slow yield increases that took place in the past), with few exceptions, will not be possible. New seeds that are resistant to climate risks and adapted to local conditions will need to be developed and sustainable irrigation systems expanded. The most difficult challenges are institutional and economic. Often smallholders cannot internalize the benefit of their efficiency (compared with large farms) because of missing markets for insurance and credit, low education levels, limited market access and market information, and insecure property and usage rights. Hence, although new advances in R&D—such as genetically modified organisms and extension services—are important for future growth and poverty reduction, getting fundamental institutions right is a prerequisite for growth and a priority on the agricultural development agenda.

In the third section, we broaden our focus and look at the rural sector as a whole, examining why rural households diversify their income and reviewing various approaches to rural development. Nonfarm employment is an important income source for the poor and an effective way out of poverty for rural households, as well as a means to cope with missing insurance and credit markets. However, although the rural non-farm sector is a source of additional employment opportunities and an instrument to reduce poverty, diversification of income by farmers does not necessarily guarantee upward mobility. In order for this to happen, proper education and information about and access to non-farm jobs are necessary. As a consequence, rural development programs have to incorporate such needs into their strategies. Past experiences have shown that private provision of certain goods and services can easily fail and therefore it is important to have an ‘‘enabling state’’ to orchestrate and initiate these activities without being their sole purveyor. Their implementation should take advantage of private sector initiatives and local civil society expertise. New approaches, such as community-driven development, can be successful in managing common resources and local projects. But the lesson from the past is the importance of egalitarian preferences and social capital among community members. Balancing centralization and decentralization of program implementation hence is the key for successful rural development.

In the fourth section, we review trade policy and food security concerns in light of the deadlock in the Doha round and today’s volatility in food prices. We argue that insulating poor people from world food price swings and eliminating trade barriers for developing country agricultural exports, in the context of the WTO trade negotiations, are crucial for the reduction of poverty in low-income countries. Developed countries should reduce these trade barriers further because low-income country exports are mainly agricultural goods and these countries lose the most from current protectionism. For the negotiations to succeed, this must go hand-in-hand with a reduction in trade barriers by developing countries. Price volatility and beggar-thy-neighbor policies to stabilize prices and guarantee national food security by some countries during the 2008 food price crisis have harmed vulnerable and poor populations and reversed some past gains in the global effort to reduce chronic poverty. Trade and market interventions to stabilize agricultural prices have failed or met with limited success. Even when unilateral policies have succeeded in stabilizing domestic prices, they have increased the volatility of international prices, and this eventually leads to a vicious circle of similar responses by other countries. Because the main purpose of stabilization and ‘‘food security’’ policies is to mitigate the impact on the poorest income groups (those

most affected by food price changes), the focus should be on mitigation and risk management strategies for these groups. There is evidence that some social safety net and insurance policies can offset agricultural price shocks and help poor households to prevent food insecurity and cope with idiosyncratic shocks to their income. However, the best instruments to protect small farmers from income shocks are ex ante measures, such as increased productivity that reduce the risk of shocks in the first place.

2. The role of agriculture in development

2.1. Agriculture, growth, and poverty reduction

Developing economies have generally been described as dual economies with a traditional agricultural sector and a modern capitalist sector. Productivity is assumed to be lower in agriculture than in the modern sector. The canonical model was put forward by Lewis (1954) and subsequently extended by Ranis and Fei (1961). Lewis' model rests on the idea of surplus labor in the agricultural sector. With lower productivity in agriculture, wages will be higher in the modern sector, which induces labor to move from agriculture to the modern sector, which in turn generates economic growth. Other precursors, such as Schultz (1964), also point out the importance of food supply by the agricultural sector. In Schultz's view, agriculture is important for economic growth in the sense that it guarantees subsistence for society, without which growth is not possible. This early view on the role of agriculture in economics matched Kuznets' (1966) empirical observation that the importance of the agricultural sector declines with economic development. In this view, the role of agriculture in economic development is to supply cheap food and low wage labor to the modern sector. Otherwise, both sectors have few interconnections. Growth and higher productivity in the agricultural sector can contribute to overall economic growth by releasing labor as well as capital to other sectors in the economy. However, industrialization is seen as the ultimate driving force behind a country's development and agriculture as a traditional low-productivity sector.

Building on the Lewis model, Johnston and Mellor (1961) account explicitly for agriculture as an active sector in the economy. In addition to providing labor and food supply, agriculture plays an active role in economic growth through production and consumption linkages. For instance, agriculture can provide raw materials to nonagricultural production or demand inputs from the modern sector. On the consumption side, higher productivity in agriculture can increase the income of the rural population, thereby creating demand for domestically produced industrial output. Such linkage effects can increase employment opportunities in the rural non-farm sector, thereby indirectly generating rural income. Moreover, agricultural goods can be exported to earn foreign exchange in order to import capital goods.

The importance of such linkages was further stressed by Singer (1979) and explicitly embodied in Adelman's general equilibrium idea of "agricultural demand-led industrialization" (ADLI), according to which, because of production and consumption linkages, a country's development strategy should be agriculture-driven rather than export-driven and increased agricultural productivity would be the initiator of industrialization. Moreover, emphasis should be placed on small-to-medium-size farmers because they are more likely to use domestically produced intermediate goods, as opposed to largescale producers who might import machinery and other inputs, which would weaken the linkages between agriculture and other sectors (Adelman, 1984).

The fact that there are important linkages between the traditional and modern sectors in developing countries makes agricultural growth an important instrument for decreasing poverty. The contribution to poverty reduction takes place directly, through the effects of agricultural growth on farm employment and profitability, and indirectly because increases in agricultural output induce job creation in upstream and downstream non-farm sectors as a response to higher domestic demand. Potentially lower food prices increase the purchasing power of poor consumers. The magnitude of these effects for poverty reduction depends on the specific circumstances of

an economy. For example, if technological progress in the agricultural sector is labor-saving, farm employment might not necessarily increase (Irz et al., 2001).

Although most of the literature views agriculture as an active and dynamic economic sector, some authors reach quite different conclusions. Gollin (2010) notes that the large share of agriculture in many developing economies does not immediately imply that overall growth has to be based on an ADLI-type strategy. Matsuyama (1992) suggests that the relation between agricultural growth and overall economic growth depends on the openness of a country to international trade. Whereas agricultural growth goes hand in hand with economic growth in small, closed economies—where gains in agricultural productivity will lead to the linkage effect described above—the relation might be reversed in the case of an open economy. If the country has a comparative advantage in agriculture, openness to trade will draw resources away from the modern sector into agriculture, which might be less productive than industry. The importance of the degree of openness of a country was pointed out early on by proponents of ‘‘agriculture-first’’ approaches to development. For instance, Ranis and Fei (1961) acknowledge that imports could potentially substitute for domestic agricultural products. Adelman (1984) suggests that ADLI would work best for low-income countries that are not yet exportdriven; and Foster and Rosenzweig (2003) stress that the tradability of rural non-farm sector goods can have different implications. In a general equilibrium perspective, productivity gains in the agricultural sector have a negative impact on the tradable non-farm sector. This is because agricultural products as well as rural non-farm non-tradables have a relatively inelastic demand for labor, whereas tradable goods have more elastic labor demand. If wages increase due to greater agricultural productivity, factories producing tradable goods, which are assumed to be operated by external producers, will move to escape the higher wages.

There is a vast literature, ranging from critical contributions that do not support ‘‘agriculturefirst’’ approaches to more recent ‘‘agro-pessimism’’ views. The latter are based on the observation that agriculture in developing countries might be the least productive sector in the economy. Dercon (2009) derives this conclusion from a two-sector model elaborated by Eswaran and Kotwal (1993). He explains that, in an open economy, in which both agricultural and modern-sector goods can be traded, linkages between the two sectors become less important for overall growth. As a result, there is less necessity to increase agricultural productivity to induce overall growth and reduce poverty. Both sectors can contribute to growth. But if agriculture is less productive than other sectors, importing food and focusing efforts on other sectors might be more beneficial to a country’s development. Both Dercon and Gollin admit that, under certain circumstances, the agricultural sector can be crucial for economic growth. If countries are landlocked and closed to international trade, agriculture can be a main driver behind overall growth and should be supported actively.

Although various theoretical models suggest opposing roles for agriculture in development, they do not necessarily contradict each other. The models are derived under different economic assumptions (e.g., openness to trade). Therefore, it is not surprising that they derive different policy implications. Because developing countries differ with respect to their economic environments, the role of agriculture for development might be re-evaluated in each specific case. This is in line with the 2008 World Development Report (World Bank, 2007), which suggests that in agriculture-based economies, agriculture can be the main engine of growth, whereas in transforming countries, agriculture is already less important as an economic activity but still a major instrument to reduce rural poverty. In urban countries, by contrast, agriculture plays the same role as other tradable sectors and subsectors with a comparative advantage and can help to generate economic growth.

So far our discussion has mostly considered theoretical models. We now turn to empirical investigations of the relation between the agricultural sector and economic growth. Early contributions by Kuznets, Chenery, and others focused on sector changes accompanying economic development. Kuznets (1966) observed that as

economies develop, the share of agriculture in output and employment diminishes, which later empirical data have reconfirmed. Other important early contributions include Chenery and Syrquin (1975), who combined cross-section and time-series data over 1950–1970.

Timmer (2002) uses a panel of 65 developing countries over 1960–1985 to show a positive correlation between growth in agricultural GDP and its lagged values and nonagricultural GDP growth. He suggests that this correlation can be explained by ‘‘first-order’’ effects of agricultural growth on lower food prices, labor migration, and capital flows from agriculture, as well as ‘‘secondorder’’ effects, such as improved nutritional intake, which improves workers’ productivity. Similarly, Self and Grabowski (2007) establish a positive relation between different measures of agricultural productivity and average growth of real GDP per capita over 1960–1995 for a cross-section of countries. However, on the basis of panel data from 52 developing countries during 1980–2001, Gardner (2005) concludes that agriculture does not seem to be a primary force behind growth in national GDP per capita.

Recent empirical literature considers that the effect of agricultural progress on poverty alleviation is highly positive. Mellor (2001) argues that it is not economic growth in general that reduces poverty in developing countries, but the direct and indirect effects of growth in agriculture. In their study of poverty in India over a 35-year period, Datt and Ravallion (1996, 1998) find that higher farm productivity reduces both absolute as well as relative poverty. This is partly due to a direct channel of higher household income operating in the short run and partly due to indirect channels, such as higher wages and lower food prices, in the longer run. Other empirical studies also suggest that these are the main channels and not labor migration from agriculture into other sectors. This strengthens the argument for supporting agricultural growth. Similarly, Loayza and Raddatz (2010) show for a crosssection of developing countries that growth in more labor-intensive sectors, such as agriculture, has a larger impact on poverty reduction than less labor-intensive activities. Christiaensen and Demery (2007) estimate that 1 percent per capita agricultural growth reduces poverty 1.6 times more than the same growth in industry and three times more than growth in the service sector.

Case studies confirm these cross-country findings. For example, Dercon and Christiaensen (2005) estimate that among 15 villages in Ethiopia, consumption per adult equivalent is 8.5 percentage points higher if households use fertilizers, i.e., inputs to increase farm productivity. Another channel through which agricultural growth can reduce poverty is employment generation in the nonagricultural sector. Mellor (2001) finds that this effect is mostly driven by increased consumption demand and not so much by production linkages. In addition, the effect of agricultural growth on poverty might differ along the income distribution. Christiaensen et al. (2010) cross-country regression analysis supports the lager poverty-reducing effect of agriculture compared with other sectors; the difference is greatest among the extremely poor. Among those living on less than $1 a day, agricultural growth leads to a reduction in poverty that is 3 to 4 times larger than growth in nonagricultural sectors. The difference is considerably less for individuals living on $2 a day. Income inequality decreases the poverty-reducing effect of growth, and the decrease is greater for growth in the agricultural sector. Overall, however, agricultural growth is a central instrument in helping the poor in developing countries.

Although these empirical investigations establish a correlation between agriculture and GDP growth, they do not imply causation in either direction. The correlation observed could be spurious if both sectors have been growing independently of each other or as a result of a common third factor. As a result, some authors criticize studies that argue that there is a causal effect of agricultural growth on economic growth. To address this issue of endogeneity in empirical work, Tiffin and Irz (2006) use Granger causality tests to establish that agricultural value added per worker has a positive effect on GDP per capita in developing countries. Bravo-Ortega and Lederman (2005) employ panel data tools, such as GMM and Granger causality tests, to re-estimate the effect of agricultural growth

on the overall growth rate. Using 1960–2000 panel data, they find that an increase in agricultural GDP raises nonagricultural GDP in developing countries, whereas a reverse relation exists for developed countries. The authors suggest that there are regional differences in the positive relation in developing countries, with a greater effect in non-Latin American and Caribbean countries.

Another problem that arises with cross-country studies is that differences in country conditions do not allow for a general relationship between agricultural and aggregate economic growth. Factors such as openness to trade could alter the relation between agriculture and nonagriculture. Global markets may substitute for what Timmer (2002) calls the first-order effects of agricultural growth (because they provide international capital flows and food imports). This might explain the different magnitudes of the positive relation that Bravo-Ortega and Lederman (2005) find for Latin America compared with other regions. Hence, the importance of linkages between the agricultural sector and the rest of the economy differs across countries. Some authors have tried to shed light on the importance of such linkages in different developing countries. For example, de Janvry and Sadoulet (2009b) show that for China in 1980–2001, 1 percent agricultural growth had an effect on aggregate growth of 0.45 percent, whereas the indirect effect through the nonagricultural sector was half that amount. In line with Mellor's findings for nonagricultural employment, consumption linkages have been the main drivers of multipliers from agriculture to the rest of the economy (Thirtle et al., 2003; Tiffin and Irz, 2006).

2.2. Agriculture and urban bias

Probably the agricultural sector's most important contribution to development in poor countries in the past has been to provide savings, i.e., surplus—extracted through various means—over and above what was required for the reproduction of agricultural producers, which allowed industrialization to take place. The literature has extensively discussed the tax and price policies that are necessary to bring about surplus extraction (see Sah and Stiglitz, 1984; Carter, 1986). These policies became famous by the discussions between Preobazhensky and Bukharin about the so-called ''primitive'' forms of socialist accumulation in the Soviet Union where farmers faced artificially low prices for their output and punitive taxation throughout the 1920s and 1930s (Conquest, 1987). Consistent with these early models of agriculture as generating a surplus that could be extracted for the benefit of industry, in the recent past, governments in developing countries have imposed a heavy burden on agriculture by implementing urban-biased policies. Krueger et al. (1991) multi-country study provides empirical support for the view that price policy, trade policy, and exchange rate policy in virtually all developing countries have discriminated against agriculture. The discrimination has been direct, through food subsidies or taxes on agricultural exports, or indirect, through manufacturing protection and exchange rate overvaluation. During 1960–1984, these policies extracted an average of 46 percent of agricultural GDP from the sector in 18 developing countries (Krueger et al., 1991). This massive study confirmed the hypothesis of Schultz (1964), who argued that peasants in poor countries are not backward and ''traditional'', but, on the contrary, rational decision makers who maximize the returns from their resources. Their apparent unwillingness to innovate, he argued, was rational because governments of developing countries often set artificially low prices on their crops and taxed them heavily. In other words, peasants respond to incentives.

Anderson (2009) updated the Krueger Schiff, and Valde`s study, reaching similar conclusions but showing that, since the mid-1980s, the inter-sector bias against agriculture and the anti-trade bias have been substantially reduced. Many developing countries have undertaken a great deal of policy reform and opened to trade and benefited proportionately more (relative to GDP) than high-income economies from those trade-related policy reforms. Developing countries would gain nearly twice as much as richer economies by completing the reform process—with 72 percent of the prospective gains to developing countries coming from agricultural and food policy reform. In developing countries, net farm income (agricultural value added) is estimated to have been 5

percent higher in 2004 than it would have been without the reforms since the mid-1980s. If policies remaining in 2004 were removed, net farm income would rise by another 6 percent (far more than the proportional gain to nonagricultural households). These reforms could further alleviate global inequality and poverty, since three-quarters of the world's extreme poor are in farm households in developing countries. One way to look at policy changes over the past 25 years would be to say that developing countries follow the example of higher-income countries in moving from anti to pro-farmer policies as they develop. The Anderson study shows that import-competing farmers in developing countries are being increasingly protected over time.

Agricultural production has been directly supported by subsidies to farm inputs such as fertilizers and irrigation in many developing countries, such as India. These policies generally benefit large farmers more than smallholders (De Gorter and Swinnen, 2002). Bezemer and Headet (2008) argue that public policies that actively support agriculture, such as pricing or support to agricultural research and extension, are a necessary prerequisite for agricultural growth, and that agricultural market liberalization has not benefited small farmers due to market failures and distortions.

Asia's Green Revolution was supported by government interventions sustained for long periods, such as fertilizer subsidies that reduced prices to 25 percent of their world market price. For example, the 5 percent annual growth in Indonesia's rice production over 1970–1988 was mainly achieved by government pricing, research, and investments in the rice sector (Gonzales et al., 1993). But such large-scale public interventions put a heavy burden on government budgets, are not a good use of public funds and not sustainable over time. They also have other detrimental effects. For instance, the subsidization of fertilizer in Asia has led to misuse and soil degradation.

Hence, although urban bias seems to be detrimental for agricultural growth because it fosters industry, agricultural market interventions are costly and may lead to mismanagement of resources. At least that was the conventional wisdom among economists and policymakers in the 1980s and 1990s. They thought that agricultural market interventions increased fiscal spending and could create macroeconomic problems. However, in recent years, there has been a resurgence of interest in these subsidies in Africa, together with the emergence of ‘‘smart subsidies’’, which are delivery systems intended to reduce the common problems facing subsidy programs. The most famous example is the Malawi Government Agricultural Inputs Subsidy Programme, a voucher system. It is seen as an effective way of rationing and targeting access to subsidies to increase agricultural productivity; it provides opportunities for innovative public–private partnerships to develop input supply and demand systems; and it may lead to economic and social welfare gains. But the program is fraught with many practical and political problems and may lead to patronage and fraud. Moreover, the program is vulnerable to factors outside government control, including variations in international fertilizer and maize prices and weather (Dorward et al., 2008). These programs have to be marketsmart and require an environment with strong institutions for decentralized targeting of input vouchers. Otherwise, the capture of the program by rural elites is almost certain. This is confirmed by the experience of the 2008 input voucher pilot program in Kilimanjaro, Tanzania, in which elected village officials received about 60 percent of the vouchers, reducing the targeting performance of the program, especially in more unequal and remote communities (Pan and Christiaensen, 2011).

3. The foundations of agricultural growth

This section looks at the performance of the agricultural sector in different regions of the world, the foundations of agricultural growth, and the challenges faced by farmers in developing countries that might diminish the returns to agricultural technologies. These include the structure of agricultural production, environmental factors, and barriers to technology adoption.

3.1. Green Revolution and technology adoption

The Green Revolution, meaning the adoption of high-yielding varieties, was largely made possible by investments in fertilizer and irrigation. The massive use of fertilizers—without the help of which high-yielding varieties cannot grow successfully—changed agricultural practices forever. Irrigation— thanks to which water can be stored and sent to dry areas, putting more land into agricultural production—also increased production. The Green Revolution exponentially increased the amount of food production worldwide and sharply reduced the incidence of famine, especially in Asia. There have been major downsides, however. First, since only a few species of high-yield varieties of rice or wheat were grown, tens (if not hundreds) of thousands of seed varieties that existed prior to the Green Revolution are no longer being used. Increased crop homogeneity implies that seeds are more prone to disease and pests because there are not enough varieties to fight them. In order to protect these few varieties, pesticide use grew, with major negative environmental externalities. Second, at least if one adopts a Malthusian view of development, the increased amount of food production available worldwide has been an important cause of overpopulation.

Between 1980 and 2004, the agricultural sector grew at an average rate of 2.6 percent worldwide, with two-thirds of this growth contributed by Asian economies. Agricultural yields in Asia increased at an average rate of 2.8 percent between 1961 and 2004. In Sub-Saharan Africa, the average rate of agricultural growth was 3 percent over the same period but growth per capita of the agricultural population (a broad measure of agricultural income) was 0.9 percent, less than half the growth rate in other regions. Moreover, whereas agricultural growth during the Green Revolution in Asia was driven by intensification, agriculture in Sub-Saharan Africa has been growing mostly as a response to land expansion and yields have been stagnant. Since the potential for land expansion will soon be exhausted, further agricultural growth will have to come from increased yields. What needs to be done in order to achieve higher yields and, hence, agricultural growth in Sub-Saharan Africa?

Consensus about the need for a Green Revolution in Africa is universal but the characteristics of the African continent call for a different approach. In comparison with Asia, Africa is heterogeneous in terms of agro-ecological conditions, farming systems, and types of crops planted. The FAO considers that there are 14 main farming systems in Sub-Saharan Africa (Staatz and Dembele, 2007). They depend rather weakly on rice or wheat, which have been the drivers of the Asian Green Revolution. Moreover, most agriculture in Africa is rain-fed (de Janvry and Sadoulet, 2009a), whereas the Green Revolution in Asia was partly driven by intensive irrigation. In fact, only 4 percent of crop area in Africa is irrigated, versus 34 percent in Asia. Another factor that makes the Sub-Saharan African context different is the underdevelopment of infrastructure, which hinders market access and leads to high transportation costs. As a consequence, several geographically separate revolutions will have to take place across Sub-Saharan Africa (Staatz and Dembele, 2007).

In order to understand past developments in agriculture and predict future ones, the mechanisms behind agricultural development and growth must be identified. According to Schultz (1964), many farmers remain poor not because they are ‘‘backward’’ but because their government provides them with few technical and economic possibilities. Schultz stressed the importance of making inputs available to farmers (and increasing the capacity of industry to supply these inputs), generating new locally specific knowledge, and improving education about new seeds and technologies via extension services. Schultz’s model did not specify which institutions could influence this process and facilitate the adoption of new technologies by farmers. This shortcoming was addressed by Hayami and Ruttan (1971), who developed a model of induced innovation to explain the factor bias of technological change. The causal sequence begins with changes in relative factor scarcities leading to changes in relative factor prices (under the assumption that markets actually exist and work). Prices, in turn, guide technological advances toward saving on the factors that become relatively more expensive. Since agricultural

research is largely a public good, the government needs to respond to market signals and factor endowments by allocating funds to alternative research programs. This occurs partly in response to producer demands for technologies that allow them to save on the factors that are becoming relatively more expensive and partly as a response to changing resource constraints, such as environmental challenges (de Janvry and Dethier, 1985). In comparing the long-run history of technological change in Japanese and U.S. agriculture, for instance, Hayami and Ruttan find that, in labor-abundant but land-scarce Japan, technology has been mainly land-saving, allowing for a rapid increase in the productivity of land. In the United States, where land was abundant and labor scarce, technology has been mainly labor-saving, allowing rapid increases in the productivity of labor.

3.2. Agricultural investment and appropriate technologies

Identifying the characteristics of agriculture in Africa does not explain why yields are low. There are two broad problems. The first is lack of appropriate technology and the second is lack of adoption. Whereas the former calls for better targeting of research to African countries and their conditions, the latter demands a reduction in the barriers to technology adoption. Of course, the problem of low yields may also be a combination of both inappropriate technology and barriers to adoption.

Agricultural R&D and its capacity to produce more productive technologies are at the heart of longrun agricultural growth. Such new technologies triggered the Green Revolution in Asia, and in light of the limited potential for land expansion in Sub-Saharan Africa such inventions are also strongly needed for African farmers. Due to the heterogeneity of the countries and differences with, say, Asian countries, crops that have been planted in other regions might not be appropriate for Africa. Technological spillovers from high-income countries to low-income African countries are unlikely. Moreover, regional differences are large within the continent and prevent technology spillovers among African countries (Pardey et al., 2007; Binswanger-Mkhize and McCalla, 2010). These differences call for more regional specific orientations in agricultural research, which take local conditions and constraints into account. In Africa, this has been addressed by both national as well as international research organizations. In 2006, for example, the CGIAR spent 48 percent of its total budget on activities directly related to Sub-Saharan Africa. But the contribution of CGIAR research to total yield growth has been much smaller in Sub-Saharan Africa than in other regions (BinswangerMkhize and McCalla, 2010).

At the regional level, new institutions have been developed, such as national agricultural research systems (NARS) and the New Partnership for Africa's Development (NEPAD). NEPAD, for example, has set a target of 6 percent agricultural growth in order to encourage public spending in this sector. Nevertheless, only a few African countries have reached that goal, whereas public spending in general has been low (during the past 30 years, 5–7 percent of the total national budget) and has fallen short of equivalent spending in other parts of the world (Fan et al., 2009). This is in stark contrast to potential returns to such expenditures. As reported by Fan et al. (2009), in some African countries, recent expenditures have been very successful in increasing agricultural productivity: one local currency unit spent on agricultural R&D has increased agricultural productivity by about 12 local currency units in Uganda and Tanzania. For Sub-Saharan Africa in general, the return to agricultural R&D and extension is estimated to be around 35 percent (IEG, 2011).

Future research will need to have a regional focus and target specific needs. Regional initiatives— such as NEPAD—are an important part of such a regional strategy. However, the mode of research is also a vital factor. Engaging farmers in such efforts, for example through participatory plant breeding, can provide valuable information to the research process. According to Ceccarelli and Grando (2007), this approach is different from normal plant breeding in three ways: the testing and selection of seeds take place on the farm, the farmers are involved in the decision making, and it can be implemented at many different locations. The participation of farmers is expected to increase the rate of adoption of new seeds.

An important agricultural R&D question is what recent biotechnology advances can do for African agriculture and whether they are the route to the continent's Green Revolution. Poor farmers might benefit especially from transgenic food crops because they are particularly disease-resistant. Estimations by Edmeades and Smale (2006) show that transgenic bananas would mostly be adopted by poor, subsistence-oriented farmers and are therefore a ''pro-poor'' variety. So far, however, transgenic crops are grown commercially only in South Africa (Eicher et al., 2006), where in 2006 transgenic white maize covered 44 percent of the total white maize area (World Bank, 2007).

Although there is a broad consensus that biotechnology could be a driving force behind Africa's Green Revolution, several constraints have prevented its fast adoption so far. Until now, the private sector has done most of the research on transgenic crops and this does not necessarily suit the interests of poor farmers. Since private agricultural research plays only a very limited role in Africa, to promote broad adoption of transgenic crops, public research would have to adopt a stronger focus toward these new technologies. But strong intellectual property rights on existing technology could deter public research efforts. Another hurdle is the absence of biosafety regulations. Weak regulatory capacity in developing countries slows these processes (World Bank, 2007). Many African policymakers are skeptical about biotechnology as a result of European consumers' concerns about health and environmental issues. Eicher et al. (2006) estimate that transgenic crops will be available to small farmers only in 10–15 years (Binswanger-Mkhize and McCalla, 2010).

3.3. Extension services as a means to foster adoption

Even if new and more productive technologies are available, farmers might lack information about their existence and knowledge about proper implementation techniques. Extension services have been used as a means to diffuse new technology in developing countries since the Second World War. Extension services also include related services, such as health and nutrition services. When they began, extension services mostly included education about new technologies, as well as input and credit provision (Birkhaeuser et al., 1991). However, most field staff lacked the necessary technical training and field experience to effectively deliver the services to farmers. During the 1970s, a new approach—mainly driven by the World Bank—called the ''training and visit'' (T&V) approach began to spread. In addition to teaching farmers about new technologies, it included obtaining their feedback about the problems they encountered. The feedback was forwarded to supervisors who were then supposed to solve such problems. Extension staff met with only a limited number of contact farmers on a regular schedule. The cost of the new system, because of its greater staff requirements, was very high and this made it unsustainable. Anderson and Feder (2007) suggest that the impact of extension services has been mixed, with some projects having high returns to investment and others only negligible success. A general problem with the T&V approach is that extension agents—who are civil servants—often lack accountability.

As described in recent review papers—Anderson and Feder (2007) and Alex et al. (2002)—the decentralization of the system, putting farmer groups or the private sector in charge of service provision, has been the response proposed to overcome these accountability problems. Farmer groups can in fact engage on both sides of the market for extension services. On the demand side, they can increase overall demand for information because they reach more farmers and can negotiate for their demands more successfully. On the supply side of the market, they can deliver services to their members and finance them.

In addition to increasing the accountability and quality of service provision, privatizing extension services has reduced the financial burden on the public sector and made services more financially sustainable. Nevertheless, globally only 5 percent of extension services are provided by the private sector. Private extension services could respond better to demands from commercialized farmers but smallholders might be unaware of their own needs, unable to articulate them, and unable to afford services. Therefore, they might demand fewer services than they

need. In this situation, provision only by the private sector to different groups of farmers might not be the best solution. A better approach would be a private-public partnership to provide services as well as a publicly funded but privately managed system. This would increase the efficiency of the system and cater to all groups of farmers. The environment in which farmers operate today is changing and requires new ways to provide extension services. A recent idea is the introduction of information and communication technologies (ICTs) into extension services and rural development projects in general. ICTs can deliver information that is important for the development of rural areas in the long term (such as education) and in the short run (such as market information). For example, ICTs can be used for long-distance learning programs and thereby help to accumulate human capital. They can provide information on weather, prices, and profitable income diversification possibilities (Chapman and Slaymaker, 2002). An important technology is cell phones, which can improve both private as well as public information.

With mobile phones, agricultural extension services can be supplied at a lower cost and higher quality information can be provided. For example, increased mobile phone coverage has increased the efficiency of local markets in Niger (Aker, 2010a, 2010b).

3.4. Environmental challenges

The need for agricultural R&D and extension services is not new and their impact has been witnessed in Asia in the past. However, any agricultural revolution today will face environmental constraints that were not considered during the Green Revolution. The issue of the sustainability of agricultural systems is high on the agenda and the preservation of ecosystems and biodiversity will be important for the potential of agriculture in the future. African yield increases, which have mostly been achieved through expanding land under cultivation, have led to deforestation and land degradation. Soil degradation can have a negative impact on the future productivity of land. In the highlands of Ethiopia, these negative effects have been so strong as to offset any gains from technological progress. In extensive areas, more intensive production can help establish a sustainable system. But since Africa's agricultural revolution will have to come from increased use of inputs, intensification will need to be sustainable over time both economically and ecologically. African farmers have used low levels of fertilizers compared with farmers in other developing countries. Although some authors (e.g., Marenya and Barrett, 2009) argue that once land is degraded, fertilizer will be ineffective, Matsumoto and Yamano (2009) do not find a diminishing yield effect of fertilizers as soil fertility decreases.

Reardon et al. (1999) suggest that intensification will have to be capital-led instead of being accomplished by employing more labor, and that abstaining from using fertilizers and other non-labor inputs could lead to soil mining and is hardly profitable. But capital-led intensification of agricultural production has its own negative environmental effects and has to be properly managed to be sustainable. Inappropriate use of fertilizers could lead to poisoning of humans and animals and water pollution, which in turn could have indirect consequences for larger ecosystems. Such negative effects have been observed in rice-wheat systems in South Asia (World Bank, 2007). Hence, what is called for is well-managed, capital-led intensification of agriculture, taking into account agro-ecological factors and avoiding environmental damage—what Conway and Toenniessen (2003) call the "Doubly Green
Revolution."

Global climate change will also have to be taken into account. Increasing global temperatures could lead to a drop in agricultural output mostly in tropical countries; and less rainfall could damage rainfed agriculture and cause more frequent droughts. This is a special concern for Sub-Saharan Africa where most agriculture is rain-fed, so that climate change implies an increased risk for farmers. Compared with a no-climate-change scenario, agricultural GDP in Sub-Saharan Africa could decline by 2–9 percent. Adapting to the changing climate is

therefore a necessity for African farmers. New crop varieties that are more drought resistant and greater investment in irrigation systems are needed. Such adaption efforts should be part of the overall agricultural development strategies. Thanks to agricultural R&D, new technologies to cope with climate change already exist, but many households in Africa have not adjusted their planting techniques (World Bank, 2007). This is partly due to various barriers to adoption.

3.5. Barriers to technology adoption

Despite some adoption of new crop varieties in Africa, adoption rates remain far below Asian rates. For example, in 2000, African adoption rates of modern varieties of rice, wheat, and maize per area harvested were less than half those of East and Southeast Asia (Gollin et al., 2005). Although low adoption rates might seem irrational when looking at promised yields, they may well be a result of rational decision making by farmers, given the various constraints they face (Brooks, 2010). Technology adoption in general is positively related to a farmer's schooling and wealth and the adoption of the same technology by neighbors (Foster and Rosenzweig, 2010a). Although this does not establish causality, it suggests that low education, missing credit markets, and externalities could be major barriers to technology adoption. The rich economic literature on ''poverty traps'' (reviewed by Azariadis and Stachurski, 2005) discusses the self-reinforcing mechanisms, or traps, that act as barriers to adoption.

Higher levels of education increase the return to experience with a new technology, which makes a technology profitable after a shorter period of time for more educated farmers. Foster and Rosenzweig (2010a) find that, in India, the returns to previous planting of high-yield variety seeds are higher for educated than for illiterate farmers. The potential to learn about new technologies also depends on the available information about new technologies and their profitability. Extension and other services can—if properly implemented—deliver the information a farmer needs to profitably adopt a new technology. Access to market or weather information is also important for producers. For example, Goyal (2010) finds that an Internet kiosk providing prices as well as a new marketing channel to soy farmers in India increased the share of soy cultivated area, and concludes that improved information leads to higher returns. Weather information is important for adapting to climate change. By providing timely weather information, a program initiated in Mali in 1982 helped farmers to better control climate risk (World Bank, 2007). The introduction of ICT is also closely related to the issue of learning and can facilitate and enhance the distribution of important information (Byerlee et al., 2010).

Another barrier to adoption is the lack of well-functioning credit markets. If new technologies require initial investment, farmers who lack sufficient funds and cannot obtain loans might be unable to adopt the technology even if it is highly profitable to them. Croppenstedt et al. (2003) find that credit constraints in Ethiopia severely restrict fertilizer adoption by farmers. Farmers' lack of collateral may be the cause of their restricted access to loans. Property rights for land may therefore be an important determinant of adoption. Also, property rights are important for farmers' incentives to plant new varieties.

Risk and uncertainty about yields—especially high when a new technology is adopted—can also lead to low rates of adoption. Poor farmers often do not have assets they can rely on in case of low output (Jack, 2009). Hence, incomplete or missing insurance markets represent an additional barrier to technology adoption for poor farmers. Dercon and Christiaensen (2007) show that downward consumption risk due to harvest failure reduces the adoption of fertilizers by farmers in Ethiopia. If the adoption of a new technology generates positive externalities for other farmers, this may reduce a farmer's incentives to be the first to adopt a new technology, especially if initial returns are expected to be negative (Jack, 2009). Such externalities may lead to strategic adoption delay.

Another major factor that may be a barrier to technology adoption is the lack of appropriate infrastructure, which is certainly the case in Sub-Saharan Africa (Foster and Briceno-Garmendia, 2010). More than 30 percent of the

region's rural population has poor access to markets, whereas this is the case for only 5 percent in South Asia (World Bank, 2007). Rural roads and transport are underdeveloped mainly because of the low population density and other factors, giving rise to high transportation costs. In fact the lack of infrastructure drives up the price of fertilizer and other inputs, and this makes them too expensive for farmers to use. For example, Suri (2009) finds that farmers in Kenya, who have high potential returns to hybrid maize, do not adopt it due to the high cost of seeds and fertilizers caused by infrastructure constraints. Similarly, Matsumoto and Yamano (2009) estimate that the low use of fertilizer in Uganda is not profitable due to the high relative price of fertilizers. Moreover, they show that not only do high relative prices discourage the use of fertilizers, high prices also discourage the adoption of high-yield variety maize, which requires fertilizer as a complementary input.

The examples of adoption barriers, especially in Sub-Saharan Africa, stress that even if appropriate technologies exist, poor farmers might not benefit from them. Therefore, eliminating such barriers and providing farmers with better access to inputs must be an integral part of today's agriculture-fordevelopment agenda.

3.6. Farm size and land tenure

Many farmers in developing countries operate on a small scale. Increasing farm size is key for improved incomes in agriculture because it allows for the use of mechanization that has indivisibilities (with differences in access to credit by small and large farms favoring the latter), implying increasing returns to scale and higher profitability per hectare. In a detailed empirical paper, Foster and Rosenzweig (2010b) show that this is the case today in India, where most farms are too small to exploit the productivity and cost-saving advantages from mechanization. But land consolidation in larger farms with continued population growth and limited long-distance migration requires vigorous employment creation in the rural non-farm economy, basically in secondary towns and cities. Agriculture-for-development strategies need to focus on the smallholder sector, understand the challenges it faces, and find ways to make it more productive (World Bank, 2007).

Much of the early discussion on smallholders revolved around the issue of efficiency of farm scale. Whereas there are potential economies of scale on large farms, small farms have often been seen by family-farm theories as more efficient because they do not bear the cost of labor supervision and there are no moral hazard issues. Many developing country studies have found an inverse relation between farm size and land productivity even after controlling for other productivity determinants, such as land quality (Eastwood et al., 2010). However, in the presence of market failures, large farms may have an advantage over small farms. For example, they might be more able to obtain loans and hence face lower capital costs. This would suggest a U-shaped relation between farm size and productivity (Chavas, 2001). Moreover, even if economies of scale in production are outweighed by the labor costs borne by large firms, economies of scale in processing could render smaller farms less competitive (Binswanger et al., 1995). In addition, recent technology advances, such as zero tillage, render the supervision cost advantages of smallholders irrelevant. If smallholder disadvantages are based on market failures (and not diseconomies), an effort could be made to eliminate such biases against small farmers to reinforce their competitiveness in the market (Byerlee et al., 2010).

New developments in the agri-business and food sector might shift the competitive advantage to large-scale producers and make it difficult for smallholders to participate actively in food markets. Two developments are of special importance: the supermarket revolution, and standards and certification. The wave of new supermarkets in developing countries has led to new procurement systems (Eastwood et al., 2010). Supermarkets usually demand standardized products in large quantities, which can put small farmers at a competitive disadvantage. Indeed, as reviewed in Reardon et al. (2009), supermarkets seem to favor large over small suppliers if they have the choice. However, some supermarkets prefer to source from small farmers because large farms have more market options and are perceived to be more risky suppliers than smaller farms. If the latter are included in the

supermarket chain, however, non-land assets, such as irrigation or access to transportation infrastructure, are usually a prerequisite. Where supermarkets can only source from small farms, they have also provided resources such as equipment and technical assistance to contracted farmers. Hence, vertical coordination can be beneficial for smallholders.

In addition, new private standards for products and processes put small farmers at a disadvantage, as validation and certification have economies of scale (Hazell et al., 2010). In order to help smallholders face these new challenges and include them in modern value chains, coordination among participants has to be improved. This could be initiated by the public sector as well as the private sector through producer cooperatives, for example. Foster and Rosenzweig (2010b) propose a different solution. They suggest that in light of today's mechanization of production, Indian farmers are too small to be competitive and land consolidation paired with increased employment opportunities in the rural non-farm sector are necessary to increase incomes from agriculture.

It is not only farm size, however, that matters for efficiency of farm production. Property and user rights are also determinants of agricultural productivity. Different tenancy arrangements exist in developing countries. Tenants either pay a fixed rent for land use or engage in sharecropping, transferring part of their harvest to the landlord. When it comes to efficiency, the question to ask is which arrangements lead to a less skewed land-use distribution and increase productivity. The extent to which fixed rent or sharecropping is preferred depends on the degree of asymmetric information between farmer and landlord. Under perfect enforceability of effort, fixed rent and sharecropping contracts should lead to the same productivity for a given farmer. But moral hazard may reduce the effort of the tenant under a sharecropping contract if the effort is not directly observable and contractible. Therefore, in terms of effort, fixed rent contracts are preferred. If tenants are risk-averse, they might be unwilling to enter into a fixed rent contract because the risk burden of a bad harvest would be completely shifted to them. In this case, sharecropping is the second-best solution in terms of efficiency. Empirical studies show that even if sharecropping reduces productivity compared with fixed rent contracts, adjusting for the land quality of shared plots, the loss is small (Otsuka and Hayami, 1988).

One way landlords try to induce higher effort levels by tenants in sharecropping arrangements is interlinked contracts in which the landlord supplies credit and inputs to the tenant. For example, if the landlord provides cheaper credit while at the same time claiming a higher output share, tenants might be encouraged to borrow more. If the consequences of default are severe, higher borrowing will induce them to employ higher effort (Braverman and Stiglitz, 1982). Another explanation for such interlinked contracts is credit constraints faced by the tenant (World Bank, 2003). Laffont and Matoussi (1995), for example, find a positive relation between the tenant's own working capital and crop share.

In Asia and Latin America, tenancy usually reduces farm size (Eastwood et al., 2010). Mearns (1995) shows that in India plot fragmentation is reduced, which increases productivity by reducing the costs of production. In terms of tenancy reforms that try to strengthen tenants' rights, Besley and Burgess (2000) find that in India such tenancy reform is negatively related to agricultural productivity. However, Ghatak and Roy (2007) disaggregate the analysis to the regional level in India and conclude that in West Bengal, where the reform was implemented rigorously, there has been a positive relation between tenancy and productivity. However, they do not find any effect on land distribution. Despite such positive findings, tenancy regulation in favor of tenants can also lead to eviction of tenants and self-cultivation by less efficient landlords (Eastwood et al., 2010).

How have land tenure reforms in developing countries affected farm size and productivity? The success of land reforms in the past has been mixed, for both economic and political reasons (de Janvry, 1981). Binswanger et al. (1995) argue that land reforms can redistribute land from large, less efficient units to smaller, more productive farmers, and that fixed rent or shared tenancy contracts should be preferred to large farms. Titling of land can

increase productivity in the agricultural sector if it increases investment incentives or relaxes credit constraints for landholders. Feder (1993) shows that in Thailand titled land has been more productive than untitled land, but Place and Hazell (1993) do not find a positive relation between land rights and productivity among four African countries.

Titling programs may increase land concentration if more powerful individuals claim more land or do so faster. For example, in Bolivia during the 1980s, large farms got their titles much faster than smaller farmers. Nevertheless, if titling is done properly and concentration can be avoided, it can increase productivity by relaxing credit constraints for more efficient small farms. Direct land distribution implemented by imposing ceilings on land holdings seems to have achieved only little redistribution of land. As suggested by Eastwood et al. (2010), many redistribution efforts in Latin America left land mostly unreformed due to lack of proper implementation. Even where land was redistributed, it might not have had a positive effect on productivity. Mearns (1995) explains that ceilings in India have redistributed land to the poor, but Ghatak and Roy (2007) find the effect on productivity of this redistribution to be negative. They suggest that this is the case because redistribution leads to inefficient fragmentation of plots.

The discussion so far has focused on the efficiency of small farms and the role they play in agricultural development. The social contribution of small farms is a separate issue. In a long tradition that goes back at least to Jefferson, Hazell et al. (2010) argue that small farms can be an alternative for rural households until they can fully exit the agricultural sector and work in non-farm activities. Also, small farms can guarantee subsistence in rural areas.

4. The rural non-farm sector and rural development

4.1. Income diversification in rural areas

In the past, governments paid little attention to the rural non-farm sector because they perceived it to be unproductive and of negligible importance (Lanjouw and Lanjouw, 1995, 2001). Recent contributions point out that the rural non-farm sector serves as a bridge between agricultural-based livelihoods and industrial ones (Barrett et al., 2010), thereby playing an important role in a country's structural transformation. Further agricultural growth will have to come from capital-led intensification of production, which will limit the capacity of agriculture to employ a constantly growing rural labor force. Hence, rural and peri-urban sectors will play an important part in absorbing additional labor. Employment in those sectors is stimulated by agricultural growth through production and consumption linkages, and is an important complement to agriculture for rural poverty reduction (de Janvry and Sadoulet, 2009b).

The rural non-farm sector—comprising, for example, home production of clothing as well as wage employment in rural factories—is heterogeneous. The emergence of rural towns is of particular interest. They offer a larger market compared with rural settlements, and allow rural enterprises to benefit from economies of scale and higher profits (Hazell and Haggblade, 1993). Empirical evidence suggests that such towns have the potential to generate economic growth. China's Township and Village Enterprises are a leading example of this phenomenon (Lanjouw and Lanjouw, 1995, 2001).

Many households in rural areas today do not specialize in either agriculture or non-farm activities but derive their income from multiple sources. Income diversification plays an important role in the livelihoods of rural populations. Farmers grow different types of crops during the year. Families derive income from non-farm rural activities and receive remittances from household members who have migrated. The literature mentions several reasons why rural households and individuals—as opposed to their urban counterparts—diversify rather than specialize.

Barrett et al. (2001) name four main causes of income diversification into nonagricultural activities: seasonality in employment opportunities, diminishing returns to factors of production, market failures, and risk management. Due to seasonal variations in returns to labor in farm activities, individuals might work temporarily in the non-farm sector. Some household members might work off-farm if there are diminishing returns to labor in agricultural production. Simultaneous income generation from both farm and non-farm sectors can be a strategy to cope with income risk if appropriate insurance markets are not available. Also, engaging in activities independent from agriculture, such as manufactures, can counter farm-related risk. Households in Burkina Faso that diversified their income into non-farm activities were more able to cope with droughts during the 1980s (Webb and Reardon, 1992). Being able to hedge against risk in this way may enable farmers to increase the adoption of more risky high-return crops (Lanjouw and Lanjouw, 1995, 2001). Other market failures can also explain income diversification. If capital markets do not exist, households investing in farm equipment will engage in non-farm activities to raise the required capital. Non-farm income in Burkina Faso increased farm productivity by stimulating the adoption of animal traction (Savadogo et al., 1998). Missing land markets might prevent individuals whose comparative advantage is in non-farm employment from fully specializing in these activities.

Rural non-farm employment is not an option for all rural households. Zezza et al. (2007), using survey data from 15 developing countries, identify patterns along demographic characteristics as well as asset possession of households by income source. They conclude that households are more likely to engage in on-farm work if they own land, have lower levels of education, have little access to infrastructure, and a greater share of their labor force members are female. Households deriving income from nonagricultural wages are usually more educated and have better access to infrastructure. Households receiving income from remittances are more likely to have a female head. Reardon (1997), focusing on African countries, draws similar conclusions but stresses the fact that households with higher income from non-farm activities also have higher total income and larger landholdings. This raises the question of causality. Either income diversification into non-farm activities leads to higher income because they generate higher returns, or diversifying households are better endowed initially.

Several empirical studies (e.g., Barrett et al., 2001; Lanjouw and Lanjouw, 1995, 2001) draw similar conclusions. Asset endowments of households determine their ability to diversify incomes by participating in non-farm activities. One of the most important determinants is the level of education among household members. Many high-return, non-farm jobs require a certain amount of human capital, creating barriers for less educated households to take advantage of such diversifying opportunities. For example, Estudillo and Otsuka (2010) show that secondary and tertiary education is positively related to non-farm income in the Philippines.

Social capital is another factor explaining the ability of individuals to work off-farm. Workers who lack strong social networks, such as women or immigrants, have less access to well-paid non-farm jobs. Also, limited access to infrastructure can leave households in remote rural areas unable to participate in non-farm income diversification (Barrett et al., 2001). In Africa, if access to urban areas is given, migration income becomes more important than non-farm rural income in the total income of rural households (Reardon, 1997). Access to proper infrastructure is not only important for households to access the non-farm employment sector, but also for this sector to function properly and be profitable, thereby guaranteeing job opportunities for rural households. For example, electricity shortages that make the use of generators necessary can raise costs and reduce profits for rural enterprises (Lanjouw and Lanjouw, 1995, 2001).

Although there are barriers to high remunerative rural jobs, households that are poor in assets still engage in non-farm work. Lanjouw (2001) shows that there are two types of off-farm employment in El Salvador, one in which labor productivity and wages are high and another one that plays the role of ‘‘last resort’’ employment for poor households. Whereas the former can lead to upward income mobility of workers, this is not necessarily the case

for the latter. Lanjouw argues that even lowpaying, non-farm jobs support the income of the poor if, for example, unemployment is the alternative. Himanshu et al. (2010) find that employment growth in the rural non-farm economy is strongly correlated with growth in neighboring urban centers, and that poverty reduction has occurred partly by generating employment opportunities for historically disadvantaged rural groups.

Although the literature suggests that richer rural households engage more in higher-paying nonfarm activities, there is a consensus that diversification improves incomes and contributes significantly to poverty reduction in rural areas. Evidence from Africa shows that higher non-farm income leads to faster growth in income and consumption (Barrett et al., 2001), while evidence from rural Asia shows that household access to non-farm income is one of the main drivers of poverty reduction (Estudillo and Otsuka, 2010). Hence, a well functioning non-farm sector to which poor households have access is, next to agriculture, important for income generation and poverty reduction in rural areas.

The question that arises for policy is whether agricultural and rural non-farm sector activities are complementary or substitutes. If, for example, agriculture has little potential in certain regions (a view consistent with ‘‘agro-pessimism’’), policies might need to be more tailored toward non-farm activities. Both consumption and (upward and downward) production linkages exist between agriculture and the non-rural sector, although the strength of these linkages varies across time and space. The existence of linkages does not mean that a vibrant agricultural sector is a necessary condition for a successful non-farm sector. There are examples of agricultural growth limiting the tradable sector in rural areas—see, e.g., the study by Foster and Rosenzweig (2003). What follows from the existence of linkages between agriculture and the rural non-farm sector is that policies targeted at one or the other should not be made in isolation but integrated in an overall framework (Lanjouw, 1999). Although the traditional interpretation of the rural non-farm economy (Mellor, 2001; Adelman, 1984) was that it emerged though linkages with agriculture, new empirical studies have opened important new perspectives for poverty reduction and shown that more attention should be paid to small towns (as the India study by Himanshu et al., 2010, shows). Agricultural growth stimulates the growth of the rural non-farm economy through forward, backward, and final demand linkages, located in rural areas due to the advantages of proximity to agriculture (Byerlee et al., 2010).

4.2. Changing approaches to rural development

The rural sector has contributed more than 50 percent to global poverty reduction and is important for agricultural growth in developing countries. Rural development—improving the livelihoods of the rural population and especially the poor—is broader than agricultural development, which mainly focuses on the farm sector. Rural development is concerned with household income, resource allocation, poverty, and access to basic needs such as health, education, and food security. The heterogeneity among households in rural areas with respect to these issues is important for the design of rural development strategies (de Janvry et al., 2002). Whereas households that derive their main income from farm activities can benefit from improved agricultural technologies, landless rural households that diversify toward the non-farm sector would generate greater welfare from policies that improve such employment opportunities. Agricultural development and rural development are often connected. For example, smallholders are important for guaranteeing food security. Rural development strategies often involve many different actors, such as the state, civil society, and market participants. Defining a new approach toward rural development for today’s developing world will require defining the roles and importance of the actors in the process. Understanding the positions they took in past approaches to rural development is an important first step.

Approaches to achieve the goal of rural development have changed significantly over the past decades.[15] During the 1950s and 1960s, community-based rural development strategies, in which members of communities were given joint responsibility to manage their community resources, were put in place. UN programs, for example,

sent civil servants and experts from government agencies to support village communities, and the latter were supposed to establish their own development plans—involving infrastructure, education, and agricultural improvements—while outside experts provided advice and grants. Community development (CD) was meant to enable cooperation between the state and the rural population. It decentralized development issues to encourage self-help efforts (Holdcroft, 1978). In the heydays of the Green Revolution during the 1960s, the diffusion of technology to smallholders by government agencies was considered a key part of rural development. CD was very popular and by 1960, 60 countries had started to implement CD programs. But by 1965 many of these programs had been stopped or reduced. These early attempts at rural development were not very successful because communities were not given additional resources, old power structures persisted, and traditional elites prevented the programs from reaching the poor.

As economic growth in developing countries slowed during the 1970s, it became clear that it would not trickle down automatically to the poor. The focus of rural development approaches shifted toward poverty reduction. The leading approach to achieve this goal in rural areas became Integrated Rural Development (IRD), supported by major donors such as IDA (the World Bank) and USAID. The programs had twin objectives: improving agricultural productivity and satisfying basic needs through health or education services (Staatz and Eicher, 1984). Compared with the former CD approach, IRD was intended to focus directly on the poor. Again, the state played the central role in delivering public goods as well as subsidized inputs, credit, or extension services. In the aggregate, IRD programs were not successful. For example, Lele (1975), who reviewed 17 projects in Africa, concluded that the main reason was that they did not incorporate local technical expertise, did not emphasize local institutions, and did not understand the constraints faced by small farmers. Moreover, most projects were too costly to be sustainable beyond the pilot phase. Other factors that led to the disappointing performance of IRD programs were the urban bias of price policies, the lack of access to land and other assets, and the lack of participation in the projects by beneficiaries. Support for IRD—both by governments and major donors like the World Bank—decreased sharply in the early 1980s. The donors shifted their focus to extension, roads, or education projects, which had previously been specific rural development areas and were now dealt with in isolation (Binswanger, 1998).

During the 1980s, rural development approaches also shifted toward more ‘‘market oriented’’ solutions and public interventions in rural areas diminished—in line with the neo-liberal belief that free market forces would eliminate distortions and reduce poverty. It soon became clear that smallholders were not in a position to adjust to the new market rules and the ‘‘de-institutionalization’’ of the agricultural sector contributed to the fact that smallholders were falling behind. Private provision of services could not easily replace public provision due to the smallness of markets and information failures. Moreover, there were many market failures in developing countries, in particular in credit and insurance markets, and missing markets can be a major barrier preventing smallholders from adopting new technology and internalizing the benefits.

Failed attempts at rural development, which relied heavily either on state involvement or on market forces, raise the question of the respective roles the government and the market should play in rural development today. The limited success of market liberalization has been partly attributed to weak institutions that are essential for markets to work, such as clearly defined property rights and legal institutions that allow contracts to be enforced (Dorward et al., 2005). Therefore, the first role for the state is to strengthen such institutions. Second, the state has to supply public goods such as R&D for agriculture, basic education, and rural roads (World Bank, 2007). Private expenditure for agricultural R&D is very low in developing countries and public provision of research and extension services is essential if innovative new technologies are to reach smallholders. Education and access to employment opportunities are important prerequisites for successful income diversification in rural areas and

should be available to rural households. Appropriate infrastructure and functioning markets are also important for rural non-farm sectors to emerge. This does not necessarily mean that public good projects have to be carried out by the state, but it means that the state must take the initiative, provide incentives for their provision, and regulate the providers. Public–private partnerships, in which projects are publicly financed but provided by the private sector, can increase the efficiency of public good provision—although they can also lead to high public spending (Engel et al., 2008). The third role for the state is to specifically target safety net policies to address the various risks faced by the vulnerable rural poor. Such programs can involve cash transfers or work-for-food programs (de Janvry et al., 2002). Fourth, markets can be inefficient because agents are disconnected because they lack transportation and communication infrastructure or complementary investments are not undertaken by other agents in the supply chain (World Bank, 2007). This is one of the reasons why market liberalization has often not been successful. Hence, a possible role for the state is to help overcome such coordination failures between different actors in the rural economy. Investments might be targeted at communication and information systems, supporting farmer associations, input or credit subsidies, and extension services (Kydd and Dorward, 2004).

Governance is important for rural development policies to succeed (Dethier, 1999). Political and social conflicts can be major impediments to development efforts. Moreover, decentralizing governance and empowerment might be important for successful rural development strategies. Such decentralization can increase access to local information, mobilization of social capital for effective cooperation, participation of beneficiaries in the decision-making process, the accountability of elected officials, and the empowerment of poor minorities (de Janvry et al., 2002). Especially for the heterogeneous rural non-farm sector, where broad policies might not be the most appropriate to stimulate the sector's development, decentralization might be necessary to allow for locally adapted interventions (Lanjouw and Lanjouw, 2001).

This has led to a revival of previous community-driven development and participatory development ideas. For example, the World Bank has adopted this approach in recent years by increasing its lending for such projects (Mansuri and Rao, 2004). It is not clear that the problems which previous approaches faced will not occur again, in particular because of capture of program benefits by local elites (Bardhan and Mokherjee, 2006; Lanjouw and Ravallion, 1999). Community-based safetynet programs target the poor best if communities have egalitarian preferences, whereas heterogeneous communities can suffer from conflicting ideas (Conning and Kevane, 2002). Incorporating civil society—farmer organizations or nongovernmental organizations—into today's rural development strategies would benefit the poor. It would help to overcome market failures and deliver services locally. Such organizations can help their members reach economies of scale and thereby obtain credit or other services, which they could not obtain individually otherwise. With proper management of common resources and/or environmental resources to guarantee the sustainability of the agricultural system, communities and civil society can also play a key role. de Janvry et al. (2002) suggest that cooperation of such organizations with the public sector can lead to successful partnerships in which each party specializes according to its comparative advantage. Finally, institutions in which social capital among group members plays an essential role are important in rural areas. This is the case for group lending—in which peers are jointly responsible for the loans of individual members—to overcome credit market failures due to moral hazard and adverse selection problems.

5. Agricultural policy and food security

We now turn to the international dimensions of agricultural policy. The past decade has experienced a worrisome rise of protectionism—in spite of the ongoing World Trade Organization Doha Round of trade talks—which put developing country needs at the top of the agenda. Both developed and developing countries maintain high protection for agriculture, which creates a drag on developing countries' agricultural exports. In addition, in the

name of food security, some countries have reacted to food price increases with additional protectionist policies, such as export bans in Vietnam and India.

5.1. Market distorting policies of developed countries

Trade flows have grown more than twice as fast as aggregate GDP over the past 30 years. The developing world's share of global trade increased from about one quarter to more than one third, and the composition of its exports has been upgraded. For a long time, developing countries exported primary commodities and imported manufactured goods, but over the past two decades they have moved strongly into manufactured exports. The export share of developing countries in global manufacturing exports was 20 percent in 1990/91 and rose to 42 percent in 2006/07. For agricultural exports, the numbers are 32 and 41.5 percent, respectively. Moreover, trade among developing countries also gained importance. While 4 percent of global manufacturing exports went from developing countries to other developing countries in 1990/91, this number increased to 20 percent in 2006/07. For agriculture, the corresponding numbers are 7 and 20 percent, respectively (Aksoy and Ng, 2010).

Despite these changes and several rounds of trade liberalization, many developing countries have been unsuccessful in integrating with the world economy. Nearly all the growth in developing country shares of trade has been driven by middle-income countries. By contrast, the 49 least-developed countries—most of which are in Africa—have gained no market share at all. Moreover, some regions have seen much smaller shifts in the composition of their exports. The manufactured share of merchandise exports is 80–90 percent in East and South Asia but only 60 percent in Latin America. Africa and the Middle East have yet to reach the 30 percent mark, and many countries—particularly poor countries—remain dependent on exports of agricultural goods and natural resources.

Trade barriers in developed countries share the blame for this stagnation. True, in almost all slow or non-integrating countries, the investment climate has not been favorable enough—for a range of reasons, including resource depletion, weak infrastructure, and poor economic management—to attract the investments needed to transform export patterns. Thus, steps to strengthen the investment climate need to be a major element of any strategy to promote integration. But developing country exporters have also faced obstacles to developed country markets in every major sector—agriculture, manufacturing, and services.

Developed and developing countries alike maintain high protection especially for agriculture, creating a drag on developing countries' agricultural exports. In 2004, agricultural policies contributed 83 percent to the welfare cost of overall trade-distorting policies in developing countries (Valenzuela et al., 2009). Of particular concern are the pockets of protection against products of interest to developing countries, especially agricultural products. Developed countries continue to impose substantial obstacles on imports from developing countries, despite pledges to remove or reduce them. High-income countries provide more than $300 billion a year in domestic agricultural subsidies—three times the amount of aid to developing countries—and block or discourage agricultural exports from developing countries in many other ways. Developed countries have tariffs and quotas on textile imports that cost developing countries an estimated 27 million jobs. Other tariffs and nontariff barriers further undermine manufacturing and employment in developing country industries.

Developed countries have an extensive network of protection and support for their agricultural sector, mainly border barriers and subsidies. Border barriers, such as tariffs and quantitative restrictions, are designed to support prices in domestic markets. This form of protection most distorts international markets and harms developing countries, and accounts for about 70 percent of protection in OECD countries. Production-related subsidies given to farmers under different schemes, called direct support, usually take the form of direct budget transfers and are much less distortive. Agricultural goods produced behind high tariff walls and with production subsidies often require export subsidies to be sold in world markets. These agricultural policies raise costs by $17 billion per year

on developing countries, which is five times the overall flow of overseas development assistance to agriculture. To export their agricultural goods to OECD countries, developing countries must overcome tariffs at least 10 times those on typical intra-OECD exports (of all products). The average tariff that developing countries face for agricultural products in general is 16 percent compared with only 2.5 percent for manufactures (Anderson and Martin, 2005). Moreover, OECD countries provide agricultural subsidies that drive down world prices for agricultural exports, undermining the livelihoods and markets of farmers in developing countries. Although average support to agricultural producers decreased from 37 percent of gross value farm receipts in 1986–1988 to 30 percent in 2003–2005, the absolute amount increased from $242 billion to $273 billion a year over the same period (World Bank, 2007). The issue here is not the support that developed countries provide for rural development; it is the size and form of that support and its pernicious effects on the prices of goods produced by developing countries.

Developed countries have made some efforts to address this problem, introducing preferential schemes that give the poorest countries—primarily those classified as least-developed countries— duty-free access to their markets. Examples include the EU ‘‘Everything But Arms’’ initiative and the U.S. African Growth and Opportunity Act. But these schemes have had limited impact. For example, Everything But Arms grants preferential access to exports from the least-developed countries but only half of eligible exports are actually granted preferences. Under the African Growth and Opportunity Act, the most generous provisions are granted to apparel exports from Sub-Saharan Africa. But 99 percent of apparel exports under the act come from just seven Sub-Saharan African countries, and only two of these are least-developed countries (Madagascar and Malawi). The low coverage of these schemes is primarily the result of complex rules of origin, complicated administrative requirements, and the weak trade capacity of developing countries. Finally, most of the world’s poor people are located outside Africa and the least-developed countries. Thus, preferential market access that targets these countries excludes a large share of the world’s poor people—and could even hurt them through the trade diversion that may accompany these schemes. A more open global trade system would be far superior.

A more open trade system would generate enormous benefits for all countries—and particularly for the world’s poor people. Removing all trade impediments would reduce poverty worldwide by 3 percent (Anderson et al., 2011). The bulk of the gains from liberalizing merchandise trade would come from agriculture, not only in OECD countries, but also in developing countries, where tariff barriers are often as or even more distorted than in OECD countries (although the degree of distortion on the production side, through subsidies, is generally much lower). Reducing agricultural protection— including trade-distorting tariffs, quotas, other export subsidies, and anti-development tariff escalation and tariff peaks—is the most important step for development.

Not all developing countries would benefit from the liberalization of agriculture. Serious reforms in global agricultural trade policies would lead to higher prices for many products which are now protected, and these price changes could initially lead to balance of payments problems for lowincome countries that are net agricultural importers. But if we take out oil exporters and countries with temporary deficits worsened by conflict, only 14 low-income countries are net food importers. Three of these countries account for 80 percent of the net imports: Bangladesh, the Democratic People’s Republic of Korea, and Pakistan. The other 11 countries have a deficit of just $565 million, a small percentage of their trade. These countries would also gain from price increases, because their exports are also predominantly agricultural, as well as from other aspects of multilateral trade negotiations. Still, the international community should be prepared to provide assistance to help countries adjust to and take advantage of new trade opportunities.

5.2. Food security, the recent food price crisis, and its consequences

The concept of food security covers not only the amount of food required to guarantee the absence of hunger, but also the right choice of nutritional intake to avoid malnutrition and health issues (Barrett, 2002). Although food insecurity can arise due to shocks at the national level, putting entire populations in danger, it occurs at an individual level as a result of idiosyncratic shocks as well. At the height of the world food worries of the late 1960s and early 1970s (for instance, at the 1974 World Food Conference), the focus was on deficiencies in and volatility of production. Now the focus is clearly on access to food. Even when food is available in sufficient quantities, poor and vulnerable groups might be unable to consume food sufficiently and adequately because they lack access to it. Amartya Sen, for the first time in 1981, shifted the focus from supply side threats to food *availability* to demand side issues that prevent households and individuals from *access* to food products. Limited demand and access can arise, for example, as a consequence of employment and income shocks. Today's threat to global food security indeed does not arise from lack of supply but from lack of access: ''The world has more than enough food to feed everyone, yet [more than 1 billion] are food insecure.''

Although the recent food price crisis was partly caused by agricultural supply shocks and food supplies became scarcer, the issue of food security was not directly related to world food availability but to food accessibility by the poor in developing countries. In mid-2008, food prices peaked after a steady increase over the previous years, reaching a 30-year high (FAO, 2010a). In addition to the price level, price volatility also increased (Headey and Fan, 2008). After a decline, food prices started to increase again in mid-2010 and reached a record high in February 2011, much above their secular high (see Fig. 2).

Food prices play an important role for the poor because approximately three-quarters of their income is spent on staple foods. Food price increases have a major impact on poor consumers and are a threat to their food security. Ivanic and Martin (2008) estimate that the 2007–2008 crisis pushed an additional 105 million people into poverty, thus setting back poverty reduction efforts by seven years. In Sub-Saharan Africa, poverty is estimated to have increased by 2.5 percentage points as a result of the crisis (Wodon and Zaman, 2008). Even if income shocks from higher food prices are short-lived, they have long-term effects for household food security and welfare. For example, households try to cope with such shocks by lowering calorie intake. Torlesse et al. (2003) show that the percentage of underweight children in Bangladesh is correlated with the expenditure on rice (because lower rice expenditure allows more income to be spent on higher quality food). Rice expenditure in turn rises with rice prices. In addition, households sell assets such as livestock and spend less on children's education, as shown by a recent survey in Bangladesh (Wodon and Zaman, 2008). Such coping strategies can lead to lower labor productivity and less accumulation of human capital in the long run, which can prevent households from escaping poverty again once food prices are back to lower levels. As a result, households that are pushed into poverty because of temporary shocks may become chronically poor.

Evaluation of the future potential of renewed food crises requires an understanding of the factors that caused the recent price spikes. The literature suggests that several causes have contributed to the

[(ig._2)TD$FIG]

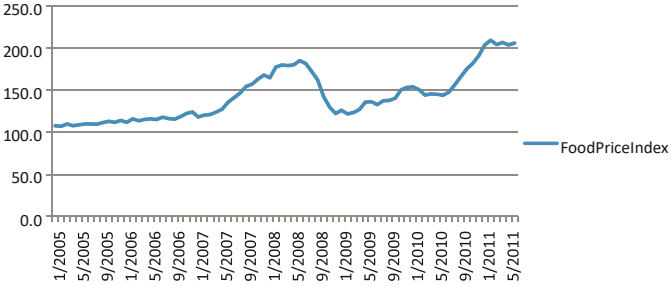

Fig. 2. Food price index.

Source: Food and Agriculture Organization. The graph shows the real price index (1992=100) which is an average of cereals, oils & fats, meat, dairy, and sugar nominal price indices deflated by the World Bank's manufacturing unit value index.

price increases. First, higher fuel prices have led to high production costs in agriculture by raising the cost of inputs such as fertilizers. Second, the depreciation of the dollar vis-a`-vis previous years has led to higher prices of US$ priced commodities. Third, diet changes around the world, and especially in China and India, have caused a higher demand for meat and thereby for feed grains. Fourth, increased bio-fuel production in the United States, the European Union, and Brazil has increased the demand for feedstock and put pressure on the land area used for food production. The European Union and the United States subsidize production; Brazil is the only competitive producer of biofuel. Fifth, weatherrelated shocks leading to droughts and low harvests have hit countries like Australia and Russia. Finally, financial speculation in agricultural commodity markets may have contributed to food price increases (von Braun and Torero, 2009). Although some of these factors have had greater impact than others, all of them seem to have jointly contributed to the spike in food prices over the past years.

An additional factor that has amplified the rise in the level and volatility of food prices has been the low level of global stocks of food staples. In 2007, the stock-to-use ratio of grains and oilseeds reached the lowest level since 1970. Stocks can function as a buffer for market shocks and thereby dampen the effect on prices. However, as shown in the competitive storage model of Deaton and Laroque (1992), if stocks are very low, shocks in the market will be fully reflected in price behavior. Increased prices will look like spikes, although they reflect the normal price behavior that would exist in the absence of any storage. Since the middle of the 1990s, global food reserves have declined as countries such as China have deliberately reduced their stockholdings and, as a result, shocks to food markets could not be attenuated by releasing accumulated quantities.

Although the food price increases of 2006–2008 seemed drastic compared with previous years, the peak was not higher than others during the past century (Baffes and Haniotis, 2010). Sharp price hikes have been rather infrequent over the past 50 years, but recent forecasts suggest that prices could stay above their 2004 level for some time (Zaman et al., 2008), although wheat and rice prices were expected to decline in 2010 (FAO, 2010b). Volatility is expected to be higher than at the beginning of the century (Headey and Fan, 2008), although implied volatility from the derivate market seems to have stabilized and started to decline again, implying a possible decline in actual price volatility. Nevertheless, the recent crisis makes it clear that stable agricultural production is not only important for food availability, but also for allowing poor households in developing countries to access food supplies at an affordable price.

5.3. Price transmission and stabilization policies

International food prices are an important indicator of the global food situation, but what ultimately matters for the poor and their food security in developing countries are the domestic prices (ig._3)TD$FIG][24]

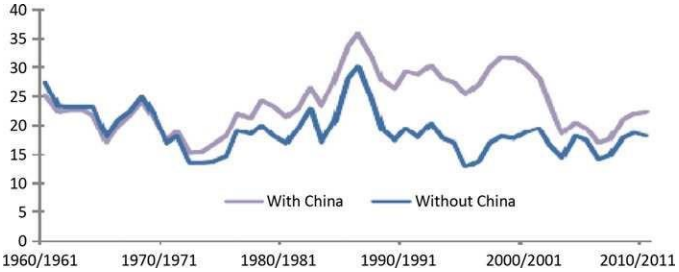

Fig. 3. Global grain stock-to-use ratio (in percent). *Source*: US Department of Agriculture.

they pay for their food. To measure the effect of international food price volatility on the poor requires understanding how much of this volatility is transmitted to domestic markets and passed to consumers. If a country is well integrated into world trade and there are no policy interventions, international prices will be fully transmitted to domestic markets. Evidence on price transmission is mixed. For example, Mundlak and Larson (1992), using a data set for 58 countries over 1968–1978, estimate that international agricultural prices are almost completely transmitted to domestic markets. A disaggregation of prices into single commodities shows that the transmission of wheat prices, for example, is lower than the average for agricultural commodities. Moreover, the authors find that the main part of domestic price instability is caused by volatile international prices. However, Baffes and Gardner (2003), investigating eight developing countries, conclude that international price volatility does not explain a major part of domestic price instability. In only three of the eight countries, price transmission is significant and domestic price volatility follows international price movements. For the recent crisis, Dawe (2008) estimates the transmission of world cereal prices to seven Asian countries. He finds that one-third of real international price increases have been passed to domestic markets. A recent FAO study (2008) finds that, whereas wheat prices in Chile closely followed international prices over 2003–2008, in Argentina there was a substantial gap between domestic and international prices which was augmented over the years (Fig. 3).

Thus, price transmission from international to domestic markets varies across countries and commodities. Trade restrictions and other policy interventions lead to imperfect price transmission. Countries have deliberately made use of market interventions to limit price transmission from international markets in order to stabilize domestic prices. In the 1970s, international commodity agreements, which set a price-band supported by stocks released when prices hit the ceiling and accumulated when prices were near the lower bound of the band, were very common. However, these price-bands soon failed. Numerical analysis reveals that most of the time, prices will be either at the ceiling or at the floor of the defined band, which is in contrast to the aim of stabilizing prices around the middle of the band (Wright, 2009). The success of using buffer stocks to manage the price instability of agricultural commodities is thus limited. For example, Srinivasan and Jha (2001) estimate that India's use of buffer stocks in the wheat market leads to more price volatility than would be observed under liberalized trade.

During the recent food crisis, export bans and other export controls were introduced in several countries. Although they succeeded in stabilizing domestic prices, these export bans led to *more* instability in international rice prices and contributed to the sharp increase in the price of rice (Headey and Fan, 2008). More generally, a country trying to isolate the domestic from the world market imposes more pressure on the international market and hence other countries to absorb shocks, which, in turn, increases international price volatility compared with the free-trade scenario (Bale and Lutz, 1979). If international prices are only partially transmitted to domestic markets, policies meant to stabilize prices may be ineffective. Even if they successfully reduce volatility relative to international prices, the absolute effect on volatility may be negligible because global instability increases at the same time.

New price stabilization mechanisms have been proposed in the recent literature, including an international reserve to which member countries would contribute specified amounts (instead of domestic reserves). The international reserve would be released in times of emergency at the discretion of a supervising committee. Wright (2009), however, suggests that such a global agreement might fail due to lack of commitment by member states. Another related approach to prevent price hikes calls for a virtual reserve that would operate by engaging in the markets whenever prices are outside a specified band (von Braun and Torero, 2009).

5.4. Mitigating food price volatility and ensuring food security

The main reason for price stabilizing efforts by governments and the use of export bans during times of crisis is to ensure food security. Given the mixed success of price stabilizing policies, the question arises whether such policies are necessary to prevent the adverse effects of volatile prices on the poor or other measures, such as

improvement of social safety nets, might be more effective in helping individuals in developing countries to cope with unstable food prices and to guarantee food security.

Governments have used different domestic instruments to protect consumers from high food prices, including food subsidies. In the Middle East and North Africa, subsidies on bread and grain have existed for a long time. In response to the recent food crisis, Yemen and Pakistan introduced subsidies on wheat. Although food subsidies are meant to support the poor, they are often not well targeted. Because they are direct interventions in the market, subsidies can also lower incentives for producers (World Bank, 2008). Social safety net measures such as food-for-work programs, school feeding, and in-cash or in-kind transfers are more targeted instruments that protect consumers from high food prices, but they are less common than market interventions or trade policy measures (Demeke et al., 2008). Bangladesh, for example, recently extended its work-for-food program in response to natural disasters and higher food prices (Coady et al., 2003). It is important that such safety net arrangements be in place before a shock hits in order to be effective. In that case, they can prevent households from falling into chronic poverty by helping them cope with higher food prices.

Most social safety net policies only address long-term poverty and are not tailored to cope with transitory income shocks. Hence, new, innovative approaches have to be developed for social safety nets to respond quickly to unexpected shocks (Byerlee et al., 2010). As a positive example, households that suffered from income shocks and received conditional cash transfers in the Progresa program in Mexico have shown lower school dropout rates than non-recipients (Alderman, 2007; de Janvry et al., 2006). This also suggests that, whereas trade policies or market interventions can only smooth aggregate shocks to food security such as higher overall food prices, social safety net measures can also help to overcome idiosyncratic shocks to households and guarantee adequate food accessibility. Often, however, limited government budgets do not allow for extensive safety nets. As a result, increased productivity in subsistence farming is probably the most effective way to guarantee food security for small farmers. Moreover, investments to increase productivity are long-term instruments for agriculture for development. Although short-term policies to cope with transitory shocks are important, the long-term measures described above—such as increasing productivity, developing more shock-resistant crops, improving farmers' access to modern markets, and creating employment opportunities in the rural non-farm sector—will be necessary to reduce the risk of shocks ex ante and guarantee food security in the future (Byerlee et al., 2010).

6. Conclusion

This paper has reviewed the economic literature related to the role of agriculture in development. Since the key question is how to use agriculture in support of a structural transformation of the economy, we began by examining the role played by agriculture in the development process and its interactions with other sectors. In poor countries, agricultural growth has a huge capacity to reduce poverty. Due to this potential, improving productivity in the agricultural sector in developing countries is critical and an essential step to reach the Millennium Development Goals. Some 75 percent of today's poor living in rural areas would benefit massively from higher incomes in agriculture. Moreover, agriculture also has the potential to generate economic growth in developing economies that depend to a large extent on this sector, for example in many Sub-Saharan African countries. But this presupposes major increases in productivity that depend on a range of factors—new technologies and their adoption, farm size and access to land, and environmental challenges—for which we do not have ''silver bullet'' solutions. The most difficult are institutional challenges related to market failures, missing markets, and property rights.

Agriculture could be an engine of growth and provide employment opportunities for the rural nonfarm economy because of its linkages with small cities and rural areas. Rural development and community-driven development could assist in this process. Governments will need to play an important role for many of the tasks suggested in

this paper. They should not, however, be the only purveyor. The private sector will be the main source of investment funds and a supplier of services. Donors, nongovernmental organizations, and civil society organizations (that benefit from local and external private expertise when implementing projects) will also play a key role. Identifying the right mix of these actors and establishing effective cooperation among them will be important.

New approaches to increase productivity in these countries have to be found. The possibility of further land expansion to increase agricultural output will soon be exhausted and intensification will be the only way to increase productivity in the future. For its Green Revolution, Africa therefore needs high-yielding varieties that are adapted to local conditions. In addition, to guarantee adoption of such crop varieties and integrate small farmers into modern value chains, existing barriers—such as low education, missing infrastructure, lack of credit, and insurance markets—and insecure property rights have to be addressed. Also, new methods of disseminating information and learning, such as the use of communications technology in extension services, could foster adoption and profitable cultivation among farmers. Increasing productivity among smallholders in developing countries would also be an instrument to guarantee food security in the long run.

The literature on the role of agriculture in development has evolved considerably since the days of the Lewis model. Over the past 60 years, countries that we still call ‘‘developing’’ by convention have experienced a huge transformation: China, Brazil, India, and Turkey. Agriculture in developing countries today, for the most part, rests on much sounder macroeconomic fundamentals than before; it has benefitted from important innovations (from new technology to new financial and insurance markets); it is more profitable in both low and high-value product markets; and, as a sector, it is more integrated both within the domestic economy and on a global scale. However, in spite of massive rural-urban migration (and in some cases, mineral export-led growth), in some parts of the world— mainly in Africa—land productivity remains stagnant, resource scarcity and degradation have worsened, and the structural transformation of the economy has stalled. At times, the literature has been helpful in pointing out the complexities of the process of structural transformation of the economy and in highlighting the major institutional and policy stumbling blocks. In our view, two ‘‘scientific revolutions’’ have helped policymakers: the Green Revolution and the recognition that traditional agriculture responds to incentives. Price and trade policies adopted in the vast majority of developing countries have represented an enormous tax on the sector and were ultimately counterproductive for development. It must also be stressed that the (relatively recent) emphasis on empirical analysis has greatly helped to better measure and gauge the impact of certain policies on agriculture.

Overall, as stated by Byerlee et al. (2010), ‘‘the agriculture-for-development mission remains substantially incomplete.’’ There are still major gaps in the research. In our view, economists should focus as a priority on the most pressing issues, which include property rights, agricultural extension, rural infrastructure, and food price stabilization. The most pressing issue at present is to make progress on food security and put in place effective coping mechanisms for poor people. Economists and policymakers have been unable to find adequate policy instruments to limit food price volatility. Macroeconomic approaches to stabilize prices in national markets are not promising. Social safety nets, which help the poor to cope with income shocks, have the potential to mitigate adverse effects and prevent households from falling into chronic poverty, but they require good targeting mechanisms and a stable institutional environment. Beggar-thy-neighbor trade policies to stabilize prices and guarantee national food security have been counterproductive: they have harmed poor populations and reversed some past gains. The best instrument to protect small farmers from income shocks is to increase agricultural productivity—but that is the most scientifically and institutionally difficult challenge.

Acknowledgements
We are grateful to Jock Anderson, Alain de Janvry, Shiva Makki, Will Martin, and an anonymous reviewer for useful comments. Any errors remain entirely ours.

References

Adelman, I., 1984. Beyond export-led growth. World Development 12, 937–949.

Alderman, H., 2007. Managing risk to increase efficiency and reduce poverty. In: Background Paper for the World Development Report 2008, World Bank, Washington, DC.

Aker, J.C., 2010a. Information from markets near and far: mobile phones and agricultural markets in Niger. American Economic Journal: Applied Economics 2, 46–59.

Aker, J.C., 2010b. Dial A for agriculture: using information and communication technologies for agricultural extension in developing countries. In: Paper Presented at the Conference Agriculture for Development-Revisited, University of California at Berkeley, CA, October 1–2.

Aksoy, M.A., Ng, F., 2010. The evolution of agricultural trade flows. In: Policy Research Working Paper 5308, World Bank, Washington, DC.

Alex, G., Zijp, W., Byerlee, D., 2002. Rural extension and advisory services – new directions. In: Rural Strategy Background Paper 9, World Bank, Washington, DC.

Anderson, J.R., Feder, G., 2007. Agricultural extension. In: Evenson, R., Pingali, P. (Eds.), Handbook of Agricultural Economics, vol. 3. North Holland, Amsterdam, pp. 2343–2378.

Anderson, K. (Ed.), 2009. Distortions to Agricultural Incentives: A Global Perspective, 1955–2007. Palgrave Macmillan, Basingstoke, and World Bank, Washington, DC.

Anderson, K., Martin, W., 2005. Agricultural trade reform and the Doha development agenda. World Economy 28, 1301– 1327.

Anderson, K., Cockburn, J., Martin, W., 2011. Would freeing up world trade reduce poverty and inequality? The vexed role of agricultural distortions. The World Economy 34, 487–515.

Azariadis, C., Stachurski, J., 2005. Poverty traps. In: Aghion, P., Durlauf, S.N. (Eds.), Handbook of Economic Growth, vol. 1A. North Holland, Amsterdam, pp. 295–384.

Baffes, J., Gardner, B., 2003. The transmission of world commodity prices to domestic markets under policy reforms in developing countries. Journal of Economic Policy Reform 6, 159–180.

Baffes, J., Haniotis, T., 2010. Placing the 2006/08 commodity price boom into perspective. In: Policy Research Working Paper 5371, World Bank, Washington, DC.

Bale, M., Lutz, E., 1979. The effects of trade intervention on international price instability. American Journal of Agricultural Economics 61, 512–516.

Bardhan, P., Mokherjee, D. (Eds.), 2006. Decentralization and Local Governance in Developing Countries. The MIT Press, Cambridge, MA.

Barrett, C.B., Reardon, T., Webb, P., 2001. Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications. Food Policy 26, 3151–3331.

Barrett, C.B., 2002. Food security and food assistance programs. In: Gardner, B.L., Rausser, G.C. (Eds.), Handbook of Agricultural Economics, vol. 1B. North Holland, Amsterdam, pp. 2103–2190.

Barrett, C., Carter, M.R., Timmer, C.P., 2010. A century-long perspective on agricultural development. American Journal of Agricultural Economics 92, 447–468.

Besley, T., Burgess, R., 2000. Land reform, poverty reduction, and growth: evidence from India. The Quarterly Journal of Economics 115, 389–430.

Bezemer, D., Headet, D., 2008. Agriculture, development, and urban bias. World Development 36, 1342–1364.

Binswanger, H.P., Deininger, K., Feder, G., 1995. Power, distortions, revolt and reform in agricultural land relations. In: Behrman, J., Srinivasan, T.N. (Eds.), Handbook of Development Economics, vol. 3B. North Holland, Amsterdam, pp. 2659–2772.

Binswanger, H.P., 1998. Agricultural and rural development: painful lessons. In: Eicher, C.K., Staatz, J.M. (Eds.), International Agricultural Development. Third Edition. John Hopkins University Press, Baltimore and London, pp. 287– 299.

Binswanger-Mkhize, H., McCalla, A.F., 2010. The changing context and prospects for agricultural and rural development in Africa. In: Evenson, R., Pingali, P. (Eds.), Handbook of Agricultural Economics, vol. 4. North Holland, Amsterdam, pp. 3571– 3712.

Birkhaeuser, D., Evenson, R., Feder, G., 1991. The economic impact of agricultural extension: a review. Economic Development and Cultural Change 39, 607–650.

Braverman, A., Stiglitz, J.E., 1982. Sharecropping and the interlinking of agrarian markets. The American Economic Review 72, 695–715.

Bravo-Ortega, C., Lederman, D., 2005. Agriculture and national welfare around the world: causality and international heterogeneity since 1960. In: Policy Research Working Paper 3499, World Bank, Washington, DC.

Brooks, K., 2010. African agriculture–What do we know? What do we need to know?. In: Presentation at the Conference Agriculture for Development-Revisited, University of California at Berkeley, CA, October 1–2.

Byerlee, D., de Janvry, A., Sadoulet, E., 2010. Agriculture for development – revisited. Lessons learned from the University of California at Berkeley conference.In: Paper Presented at the Conference Agriculture for Development – Revisited, University of California at Berkeley, CA, October 1–2.

Ceccarelli, S., Grando, S., 2007. Decentralized-participatory plant breeding: an example of demand driven research. Euphytica 155, 349–360.

Chapman, R., Slaymaker, T., 2002. ICTs and rural development: review of the literature, current interventions and opportunities for action. In: Working Paper 192, Overseas Development Institute, London.

Carter, M., 1986. The economics of price scissors: comment. The American Economic Review 76, 1192–1194.

Chavas, J.-P., 2001. Structural change in agricultural production: economics, technology and policy. In: Gardner, B.L., Rausser, G.C. (Eds.), Handbook of Agricultural Economics, vol. 1A. North Holland, Amsterdam, pp. 263–285. Chenery, H., Syrquin, M., 1975. Patterns of Development, 1950–1970. Oxford University Press, Oxford.

Christiaensen, L.J., Demery, L., 2007. Down to Earth: Agriculture and Poverty in Africa. World Bank, Washington, DC.

Christiaensen, L.J., Demery, L., Kuhl, J., 2010. The (evolving) role of agriculture in poverty reduction – an empirical perspective. Journal of Development Economics 96, 239–254.

Coady, D., Grosh, M.E., Hoddinott, J., 2003. Targeting of Transfers in Developing Countries: Review of Lessons and Experience. World Bank, Washington, DC.

Conquest, R., 1987. The Harvest of Sorrow: Soviet Collectivization and the Terror-Famine. Oxford University Press, Oxford.

Conning, J., Kevane, M., 2002. Community-based targeting mechanisms for social safety nets: a critical review. World Development 30, 375–394.

Conway, G., Toenniessen, G., 2003. Science for African food security. Science 299, 1187–1188.

Croppenstedt, A., Demeke, M., Meschi, M.M., 2003. Technology adoption in the presence of constraints: the case of fertilizer demand in Ethiopia. Review of Development Economics 7, 58–70.

Cypher, J.M., Dietz, J.L., 2008. The Process of Economic Development. Routledge, Oxon.

Datt, G., Ravallion, M., 1996. How important to India's poor is the sectoral composition of economic growth? The World Bank Economic Review 10, 1–25.

Datt, G., Ravallion, M., 1998. Farm productivity and rural poverty in India. Journal of Development Studies 34, 62–85.

Dawe, D., 2008. Have recent increases in international cereal prices been transmitted to domestic economies? The experience in seven large Asian countries. In: ESA Working Paper 08-03, FAO, ESA, Rome.

Deaton, A., Laroque, G., 1992. On the behaviour of commodity prices. The Review of Economic Studies 59, 1–23.

De Gorter, H., Swinnen, J., 2002. Political economy of agricultural policy. In: Gardner, B.L., Rausser, G.C. (Eds.), Handbook of Agricultural Economics, vol. 2B. North Holland, Amsterdam, pp. 1893–1943. de Janvry, A., 1981. The role of land reform in economic development: policies and politics. American Journal of Agricultural Economics 63, 384–392.

de Janvry, A., Sadoulet, E., Murgai, R., 2002. Rural development and rural policy. In: Gardner, B.L., Rausser, G.C. (Eds.), Handbook of Agricultural Economics, vol. 2A. North Holland, Amsterdam, pp. 1593–1658. de Janvry, A., Finan, F., Sadoulet, E., Vakis, R., 2006. Can conditional cash transfer programs serve as safety nets in keeping children at school and from working when exposed to shocks? Journal of Development Economics 79, 349–373.

de Janvry, A., Dethier, J.-J., 1985. Technological innovation in agriculture: the political economy of its rate and bias. In: CGIAR Study Paper 1, World Bank, Washington, DC. de Janvry, A., Sadoulet, E., 2009a. Agriculture for development: lessons from the World Development Report 2008. QA Rivista dell'Associazione Rossi-Doria 1, 9–24. de Janvry, A., Sadoulet, E., 2009b. Agricultural growth and poverty reduction: additional evidence. The World Bank Research Observer 25, 1–20.

Demeke, M., Pangrazio, G., Maetz, M., 2008. Country Responses to the Food Security Crisis: Nature and Preliminary Implications of the Policies Pursued. Agricultural Policy Support Service, FAO, Rome.

Dercon, S., Christiaensen, L.J., 2005. The Impact on Poverty of Policies to Stimulate Modern Input Adoption: The Case of Fertilizer in Ethiopia. Mimeo, World Bank, Washington, DC.

Dercon, S., Christiaensen, L.J., 2007. Consumption risk, technology adoption, and poverty traps: evidence from Ethiopia. In: Policy Research Working Paper 4257, World Bank, Washington, DC.

Dercon, S., 2009. Rural poverty: old challenges in new contexts. The World Bank Research Observer 24, 1–28.

Dethier, J.-J., 1999. Governance and poverty. Quarterly Journal of International Agriculture 38, 293–314.

Diao, X., Hazell, P., Resnick, D., Thurlow, J., 2006. The role of agriculture in development: implications for Sub-Saharan Africa. In: DSGD Discussion Paper 29, IFPRI, Washington, DC.

Dorward, A., Chirwa, E., Boughton, D., Crawford, E., Jayne, T., Slater, R., Kelly, V., Tsoka, M., 2008. Towards smart subsidies in agriculture? Lessons from recent experience in Malawi. In: Natural Resource Perspectives 116, Overseas Development Institute (ODI), London.

Dorward, A., Kydd, J., Poulton, C., 2005. Beyond liberalisation: 'Developmental Coordination' policies for African smallholder agriculture. IDS Bulletin 36, 80–85.

Eastwood, R., Lipton, M., Newell, A., 2010. Farm size. In: Evenson, R., Pingali, P. (Eds.), Handbook of Agricultural Economics, vol. 4. North Holland, Amsterdam, pp. 3323–3397.

Edmeades, S., Smale, M., 2006. A trait-based model of the potential demand for a genetically engineered food crop in a developing economy. Agricultural Economics 35, 351–361.

Eicher, C.K., Maredia, K., Sithole-Niang, I., 2006. Crop biotechnology and the African farmer. Food Policy 31, 504–527.

Engel, E., Fischer, R.D., Galetovic, A., 2008. The basic public finance of public–private partnerships. In: Yale University Economic Growth Center Discussion Paper 957, New Haven, CT.

Estudillo, J.P., Otsuka, K., 2010. Rural poverty and income dynamics in Southeast Asia. In: Evenson, R., Pingali, P. (Eds.), Handbook of Agricultural Economics, vol. 4. North Holland, Amsterdam, pp. 3435–3468.

Eswaran, M., Kotwal, A., 1993. Export led development primary vs. industrial exports. Journal of Development Economics 41, 163–172.

Fan, S., Mogues, T., Benin, S., 2009. Setting priorities for public spending for agriculture and rural development in Africa. In: IFPRI Policy Brief 12, IFPRI, Washington, DC.

FAO, 2008. Financial mechanisms for adaption to and mitigation of climate change in the food and agriculture sectors. In: HighLevel Conference on World Food Security: The Challenges of Climate Change and Bioenergy, FAO, Rome.

FAO, 2010a. Price surges in food markets. In: Economic and Social Perspective Policy Brief 9, FAO, Rome. FAO, 2010b. Food Outlook Global Market Analysis June 2010. FAO, Rome.

Feder, G., 1993. The economics of land and titling in Thailand. In: Hoff, K., Braverman, A., Stiglitz, J.E. (Eds.), The Economics of Rural Organization. Oxford University Press, San Jose, pp. 259–268.

Foster, A., Rosenzweig, M., 2003. Agricultural Development, Industrialization and Rural Inequality. Mimeo, Brown University, Providence, RI, and Harvard University, Cambridge, MA.

Foster, A., Rosenzweig, M., 2010a. Microeconomics of technology adoption. In: Economic Growth Center Discussion Paper 984, Yale University, New Haven, CT.

Foster, A., Rosenzweig, M., 2010b. Barriers to farm profitability in India: mechanization, scale and credit markets. In: Paper

Presented at the Conference Agriculture for Development – Revisited, University of California at Berkeley, CA, October 1–2.

Foster, V., Briceno-Garmendia, C., 2010. Africa's Infrastructure – A Time for Transformation. World Bank, Washington, DC.

Gardner, B., 2005. Causes of rural development. Agricultural Economics 32, 21–41.

Ghatak, M., Roy, S., 2007. Land reform and agricultural productivity in India: a review of the evidence. Oxford Review of Economic Policy 23, 251–269.

Gollin, D., Morris, M., Byerlee, D., 2005. Technology adoption in intensive post-Green Revolution systems. American Journal of Agricultural Economics 87, 1310–1316.

Gollin, D., 2010. Agricultural productivity and economic growth. In: Evenson, R., Pingali, P. (Eds.), Handbook of Agricultural Economics, vol. 4. North Holland, Amsterdam, pp. 3825–3866.

Gonzales, L.A., Kasryno, F., Perez, N.D., Rosegrant, M., 1993. Economic incentives and comparative advantage in Indonesian food crop production. In: Research Report 93, IFPRI, Washington, DC.

Goyal, A., 2010. Information, direct access to farmers, and rural market performance in Central India. In: Policy Research Working Paper 5315, World Bank, Washington, DC.

Hazell, P., Haggblade, S., 1993. Farm-nonfarm growth linkages and the welfare of the poor. In: Lipton, M., van der Gaag, J. (Eds.), Including the Poor. World Bank,, Washington, DC, pp. 190–204.

Hazell, P., Poulton, C., Wiggings, S., Dorward, A., 2010. The future of small farms: trajectories and policy priorities. World Development 38, 1349–1361.

Hayami, Y., Ruttan, V.W., 1971. Agricultural Development: An International Perspective (Second Edition, 1985). Johns Hopkins University Press, Baltimore, MD.

Headey, D., Fan, S., 2008. Anatomy of a crisis: the causes and consequences of surging food prices. Agricultural Economics 39, 375–391.

Himanshu, Lanjouw, P., Mukhopadhyay, A., Murgai, R., 2010. Non-farm diversification and rural poverty decline: a perspective from Indian sample survey and village study data. In: Paper Presented at the Conference Agriculture for Development – Revisited, University of California at Berkeley, CA, October 1–2.

Holdcroft, L.E., 1978. The rise and fall of community development, 1950–65. In: Eicher, C.K., Staatz, J.M. (Eds.), Agricultural Development in the Third World. John Hopkins University Press, Baltimore, MD, and London, pp. 46–58.

Independent Evaluation Group (IEG), 2011. Evaluative lessons for agriculture and agribusiness. In: ECG Paper 3, World Bank, Washington, DC.

International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), 2009. Agriculture at a crossroads. In: McIntyre, B., Herren, H.R., Wakhungu, J., Watson, R.T. (Eds.), Synthesis Report. IAASTD, Washington, DC.

Irz, X., Lin, L., Thirtle, C., Wiggins, S., 2001. Agricultural productivity growth and poverty alleviation. Development Policy Review 19, 449–466.

Ivanic, M., Martin, W., 2008. Implications of higher global food prices for poverty in low-income countries. Agricultural Economics 39, 405–416.

Jack, B.K., 2009. Barriers to the adoption of agricultural technologies in developing countries. In: Draft White Paper for Agricultural Technology Adoption Initiative, Center of Evaluation for Global Action at the University of California, Berkeley, CA.

Johnston, B.F., Mellor, J.W., 1961. The role of agriculture in economic development. The American Economic Review 51, 566– 593.

Krueger, A., Schiff, M., Valdes, A., 1991. The Political Economy of Agricultural Pricing, 5 Volumes. John Hopkins University Press for the World Bank, Washington, DC.

Kuznets, S., 1966. Modern Economic Growth: Rate, Structure, and Spread. Yale University Press, New Haven, CT.

Kydd, J., Dorward, A., 2004. Implications of market and coordination failures for rural development in least developed countries. Journal of International Development 16, 951–970.

Laffont, J.-J., Matoussi, M.S., 1995. Moral hazard, financial constraints and sharecropping in El Oulja. Review of Economic Studies 62, 381–399.

Lanjouw, P., 1999. The Rural Non-Farm Sector: A Note on Policy Options. Mimeo, World Bank, Washington, DC.

Lanjouw, P., 2001. Nonfarm employment and poverty in rural El Salvador. World Development 29, 529–547.

Lanjouw, J.O., Lanjouw, P., 1995. Rural nonfarm employment. In: Policy Research Working Paper 1463, World Bank, Washington, DC.

Lanjouw, J.O., Lanjouw, P., 2001. The rural non-farm sector: issues and evidence from developing countries. Agricultural Economics 26, 1–23.

Lanjouw, P., Ravallion, M., 1999. Benefit incidence, public spending reforms and the timing of program capture. The World Bank Economic Review 13, 257–273.

Lele, U., 1975. The Design of Rural Development: Lessons from Africa. John Hopkins University Press, Baltimore, MD.

Lewis, W.A., 1954. Economic development with unlimited supply of labour. Manchester School of Economic and Social Studies 22, 139–191.

Loayza, N.V., Raddatz, C., 2010. The composition of growth matters for poverty alleviation. Journal of Development Economics 93, 137–151.

Mansuri, G., Rao, V., 2004. Community-based and -driven development: a critical review. The World Bank Research Observer 19, 1–39.

Marenya, P.P., Barrett, C., 2009. State-conditional fertilizer yield response on Western Kenyan farms. American Journal of Agricultural Economics 91, 991–1006.

Matsumoto, T., Yamano, T., 2009. Soil fertility, and the maize Green Revolution in East Africa. In: Policy Research Paper 5158, World Bank, Washington, DC.

Matsuyama, K., 1992. Agricultural productivity, comparative advantage, and economic growth. Journal of Economic Theory 58, 317–334.

Mearns, R., 1995. Access to land in rural India. In: Policy Research Working Paper 2123, World Bank, Washington, DC.

Mellor, J.W., 2001. Faster more equitable growth – agriculture, employment multipliers and poverty reduction. Agricultural Policy Development Project Research Report 4, Cambridge, MA.

Mundlak, Y., Larson, D.F., 1992. On the transmission of world agricultural prices. World Bank Economic Review 6, 399–422.

Otsuka, K., Hayami, Y., 1988. Theories of share tenancy: a critical review. Economic Development and Cultural Change 37, 31– 68.

Pan, L., Christiaensen, L., 2011. Who Is vouching for the input voucher? Decentralized targeting and elite capture in Tanzania. In: Policy Research Working Paper 5651, World Bank, Washington, DC.

Pardey, P., Alston, J., James, J., Glewwe, P., Binenbaum, E., Hurley, T., Wood, S., 2007. Science, technology and skills. In: Background Paper for the World Development Report 2008, World Bank, Washington, DC.

Place, F., Hazell, P., 1993. Productivity effects of indigenous land tenure systems in Sub-Saharan Africa. American Journal of Agricultural Economics 75, 10–19.

Ranis, G., Fei, J.C.H., 1961. A theory of economic development. The American Economic Review 51, 533–565.

Reardon, T., 1997. Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. World Development 25, 735–747.

Reardon, T., Barrett, C., Berdegue, J., 2009. Agrifood industry transformation and small farmers in developing countries. World Development 37, 1717–1727.

Reardon, T., Barrett, C., Kelly, V., Savadogo, K., 1999. Policy reforms and sustainable agriculture intensification in Africa. Development Policy Review 17, 375–395.

Ruttan, V.W., 1998. Models of agricultural development. In: Eicher, C.K., Staatz, J.M. (Eds.), International Agricultural Development. Third Edition. John Hopkins University Press, Baltimore, MD, and London, pp. 155–162.

Ruttan, V.W., 2002. Productivity growth in world agriculture: sources and constraints. Journal of Economic Perspectives 16, 161–184.

Sah, R.K., Stiglitz, J.E., 1984. The economics of price scissors. The American Economic Review 74, 125–138.

Savadogo, K., Reardon, T., Pietola, K., 1998. Adoption of improved land use technologies to increase food security in Burkina Faso: relating animal traction, productivity, and non-farm income. Agricultural Systems 58, 441–464.

Self, S., Grabowski, R., 2007. Economic development and the role of agricultural technology. Agricultural Economics 36, 395– 404.

Schultz, T.W., 1964. Transforming Traditional Agriculture. Yale University Press, New Haven, CT.

Sen, A., 1981. Ingredients of famine analysis: availability and entitlements. Quarterly Journal of Economics 96, 433–464.

Singer, H., 1979. Policy implications of the Lima target. Industry and Development 3, 17–22.

Srinivasan, P.V., Jha, S., 2001. Liberalized trade and domestic price stability. The case of rice and wheat in India. Journal of Development Economics 65, 417–441.

Staatz, J.M., Dembele, N.N., 2007. Agriculture for development in Sub-Saharan Africa. In: Background Paper for the World Development Report 2008, World Bank, Washington, DC.

Staatz, J.M., Eicher, C.K., 1984. Agricultural development ideas in historical perspective. In: Eicher, C.K., Staatz, J.M. (Eds.), International Agricultural Development. John Hopkins University Press, Baltimore, MD, and London, pp. 3–30.

Suri, T., 2009. Selection and comparative advantage in technology adoption. National Bureau of Economic Research Working Paper 15346, London.

Thirtle, C., Lin, L., Piesse, J., 2003. The impact of research-led agricultural productivity growth on poverty reduction in Africa, Asia and latin America. World Development 31, 1959–1975.

Tiffin, R., Irz, X., 2006. Is agriculture the engine of growth? Agricultural Economics 35, 79–89.

Timmer, C.P., 2002. Agriculture and economic development. In: Gardner, B.L., Rausser, G.C. (Eds.), Handbook of Agricultural Economics, vol. 2A. North Holland, Amsterdam, pp. 1487–1546.

Timmer, C.P., 2008. Causes of high food prices. Asian Development Bank Economics Working Paper Series 128, Manila.

Torlesse, H., Kiess, L., Bloem, M.W., 2003. Association of household rice expenditure with child nutritional status indicates a role for macroeconomic food policy in combating malnutrition. The Journal of Nutrition 133, 1320–1325.

Trostle, R., 2008. Global agricultural supply and demand factors contributing to the recent increase in food commodity prices. In: Economic Research Service WRS 0801, US Department of Agriculture, Washington, DC.

Valenzuela, E., van der Mensbrugghe, D., Anderson, K., 2009. General equilibrium effects of price distortions on global markets, farm incomes and welfare. In: Anderson, K. (Ed.), Distortions to Agricultural Incentives: A Global Perspective 1955–2007. Palgrave Macmillan/World Bank, Basingstoke/Washington, DC, pp. 505–563.

Von Braun, J., Torero, M., 2009. Implementing physical and virtual food reserves to protect the poor and prevent market failure. In: Policy Brief 10, IFPRI, Washington, DC.

Webb, P., Reardon, T., 1992. Drought impact and household response in East and West Africa. Quarterly Journal of International Agriculture 31, 230–246.

Wodon, Q., Zaman, H., 2008. Rising food prices in Sub-Saharan Africa: poverty impact and policy responses. In: Policy Research Working Paper 4738, World Bank, Washington, DC.

World Bank, 2003. Land Policies for Growth and Poverty Reduction. World Bank/Oxford University Press, Washington, DC/ Oxford.

World Bank, 2007. World Development Report 2008: Agriculture for Development. World Bank/Oxford University Press, Washington, DC/Oxford.

World Bank, 2008. Rising food prices: policy options and World Bank response. In: Background Note, World Bank, Washington, DC.

Wright, B., 2009. International grain reserves and other instruments to address volatility in grain markets. In: Policy Research Working Paper 5028, World Bank, Washington, DC.

Zaman, H., Delgado, C., Mitchell, D., Revenga, A., 2008. Rising food prices. Development Outreach 10, 6–12.

Zezza, A., Winters, P., Davis, B., Carletto, G., Covarrubias, K., Quinones, E., Stamoulis, K., Karfakis, T., Tasciotti, L., DiGiuseppe, S., Bonomi, G., 2007. Rural household access to assets and agrarian institutions: A cross country comparison. In: ESA Working Paper 07-17, FAO, ESA, Rome.