Agricultural Productivity and Poverty Reduction: Linkages and Pathways

By Kate Schneider and Professor Mary Kay Gugerty

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Evans School Policy Analysis and Research (EPAR)
Professor Leigh Anderson, PI and Lead Faculty
Associate Professor Mary Kay Gugerty, Lead Faculty

This literature review identifies the linkages between increases in agricultural productivity and poverty reduction. The evidence suggests that there are multiple pathways through which increases in agricultural productivity can reduce poverty, including real income changes, employment generation, rural non-farm multiplier effects, and food prices effects. However, barriers to technology adoption, initial asset endowments, and constraints to market access may all inhibit the ability of the poorest to participate in the gains from agricultural productivity growth.

Agricultural productivity is defined in several ways throughout the literature, including as general output per unit of input, farm yield by crop or total output per hectare, and output per worker. Regardless of which measure is used, empirical studies support the idea that improvements in agricultural productivity are important for poverty reduction (Mellor 1999). However, productivity growth can catalyze a wide range of direct and indirect effects that mediate the pathways to poverty alleviation (Thirtle et al. 2003). The appropriate methodology for measuring agricultural productivity is also the subject of debate; this brief sets aside these methodological debates and takes the productivity measures in the various studies as a given.

An overview of several studies illustrates the variety of approaches contributing to the consistent finding that agricultural productivity is important for poverty reduction. Datt and Ravallion (1998) found output per unit of land to be statistically significant as a determinant of the squared poverty gap (using national, annual Indian data). Timmer (1997) uses output per worker as the productivity measure, which Mellor (1999) agrees is a better measure of productivity to identify linkages to non-agricultural growth since it encapsulates the additional ways through which farm households earn income. Byerlee, Diao and Jackson (2009)

Kate Schneider has been a research assistant conducting agricultural development research with the Evans School Policy Analysis & Research Group for the past two years. She graduated with a Master of Public Administration in June 2011 and will be working this summer in Ethiopia. She can be contacted at schneider.kate1@gmail.com.
review 12 country case studies and use bivariate analysis to compare agricultural growth per worker across countries. They show that the countries with the highest agricultural growth per worker experienced the greatest rate of rural poverty reduction (Byerlee, Diao, and Jackson 2009). Fan, Hazell and Thorat (1999) measure the relationship between total factor productivity and poverty outcomes by investigating returns on different productivity increasing investments. They find that investments in roads, agricultural research, development, and extension had the greatest impact on both productivity and poverty reduction (Fan, Hazell, and Thorat 1999).

I. THEORETICAL BACKGROUND

This brief attempts to distinguish between increases in output and in productivity since these do not necessarily have similar impacts, however, the literature is not always clear on this distinction. In some cases, output and productivity increase together. In other cases they can vary inversely with differential consequences for poverty. A new technology, for example, can have a variety of impacts with different consequences for output, profits and employment. First, if the technology reduces needed inputs, production costs will decrease (raising profits), but output may not be affected and employment could be reduced. If instead the technology raises yields, output and (most likely) employment will increase, but profits will not necessarily increase. Alternatively, if the technology raises labor productivity, wage rates will increase but probably at the expense of the quantity of labor employed, and with unclear effects on profits and output. A technology that permits expansion of cultivated area, might raise output, employment and profits, but is likely to lower yields. Finally, productivity gains may not result in poverty reduction if the decline in output prices outweighs the gain from increased productivity (Thirtle et al. 2001). The complex relationships between direct and indirect general equilibrium effects underpin the following discussion of linkages between agricultural productivity and poverty reduction.

Agriculture and Economic Growth

Computable general equilibrium (CGE) models typically use data on the production structure of a given country to estimate how an economy responds to a shock or a change in policy. Several country level CGE models demonstrate the multiplier effects of agricultural growth in other sectors of the economy (Coxhead and Warr 1991, De Franco and Godoy 1993, Datt and Ravallion 1996). As Figure 1 illustrates, poorer households appear to benefit more than less poor households from a 1% increase in GDP, in terms of increases expenditure. Furthermore, agriculturally driven growth generates a larger welfare effect than non-agriculturally driven growth, especially for the poorest 20% of the population (World Bank 2007). Irz et al. (2001) find that the most direct contribution of agricultural (sector) growth is through generating higher incomes for farmers. The general equilibrium effects linking agricultural and overall economic growth have been modeled.
with increasing degrees of sophistication. Although the model results are generally supported by empirical evidence, no single comprehensive or generally accepted model has emerged (Thirtle et al. 2001). Similarly, in a cross-country sample, Gallup et al. (1997) find a 1% increase in agricultural GDP leads to a 1.61% increase in the incomes of the poorest quintile (Irz et al. 2001, Thirtle et al. 2001). While empirical evidence confirms the presence of agricultural multiplier effects, their strength depends on the structure of the economy since nontradable goods will generate more local economic activity. For example, small economies with large tradable sectors, such as Lesotho, experience smaller multipliers from agricultural growth than larger economies with a greater share of nontradable goods and services, such as Cameroon, Nigeria and Tanzania (World Bank 2007)

While it has been long hypothesized that agricultural growth contributes to poverty reduction, the large data sets providing empirical evidence to support this hypothesis are relatively new. These include large-scale sample surveys from the Indian Statistical Institute, Deininger and Squire’s (1996) cross-country data, and panel data from China and several other South Asian economies covering their periods of rapid economic growth. Using these data sets, Ravallion and colleagues at the World Bank and Timmer at Harvard conducted a series of studies using very different methodologies that all demonstrate the importance of the structure of growth for poverty reduction. Ravallion and Datt (1996) built a CGE model, mentioned above, to demonstrate that growth in the agricultural sector is a key determinant of poverty alleviation in India. They show that rural growth also contributes to urban poverty alleviation, but also show that urban growth appears to have no affect on rural poverty. Other micro-level empirical studies support these findings in many other settings including Wodon (1999) in Bangladesh, Thorbecke and Jung (1996) in Indonesia, and Timmer (1995) in Kenya (Irz et al. 2001).

**Agricultural Productivity Growth**

“History suggests the necessity of productivity increases in smallholder agriculture. Except for a handful of city-states, there are virtually no examples of mass poverty reduction since 1700 that did not start with sharp rises in employment and self-employment income due to higher productivity in small family farms.” –Jayne et al., 2010 (Jayne, Mason, Myers, Ferris, Mather, Beaver, Lenski, Chapoto and Boughton 2010, x).

Bravo-Ortega and Lederman (2005) find that agricultural labor productivity (output per worker) has a significant effect on the average income of the first income quintile (the poorest) and this relationship is consistent across regions. However, they also show that agricultural productivity has a smaller effect on the incomes of the poorest than non-agricultural labor productivity. Agricultural
productivity explains an increasing share of the income for quintiles two and three (the second poorest and median quintiles) for poor countries (Bravo-Ortega and Lederman, 2005). This is consistent with evidence on the impact of wage employment and rural non-farm economic growth on poverty reduction discussed below. Finally, Bravo-Ortega and Lederman (2005) also find that richer quintiles benefit more from advances in agricultural labor productivity than the poorest households. This last point is consistent with the importance of assets to gain from productivity increases, also discussed further below.

*Increasing Farm Productivity and Output*

Success stories of agricultural productivity growth in Africa can be found in both farm and off-farm sectors of food and fiber systems. Among such successes are diversification away from cereals, localized yield improvements (such as rice in Mali), development of higher yielding maize varieties, increased production of non-cereal staples such as cassava, increased productivity of cotton in francophone Africa, increased successful participation in high value crops (such as horticulture in East Africa and specialty coffee in Rwanda), and increased efficiency in marketing staples (Staatz and Dembélé 2008). Staatz and Dembélé note that these successes have been mostly demand-driven or have addressed market failures such as asymmetric information or problems in input markets. In other cases, such as rice production in Mali, careful sequencing of technology development, institutional changes, and sectoral and macroeconomic reforms drove productivity improvements (Staatz and Dembélé 2008).

*Multiplier and General Equilibrium Effects*

Agricultural productivity growth can drive rural growth and catalyze a pro-poor development process (Thirtle et al. 2001). In theory, increasing agricultural production (output) increases incomes for poor farmers who then increase demand for the goods and services produced by the non-farming rural poor (Mellor 1999). Higher agricultural output thus stimulates employment in the rural and urban non-farm sectors through both forward and backward linkages (Hanmer and Naschold 2000). This in turn decreases urban poverty by slowing migration to urban areas and lowering food prices (Mellor 1999). Thus, agricultural growth benefits poor farmers and landless laborers by increasing both production and employment, benefitting both the urban and rural poor through growth in the rural non-farm economy (Thirtle, Lin, and Piesse 2003). The full general equilibrium effects of this growth thus take place through the farm, rural non-farm and national economies, as summarized in Table 1 (Irz et al. 2001).

There are also several additional linkages and multiplier effects that may arise between increased agricultural output and other measures of welfare, however, little research has been done to verify these hypotheses or measure their impact (Irz et al. 2001). Among these, Timmer (1995) theorizes that increased food production and farm incomes allow for better nutrition and increased investment in health and education. Irz et al. (2001) also suggest that growth in the farm sector could stimulate demand for infrastructure and generate the increased tax revenue to finance it, as well as generate social capital accumulation through increased interactions between farmers and
other agents in the agricultural supply chain and related sectors.

Price Effects

Agricultural productivity determines the price of food, which then determines wage costs and the competitiveness of tradable goods leading to a confluence of effects that determine the real income effects of increased output for farming households (World Bank 2007). Increased agricultural output can change the relative prices of agricultural outputs in relation to substitute or complimentary products, as well as the costs of inputs to production (Irz et al. 2001). If increased output drives down product prices or the costs of production rise due to increased demand, then increased agricultural output may not translate into higher real farm income (Irz et al. 2001). Output growth may not increase farm household incomes if the price effects counteract the production gain, however food price effects depend upon the tradability of the food. Staple food crops in agriculturally based developing countries are largely nontradable because they consist of foods (cassava, sorghum, millet, etc.) that do not have international markets and because the domestic food economy remains relatively insulated by high transport and marketing costs. Since they are nontradable, their price is not influenced by competition in the international market (World Bank 2007).

Figure 2 illustrates the complexity of the pathways between increasing agricultural productivity and poverty reduction, in a semi-closed rural economy where food output is at least partially tradable (i.e. regionally). The price effects in the market for farm output determine the income effect of increased output for farm households. These price effects also send feedback to the

\begin{table}
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\begin{tabular}{|l|}
\hline
\textbf{Farm Economy} \\
\hline
Higher incomes from farm output \\
On-farm employment \\
\hline
\textbf{Rural Economy} \\
\hline
More jobs upstream and downstream in agriculture & food value chains \\
Employment in expanding rural non-farm sectors \\
Increased incomes and employment allow better nutrition, health & increased investment in education leading indirectly to higher labor productivity \\
Generates more local tax revenue & demand for better infrastructure, contributing to second round effects promoting the rural economy \\
Linkages in production chain generate trust & information, build social capital and facilitate non-farm investment \\
\hline
\textbf{National Economy} \\
\hline
Reduced prices of food & raw materials raises real wages of the urban poor, reduces wage costs of non-farm sectors \\
Generation of savings & taxes from farming allows investment in non-farm sector, creating jobs and incomes in other sectors \\
Earning of foreign exchange allows import of capital goods & essential inputs for non-farm production \\
Release of farm labor allows production in other sectors \\
\hline
\end{tabular}
\caption{ Poverty Reduction Pathways through Increased Agricultural Production}
\end{table}

producer that determines future desired output levels. Production decisions cause responses in the labor market that shift the demand for food as rural households can afford to consume more (or cannot afford to consume as much). The most favorable outcome for the poor occurs when the new general equilibrium increases both farm incomes and the real wage rate, spurring multiplier effects in the rural non-farm economy that increase real household incomes for farming and non-farming households and decrease poverty.

II. EMPIRICAL EVIDENCE

Figure 2. Pathways to Decrease Poverty through Increased Agricultural Productivity

**Poverty Reduction through Increased Agricultural Productivity**

Only one study (reported in both Thirtle et al., 2001 and Irz et al. 2001) models the direct relationship between agricultural productivity and changes in poverty measures at the macroeconomic level across countries. The authors examine the impact of land and labor productivity (yield and the land-to-labor ratio) as well as total factor productivity (agricultural value added) on the percentage of the population living on less than US$1 per day (the headcount index) using country-level data from the 2000 World Development Report. Thirtle et al.’s (2001) findings suggest that agricultural productivity growth has a robust and consistent impact on poverty for all productivity measures. They calculate that a 1% increase in productivity is associated with a decrease of 0.62% to 1.3% in the percent of the population below the US$1 per day poverty line. Additionally, the authors regress the productivity measures against the human development index.
and find that raising yields by 1% is associated with a 0.12% increase in the HDI (Thirtle et al. 2001). However, these data are single-year snapshots aggregated at the country level from multiple years, depending on each country’s most recent census, national household survey or index calculation, which limits the ability to make causal inferences from these findings.

Nontradable Staple Food Crops
Several factors mitigate the impact of agricultural productivity growth in nontradable goods (staple and other food crops) on poverty reduction, including the proportion of the poor participating in agriculture and the effect of productivity changes on food prices. The proportion of the rural poor engaged in farming varies geographically and many rural households are still net food buyers (Irz et al., 2001). While 77% of the poor in SSA are smallholder farmers, in Asia smallholders account for less than half of the poor, according to 1998 figures (Cox et al. 1998).

Several studies provide evidence for the poverty reducing potential of agricultural productivity growth in staple crops. In Ethiopia, Diao and Pratt (2007) find that growth in staple crop productivity has greater potential for poverty reduction than any other agricultural or non-agricultural sector in their model. Minten and Barrett (2008) find similar evidence in Madagascar with regard to rice, which is largely nontradable due to high marketing and transport costs. Finally, Jayne et al. (2010) find that maize is the single most important crop in most smallholder farm incomes Kenya, Malawi, Zambia, and Mozambique, suggesting that productivity increases could result in poverty alleviation.

Food Price Effects
Increased agricultural output can decrease food prices, to the benefit of all net food buyers in both rural and urban settings. Otsuka (2000) and Binswanger and Quizon (1989) found that output expansion and the resulting decline in food prices was the primary mechanism through which the green revolution decreased inequality and poverty (Irz et al. 2001). Output growth could also increase poverty if income elasticity of demand for cereals is high (i.e. very sensitive to changes in income). In this case rising incomes will greatly increase quantity of cereals demanded and prices will rise, leaving the poorest less able to purchase staples (Dasgupta 1998). Datt and Ravallion (1998) note that even small changes in food prices can have large impacts on absolute poverty. However, they found that lower relative food prices decreased absolute poverty in India but did not any effect on the distribution of poverty (Datt and Ravallion 1998). Similarly, Byerlee et al. (2009) point out that while Asian countries have seen steady growth in productivity and poverty reduction, rural-urban disparities and rural inequality have widened in the 1990s.

Increases in agricultural productivity also contribute to lower food prices, however the size of this effect is more difficult to estimate. Datt and Ravallion (1998) demonstrate that yield growth in India contributes to poverty alleviation indirectly through falling food prices, although they note that price effects lag several years behind yield growth. According to the World Bank, consumer prices for staples in Uganda decreased in the late 1990s while on-farm productivity increased (Staatz and Dembé 2008). In Ethiopia, prices rose during a period of slow agricultural growth.
(1995/96 and 1999/2000) (Staatz and Dembélé 2008). As Staatz and Dembélé point out, estimating the impact of productivity growth on real food prices over the period of 1985–2006 is difficult because many countries were liberalizing their trade regimes during this period leading to international (regional) trade that drove up local food prices.

Large productivity increases in staples could actually lead to a price collapse in staple food markets since the elasticity of demand is low and markets are typically thin. In such a case, increased output would drive prices down and undermine incentives for production. Thus, Staatz and Dembélé argue that increases in staple crop productivity need a complimentary increase in the production of a tradable good in order to stimulate increased income growth and demand for staples (Staatz and Dembélé 2008). Similarly, if the gains in total factor productivity do not outpace the decline in food prices, profitability will not be maintained and farmers may abandon productivity increasing technologies. In other words, poor net food selling households (producers) may become worse off when food prices fall due to the price inelastic demand for staple foods in most areas. Though increasing staple crop productivity will likely decrease overall poverty at the aggregate level since the urban poor and half of the rural poor, on average, are net food buyers (World Bank 2007).

The strength of food price effects depends on the tradability of the good and the elasticity of demand. Where demand is quite inelastic, prices will fall more when production increases than where demand is more elastic. Where demand is more inelastic, a greater share of the benefits accrue to consumers. The size and openness of the market greatly determine the elasticity of demand (Thirtle et al. 2001). Where the staple crop sector is large and mostly nontradable (beyond regional trade), productivity gains will increase the aggregate food supply and drive down food prices (World Bank 2007, Thirtle et al. 2001). A negative correlation between per capita production and staple food prices has been observed in maize (Ethiopia, Ghana), sorghum (Burkina Faso, Mali, Sudan), cassava (Ghana), and weakly in millet (Burkina Faso, Mali, Sudan). Staple food prices have not followed this pattern in Kenya, however, where significant price interventions maintain stable prices and thus interrupt the market relationship between per capita production and food prices (World Bank 2007). While decreasing prices are not good for producers, Irz et al. (2001) highlight that recent market liberalizations have increased the tradability of goods, which probably increases producers’ share of the benefits from agricultural growth. This likely occurs because increased output at the local level is unlikely to affect prices when the good in question traded in a larger market (Irz et al. 2001).

Nutrition Linkages

Declines in food prices translate to an increase in real income for net food buying households and increase the resources available for consumption. These resources may be used to increase consumption of staple foods or more diverse, nutritionally rich foods (Hazell and Haddad 2001). Timmer (1995) suggests that increased food production and farming incomes may allow for better nutrition among rural laborers (Irz et al. 2001). Enhanced nutritional status can contribute to further increases in labor productivity in both current and future generations (Hazell and Haddad
Dasgupta (1998) similarly emphasizes the positive correlation between labor productivity and nutritional status of the poor.

Using data from the International Food Policy Research Institute (IFPRI), Thirtle et al. (2001) regress agricultural productivity (land, labor and total factor productivity) against nutritional outcome measures across countries. They find that a 1% increase in land productivity (output per unit of land) is associated with an increase in daily energy supply of 5.3% and that a 1% increase in land productivity is associated with a decrease in the count of under-weight children under five of 0.42% (Thirtle et al. 2001). This is consistent with Fogel's (1991) finding that increased caloric intake raised productivity among the working poor in the early stages of Western Europe’s development (Fogel 1991).

** Tradable Goods and Poverty Reduction**

The ability for productivity gains in tradable (export-oriented) agricultural goods to reduce poverty depends on the extent to which smallholders and poor households participate in production (World Bank 2007). The 2008 *World Development Report* (World Bank, 2007) notes that African countries have the potential to be competitive in the production of both traditional and new high value commodities. Specifically, there is potential for cocoa in Ghana, tea and flowers in Kenya, vegetables in Senegal, and fish in Uganda. Additionally, labor-intensive non-traditional exports can reduce poverty through employment opportunities, for instance in Kenyan horticulture production and vegetables in Senegal (World Bank 2007). And as Staatz and Dembélé (2008) articulate, if quality and time requirements can be met, there are few demand constraints to growth in high-value exports such as horticulture.

Households will react differently to cash crop production opportunities and derive different welfare benefits from participation due to the heterogeneity and complexity of production systems and asset endowments (Taylor and Adelman 2003, Brooks and Dyer 2008). Poulton, Dorward, and Kydd (2005) argue that, in general, traditional export cash crops can make a significant contribution to poverty reduction when there is broad based participation by farmers in an area, labor-intensive production processes, and potential positive linkages to staple crop productivity in cash crop production. Household-level spillover effects can result when production of a commercialized crop enables the farm household to acquire new resources that would not otherwise be accessible (Govereh and Jayne 2003, Minten, Randrianarison, and Swinnen 2009). However, studies examining the impact of cash crop activities on rural poverty reduction underscore the fact that poverty reduction is neither guaranteed nor uniformly distributed. Contextual factors prove to be critical determinants of positive welfare gains from cash crop production (Breisinger, Diao, Kolavalli, and Thurlow 2008, Deininger and Okidi 2003).

**Agricultural Employment**

Growth in agricultural productivity can increase real wage rates, which both directly and indirectly contributes to poverty alleviation. Datt and Ravallion (1998) suggest that increased agricultural productivity (defined as output per unit of land) is related to poverty reduction in India. Their
analysis of Indian survey data from 1958–1994 found that higher real wages and higher farm yields reduced absolute poverty, and that even the poorest benefitted from productivity gains (Datt and Ravallion 1998). They tested the robustness of the elasticity relationship over time and found no trend decline in the yield elasticity of rural poverty in India (Datt and Ravallion 1998). The authors note that the majority of the impact is the result of general equilibrium agricultural sector growth, although higher wages and yields do contribute to poverty reduction on their own. Their analysis also indicates that while higher farm yields and wages improved living standards and benefitted the poor in absolute terms, the distribution of poverty in the total population remained largely unchanged (Datt and Ravallion 1998).

On-farm Employment

Increased agricultural production is likely to increase the demand for farm labor through increases in area cultivated, intensity of cultivation (labor use per unit of land), or frequency of cropping. The impact of farm labor opportunities on poverty reduction depends on the extent to which the rural poor depend on farm laboring for their livelihood. Labor dependency is higher in South Asia where between one-third and one-half of rural households are landless, but households with small plots of land or little working capital may depend significantly on laboring for their income even in Africa where landlessness is rarer (Irz et al. 2001). Technology also influences the scale of the change in labor demand. Some technologies increase labor productivity and decrease input requirements, while others allow for the expansion of cultivated area or multiple cropping per season. Evidence suggests that while it is impossible to predict the impact of a technology on labor requirements a priori, net growth in agricultural yields tends to raise the demand for farm labor (Irz et al. 2001).

Real Agricultural Wages

The impact of demand for farm labor on farm wages is complex, since factors both within and outside the agricultural sector determine the agricultural wage rate (Irz et al. 2001). Few studies have examined the impact of the real agricultural wage rate on poverty reduction. Using cross-sectional data from West Bengal, Bardhan (1984) found that higher real agricultural wage rates had a poverty reducing effect. Datt and Ravallion (1998) found wage rates to be a strong predictor of poverty reduction in their analysis, and suggest that it may have been an important omitted variable in earlier studies looking at the determinants of rural poverty. They also found that real agricultural wages increased with higher average farm productivity, presumably through labor demand resulting from multiple cropping (Datt and Ravallion 1998). In some cases increased productivity did not change or lowered farm wages, as Estudillo and Otsuka (1999) found with the adoption of improved rice technologies in central Luzon and Thakur et al. (1997) found in comparing Bihar to more agriculturally prosperous regions (Irz et al. 2001). New technologies and modern varieties arguably decrease the factor share of labor and thereby drive down wages. On the other hand, others contend that population growth and slow adjustment in the wage market are responsible for wage decreases in those cases (Irz et al. 2001).
Based on his review of the empirical evidence, Mellor (1999) suggests that as long as there is underemployment in rural areas, real wages in those areas are unlikely to rise in response to agricultural growth since increased output will result in declining real prices unless effective demand for the good in question also increases. Employment can spur demand since the poor spend a high proportion of increased income on basic food goods. Therefore, where technology driven output growth is matched by a roughly equal increase in demand, real wages could increase. The poor will benefit from both increased employment and lower food prices. The employment effects are likely greater where food is at least partially tradable, since increased output will not drive down prices as much as it would in a closed market. Mellor (1999) concludes that real wages rise consistently with agricultural growth, suggesting the agricultural growth has employment multipliers. However, since rising real wages create an automatic incentive to increase labor productivity, much of the employment effect is likely to come from the non-farm sector (Mellor 1999).

**Multipliers in the Rural Non-Farm Economy (RNFE)**

Increased agricultural production creates demand for products and services both upstream (inputs, services for agriculture) and downstream (processing, storage, transport). It also generates consumption links as farmers and farm laborers spend increased incomes on goods and services. The degree of these multiplier effects depend on several factors including the extent of rural infrastructure, population density, the extent of immediate processing needs for agricultural products, the nature of technological change in farming and the tradability of goods and services both produced and demanded by agricultural communities (Irz et al. 2001). The evidence demonstrates that the RNFE tends to be most dynamic in areas where agriculture also thrives (Berdeguè, Reardon, and Escobar 2000). Where agriculture performs poorly, employment in the RNFE is often an option of last resort offering extremely low wages (Thirtle et al. 2001).

Several studies by Haggblade et al. (1989, 1991), Hazell and Ramasamy (1991) and Delgado et al. (1994) have estimated the production and consumption multiplier effects of increased agricultural production in specific regions. Their findings suggest that over 75% of the multiplier effects in rural economies occur through consumption linkages. Some studies find that multiplier effects are stronger in areas with better infrastructure (and therefore rural-urban links). On the other hand, Delgado et al. (1994) demonstrated equally strong multiplier effects in Africa (where infrastructure tends to be weaker). He argues that exogenous increases in farm earnings in isolated areas are spent disproportionately on locally produced goods and services. All of these models have been disputed, however, because they rely on assumptions about the elasticities of supply and demand that have not been empirically proven and are the source of continued debate in the literature (Irz et al. 2001).

Increased incomes from the RNFE accrue to both farming and non-farm households as rural households diversify their livelihoods. Micro-level studies provide evidence for the even greater poverty reducing potential of RNFE growth for the poorest households. In a cross-country analysis Bravo-Ortega and Lederman (2005) find that average income for the poorest quintile in
developing countries is more positively affected by growth in non-agricultural labor productivity than by agriculture (Bravo-Ortega and Lederman 2005). Byerlee et al. (2009) also confirm that profitable and productive agriculture is the principal driver of growth in the RNFE, but that the poor may not be the main beneficiaries of nonfarm income growth. Although it appears that the RNFE is becoming more important for the livelihoods of the rural poor, adequately comparable surveys through time are not available to provide systematic empirical evidence.

Multipliers from increased incomes in rural areas tend to result from investment in non-tradable goods and services, which tend to stimulate resources, primarily labor, that would otherwise be idle. Bevan, Collier, and Gunning (1987) studied the response of private agents to the Kenyan coffee boom and found that farm households invested two-thirds of the windfall income (Bevan, Collier and Gunning 1987). Also in Kenya, Block and Timmer (1994) demonstrate that the linkages from agricultural growth are directed towards the domestic economy and thereby produce multipliers three times greater than those from growth in non-agricultural sectors. This again underscores the importance of agricultural growth in mobilizing labor (Mellor 1999). Hazell and Roll (1983) find that the multipliers to the non-farm sector are much weaker in Africa than Asia. However, Delgado et al. (1998) note that agricultural output in Africa is comprised mainly of non-tradables and multipliers in the non-tradable sector are as high as those found in Asia (Delgado, Hopkins, and Kelly 1998).

III. BARRIERS TO POVERTY REDUCTION

Under unfavorable circumstances, agricultural productivity growth could produce perverse outcomes for the poor. Evidence suggests that multiple factors may constrain the potential for productivity increases to decrease poverty.

**Timeframe:** Adjustments in real wages and food prices lag behind changes in farm productivity. The short-run effects of wages and food prices are small in comparison to the long-run general equilibrium effects of overall agricultural sector growth (Datt and Ravallion 1998).

**Population Growth:** Population growth can also affect the net impact of increased employment opportunities and productivity gains on poverty reduction. In their multi-sectoral growth model, Irz and Roe (2000) demonstrate that a minimum rate of productivity growth is necessary to counter population growth and avoid the “Malthusian trap,” whereby population growth outpaces per capita economic growth. Thirtle et al. (2001) point out that this finding is particularly relevant to Sub-Saharan Africa where the demographic and technological characteristics of several countries are roughly consistent with such a poverty trap.

**Technology:** When opportunities to increase productivity rely on improved technologies or technological innovation, several factors may limit the benefits to the poor. The poor face many constraints that limit technology adoption therefore, while there are many potential
benefits of improved technology for the poor, they do not always materialize (Irz, Lin, Thirtle and Wiggins 2001, Thirtle et al. 2001). Technological change can also have ambiguous effects on the distribution of income, especially where adoption is uneven (across households or regions). Where technology-driven increases in output result in lower producer prices, non-adopting farmers will face lower returns and are made even worse off (Thirtle et al. 2001). Finally, the impact of technological change is inherently linked to other institutions. Technology alone will be insufficient to reduce poverty without infrastructure and education (Thirtle et al. 2001). Technology is more likely to generate positive benefits for the poor where initial asset and income inequality is lower and related infrastructure and social services are well developed (Thirtle et al. 2001).

**Asset & Income Distribution:** Poverty reduction depends on the production and consumption multipliers resulting from increased agricultural productivity. However, where income, asset endowments and land distribution are highly unequal, the majority of the benefits will accrue to the elite and the new resources generated will be directed towards imported or capital intensive consumer goods, rather than to locally produced, labor-intensive goods and services (Thirtle et al. 2001). Where inequality between the top and bottom income quintiles is greater, the income effect of agricultural growth is stronger for the highest quintile than the lowest. Where initial income inequality is smaller, agricultural growth contributes to an improvement in income distribution whereby the elasticity of poverty to agricultural growth declines successively with each higher income quintile (Mellor 1999). Additionally, inadequate access to land constrains the potential for poverty reduction through smallholder driven agricultural development.

**Market Access:** While infrastructure is often assumed to stimulate market access and hence productivity, micro-level evidence provides conflicting findings for the direction of causality. Using combined World Bank Living Standards Measurement Survey data from Tanzania, Guatemala, and Vietnam, Rios et al. (2008) show that households with higher productivity tend to participate more in markets. There is no evidence of a reverse causal linkage whereby market access would lead to higher productivity. They conclude that investments in market access infrastructure provide only minimal, if any, improvements in agricultural productivity. Enhancements in farm structure and capital, on the other hand, have the potential to increase productivity and market participation (Rios, Masters, Shively 2008). On the other hand, Rao, Coelli and Alauddin (2004) argue that since many of the determinants of agricultural productivity are relatively fixed, such as the quantity of land and labor, distance to core markets, and climate, continued development in productivity comes from increases in the quality of land and labor and through decreasing transport costs via improvements in infrastructure such as roads and ports (Rao, Coelli and Alauddin 2004).
I.V. CONCLUSION

There is much empirical evidence for poverty reduction through increases in agricultural productivity. Much of the literature suggests that this effect occurs through the impact on real household incomes, however there are multiple, complex pathways linking agricultural productivity to real income changes that respond to various market forces. There is strong evidence for indirect poverty reduction through employment generation, rural non-farm multiplier effects, and food prices effects, however contextual factors determine whether market forces resolve most favorably for the poor. Furthermore, the resulting equilibrium in agricultural and labor markets may affect poor net food buying households differently than poor net food producers. The available evidence supports the theories that when farm incomes and the real wage rate increase and the rural non-farm economy grow, real household incomes increase and the percentage of the population living below international poverty lines decreases. Nutritional status or other aspects of well being, such as health measures and education, may also improve. However, initial asset endowments, and land assets in particular, are significant determinants of households’ ability to access and effectively use productivity enhancing knowledge and technologies. Poor households face barriers to technology adoption and market access. In sum, the importance of productivity to agricultural sector growth and to poverty reduction is complex and depends on a variety of contextual factors including the initial distribution of poverty, asset endowments, strength of market linkages and the extent and nature of the poor’s participation in the agricultural sector.

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Agricultural Productivity and Poverty Reduction: Linkages and Pathways


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