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Agricultural Productivity and Poverty Reduction: Linkages and Pathways

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Executive Summary

Cross-country and micro-level empirical studies provide general support for the theories of a positive relationship between growth in agricultural productivity and poverty alleviation, regardless of the measures of productivity and poverty that are used. Several key findings emerge from the empirical evidence:

- Growth in the productivity of staple nontradable food production is associated with consumption increases or poverty reduction across a number of settings, although the study of these relationships is complicated by the specific market dynamics that determine food prices. The relationship between productivity growth in tradable or export-oriented production and poverty alleviation is less clear.
- Many studies suggest that lower food prices appear to be a key mechanism through which productivity increases translate into poverty reduction. Declines in real food prices underlie much of the poverty reducing impacts of the green revolution in Asia; lower food prices also appear associated with gains in energy supply and nutrition.
- The evidence suggests that agricultural productivity growth is associated with increases in the demand for farm labor and that real wage rates tend to rise with agricultural growth.
- Multiplier effects from agricultural productivity growth appear to occur through consumption linkages and are often oriented towards the nontradable, local economy.

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.

Overview

The purpose of this literature review is to identify the linkages between increases in agricultural productivity and poverty reduction. The relevant literature includes economic theory and evidence from applied growth and multiplier models as well as micro-level studies evaluating the impact of specific productivity increases on local

poverty outcomes. The first section of this review summarizes the macroeconomic theory on the contributions of growth in the agricultural sector to poverty alleviation, in terms of overall economic growth and productivity growth more specifically. The following section reviews the available literature on the direct relationship between agricultural productivity growth and poverty outcomes in the context of nontradable staple crops and export crops. We then review the evidence for indirect poverty reduction through employment generation and growth in the rural non-farm economy. Finally, the last section reviews the contextual factors under which productivity increases might not contribute to poverty alleviation or might leave the poor worse off.

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.[1] However, productivity growth can catalyze a wide range of direct and indirect effects that mediate the pathways to poverty alleviation.[2] We address these multiple effects below. The appropriate methodology for measuring agricultural productivity is also the subject of some debate; in this brief we set aside these methodological debates and take the productivity measures in the various studies as a given.

An overview of several studies illustrates the variety of approaches that contribute 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).[3,4] Timmer (1997) uses output per worker as the productivity measure, which Mellor (1999) argues is a better measure to identify linkages to non-agricultural growth because it encapsulates the additional ways through which farm households earn income.[5] Byerlee, Diao and Jackson (2009) review 12 country case studies and use bivariate analysis to compare across countries. They show that the countries with the highest agricultural growth per worker experienced the greatest rate of rural poverty reduction.[6] 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.[7]

The primary resources for this review include several meta-studies and literature reviews (Irz et al., 2001; Mellor, 1999; Thirtle et al., 2001) examining both theoretical arguments and empirical evidence of the variety of pathways through which increased productivity can reduce poverty. Additionally, there are a few seminal macro-level studies including the work of Ravallion and Datt (1996, 1998) and Timmer (1995, 1997). Micro-level evidence supporting this theoretical framework includes several cross-country studies (Byerlee et al., 2009; Minten & Barrett, 2008; Muyanga et al., 2010). Importantly, there is significantly more data, and subsequent analyses, for Asia than there are for Africa.

I. Theoretical Background

In this brief we attempt to distinguish between increases in output and in productivity since these do not necessarily have similar impacts. We find the literature is not always clear on this distinction. In some cases, output and productivity increase together. However, 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.[8] The complex relationships between direct and indirect general equilibrium effects underpin the following discussion of linkages between agricultural productivity and poverty reduction.

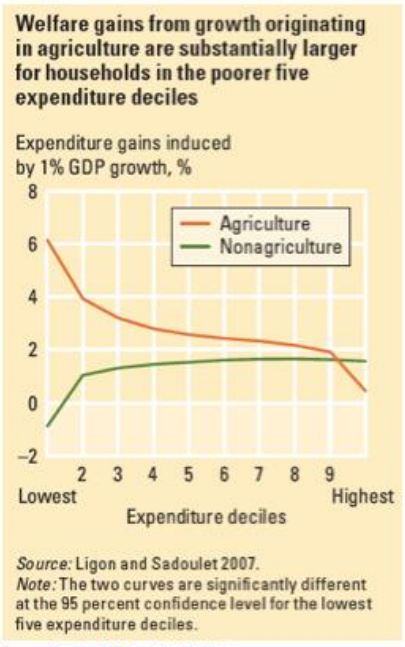
Agriculture & Economic Growth

Irz et al. (2001) identify three specific pathways whereby growth in agriculture can influence poverty reduction at the level of the national economy. First, agricultural growth can yield a sustained transfer of resources to other sectors, including through the supply of capital. This can occur through voluntary domestic savings, or through government taxes on the agricultural sector (direct or indirect). Second, increased agricultural exports can increase the supply of foreign capital or substitute for food imports. Third, where agricultural productivity grows at a faster rate than total output, it can release labor from agriculture into other sectors.[9] According to their literature review, Irz et al. (2001) find that the most direct contribution of agricultural (sector) growth is through generating higher incomes for farmers.[10] 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.[11]

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.[12] 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.[13]

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 CGE models demonstrate the multiplier effects of agricultural growth in other sectors of the economy. Coxhead and Warr (1991) demonstrate that agricultural growth through technological improvements in farming is likely to benefit labor in the Philippines, even where the technology is labor or land saving.[14] De Franco and Godoy (1993) likewise found that technological improvements in Bolivian farming should benefit the overall economy by stimulating growth and employment.[15] Similarly, Ravallion and Datt (1996) found that rural sector growth in India benefited both the urban and rural poor, while urban growth resulted in adverse distributional effects and had no impact on rural poverty.[16] However, *Figure 1* illustrates that poorer households do benefit more, in terms of increase expenditure, from a 1% increase in GDP. Furthermore, agriculturally driven growth generates a larger welfare effect than non-agriculturally driven growth, especially for the poorest 20% of the population.[17]

Figure 1. Welfare Gains from Agricultural Growth



Source: 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.[18]

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[19]

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.[20] 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.[21] 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.[22] 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.[23]

There are many different explanations for the greater productivity of small farms. The way that productivity is defined and evaluated changes the relative advantage of different farming systems. For instance, using single crop yield (i.e. maize output per unit of land) generally shows large farms to be more productive than smaller ones, due to monoculture cropping and economies of scale in input use. However, measuring total output per unit of land better captures the overall productivity of smaller farms, which are more likely to diversify their production. Evidence shows that according to the latter measure, small farms almost always produce more per unit area than larger farms.[24] Rosset (1999) points to specific practices that help to explain this greater productivity of small farms, including multiple cropping, land use intensity, output composition (diversification), irrigation, labor quality, labor intensity, input use and resource use.[25] Evidence from rice production in Madagascar (Uphoff, 2000) demonstrates that using multiple practices together leads to greater increases in output than any single intervention alone. Though as Pretty and Hine (2001) note, traditional analytical methods that evaluate a single variable while holding all others constant likely miss these synergistic, multiplicative effects.[26]

Multiplier & General Equilibrium Effects

Agricultural productivity growth can drive rural growth and catalyze a pro-poor development process.[27] 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.[28] Higher agricultural output thus stimulates employment in the rural and urban non-farm sectors through both forward and backward linkages.[29] This in turn decreases urban poverty by slowing migration to urban areas and lowering food prices.[30] 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.[31] 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*.[32]

Table 1. Poverty Reduction Pathways through Increased Agricultural Production

Farm Economy
Higher incomes from farm output
On-farm employment
Rural Economy
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
National Economy
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

Source: Irz et al. (2001), p. 450–451

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.[33] Among these, Timmer (1995) theorizes that increased food production and farm incomes allow for better nutrition and increased investment in health and education.[34] 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.[35]

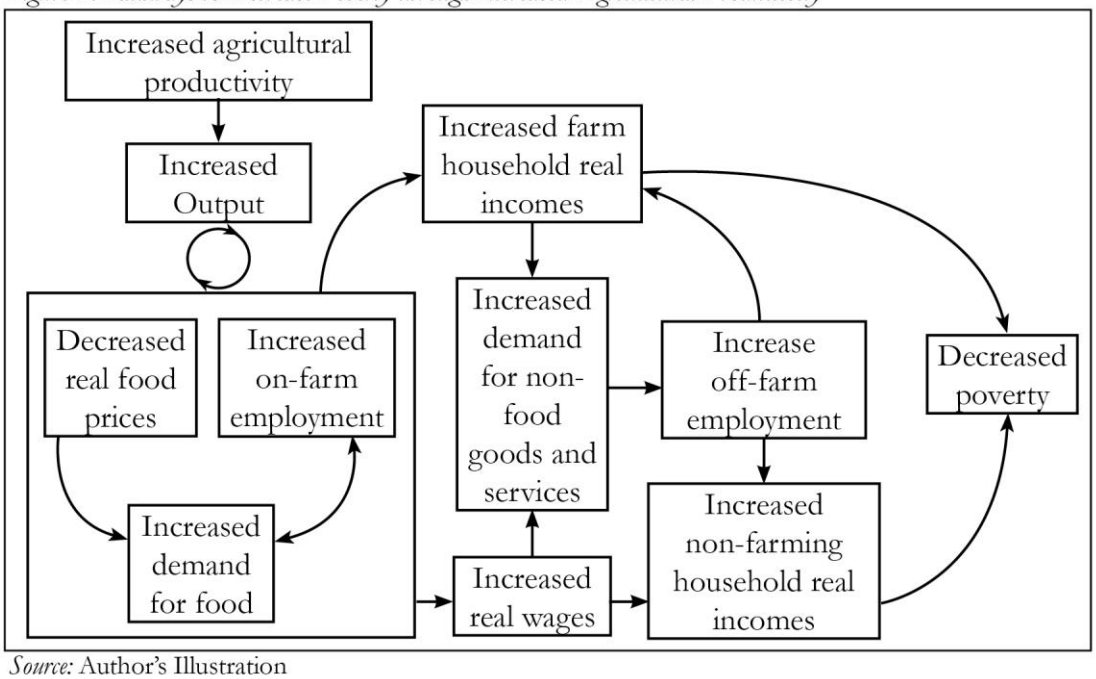
Price Effects

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.[36] 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.[37] If increased output drives down product prices or the costs of production rise due to increased demand, than increased agricultural output may not translate into higher real farm income.[38] 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.[39]

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 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.

Figure 2. Pathways to Decrease Poverty through Increased Agricultural Productivity



Source: Author's Illustration

II. Empirical Evidence

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. Their calculated poverty elasticity with respect to the productivity measures ranges

between 0.62 and 1.3. This means 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.[40] 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.

Byerlee et al. (2009) similarly find that increased agricultural productivity plays a central role in promoting pro-poor growth – especially through lower food prices in early stages of development. They review a series of country case studies commissioned for the multi-donor *Operationalizing Pro-Poor Growth* project, including Burkina Faso, Ghana, Senegal, Uganda, Zambia, Bangladesh, India, Indonesia, Vietnam, Bolivia, Brazil and El Salvador.[41] Pro-poor growth is defined as broad-based productivity growth in a sector dominated by smallholder family farmers and if poor consumers benefit from lower food prices.[42]

At the micro-level, Sarris, Savastano and Christiaensen (2006) found that agricultural productivity positively affects household consumption in two rural areas of Tanzania. They calculated an elasticity of consumption (per capita) with respect to the gross crop value per unit of land to be 0.15 in Kilimanjaro and 0.57 in Ruvuma, reflecting the difference in the share of agriculture in total incomes between the two regions.[43] They further model the impact of productivity increases (output per unit of land) on the poverty headcount and several poverty indices (average poverty gap, severity of poverty, value of consumption). Bringing all producers with below median productivity to the median level would be associated with a reduction in the poverty headcount of 21.4 percent in Kilimanjaro and 34.1% in Ruvuma. Raising the productivity of all producers by 10% was similarly associated with poverty reductions, though the effect was much stronger in Ruvuna where the initial poverty rate was greater.[44]

Table 2 presents pair-wise correlations between measures of agricultural productivity and international poverty measures for all Sub-Saharan African (SSA) countries from the recent EPAR Brief No. 109 *Investment Opportunities Segmentation: Supplementary Analysis*. These are aggregate cross-sectional country data from different years (depending on the most recent census or household survey) with a single data point per country. The data suggest that in countries where agricultural value added is a large proportion of GDP, poverty rates are higher, but that growth in agricultural productivity (output per worker) are associated with a smaller proportion of population falling below the poverty line. While this analysis shows statistically significant relationships, it cannot provide causal evidence.

Table 2. Pair-wise Correlations between Productivity Measures & Poverty Outcomes, Sub-Saharan Africa

Measures of Agricultural Productivity	**Percent of the Population Living On:**	
	< US$1.25 per day	**< US$2 per day**
Agriculture, value added (% of GDP)	0.405***	0.499***
Agriculture, value added (annual % growth)†	-0.061	-0.077
Agriculture value added per worker (constant 2000 US$)	-0.36*	-0.42***
Cereal yield (kg per hectare)	-0.112	-0.087

Source: EPAR Research Request #109, World Development Indicators, multiple years; †percent change from previous year; ***significant at 1%, **significant at 5%

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.[45] 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.[46]

Several studies provide evidence for the poverty reducing potential of agricultural productivity growth in staple crops. In their general equilibrium model of Ethiopia, Diao and Pratt (2007) use national and agricultural survey data and find that growth in staple crop productivity in Ethiopia has greater potential for poverty reduction than any other agricultural or non-agricultural sector in their model.[47] Minten and Barrett (2008) find similar evidence in Madagascar with regard to rice, which is largely nontradable due to high marketing and transport costs. In their meso-level analysis combining rural commune census and national census data from 2001 and 2003, they find a doubling of rice yields to be associated with a 38% decrease in the number of observed food insecure people in the community and decreased the hungry period by one third (1.7 months).[48] Finally, Jayne et al. (2010) find that maize is the single most important crop in most smallholder farm incomes in the countries in their study (Kenya, Malawi, Zambia, Mozambique), suggesting that productivity increases could result in poverty alleviation. Though, income from smallholder horticultural production is beginning to rival maize in some areas, the latter will likely continue to play a crucial role even if its share of farm income and sales revenue declines somewhat over time.[49]

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.[50] 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.[51] 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.[52] 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.[53]

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.[54] According to the World Bank, consumer prices for staples in Uganda decreased in the late 1990s while on-farm productivity increased.[55] In Ethiopia, prices rose during a period of slow agricultural growth (1995/96 and 1999/2000).[56] 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.[57]

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.[58] 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.[59]

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.[60] 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.[61,62] 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.[63] 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.[64]

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.[65] Timmer (1995) suggests that increased food production and farming incomes may allow for better nutrition among rural laborers.[66] Enhanced nutritional status can contribute to further increases in labor productivity in both current and future generations.[67] Dasgupta (1998) similarly emphasizes the positive correlation between labor productivity and nutritional status of the poor.[68]

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 (ouptut 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%.[69] 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.[70]

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.[71] 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.[72] 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.[73]

EPAR Brief No. 94 *The Impact of Export-Driven Cash Crops on Smallholder Households* summarizes the available

literature on the impact of smallholder participation in cash crop and export markets on household welfare and rural markets. Our findings in that review suggest that 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.[74,75,76] 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.[77] 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.[78,79] 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.[80,81]

Micro-level evidence from Benfica (2006) demonstrates the poverty reducing potential of tobacco in rural Mozambique. He finds that this export crop provides a critical source of income for the rural population where there are few alternative income-generating activities. Furthermore, he finds that households without access to off-farm wage labor are most likely to grow tobacco, suggesting that tobacco cultivation could reduce income inequality.[82] In addition, evidence suggests that the spillover effects of inputs and technology from cash crop production can lead to higher productivity of food crops, increasing food quantity available and excess output for sale. However, the links between cash crop production and household health and nutrition are complex, and few studies have been carried out with sufficient baseline data to test the theoretical relationship.[83]

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.[84] They tested the robustness of the elasticity relationship over time and found no trend decline in the yield elasticity of rural poverty in India.[85] 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.[86]

<u>On-farm Employment</u>

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. [87]

Multiple studies in Asia have shown that the demand for farm labor increases with the introduction of new rice and wheat varieties or green revolution technologies more generally.[88,89] For example, in central Luzon in the Philippines, the adoption of green revolution rice technology between 1966 and 1986 increased wage rates by 39%–58%.[90] Similarly, Thakur et al. (1997) found that wages in areas of Bihar where agriculture was prosperous

were twice those in lagging areas in the 1990–1991 season.[91]

Technology 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. In Asia, Hayami and Ruttan (1985) found that the introduction of modern rice and wheat varieties increased labor requirements per unit of land. However, Lipton and Longhurst (1989) suggest that the rate of increase in labor demand slowed after its initial impact due to the introduction of labor saving inputs such as herbicides and machinery. Similarly in Africa, Binswanger and Quizon (1986) also found a low, but positive output elasticity of agriculture with respect to labor.[92] 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.[93]

Real Agricultural Wages

The impact of demand for farm labor on farm wages is complex, since factors both within and outside of the agricultural sector determine the agricultural wage rate.[94] 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.[95] They also found that real agricultural wages increased with higher average farm productivity, presumably through labor demand resulting from multiple cropping.[96] 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.[97] 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.[98]

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.[99]

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.[100] The evidence demonstrates that the RNFE tends to be most dynamic in areas where agriculture also thrives.[101] Where agriculture performs poorly, employment in the RNFE is often an option of last resort offering extremely low wages.[102]

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.[103]

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.[104] 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.[105] 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. Thirtle et al. (2001) review several studies and literature reviews measuring the importance of the RNFE to rural household incomes. In Africa, 35 different studies estimate that rural households derive 15–80% (median: 43%) of their total income from the RNFE. Twelve studies estimate that this percentage ranges from 38–68% (median: 46%) in Latin America. For Asia, data from 42 household surveys estimates that income from the RNFE comprises 25–60% of rural household incomes, with a mean of 31% but most responses clustering between 40% and 50%.[106]

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.[107] 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.[108] 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.[109]

III. Barriers to Poverty Reduction

Timeframe

Datt and Ravallion (1998) note that the 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. Specifically, they estimate that the long-run elasticity

of absolute poverty to farm yield is five times greater than the short-run values.[110] Muyunga, Jayne and Burke (2010) use national household survey panel data from 1997, 2000, 2004, and 2007 in Kenya and find that only a relatively small fraction of households in the sample experienced changes in their asset wealth over the 10-year period. Over 70% are in the same position as a decade ago, however more households experienced an increase in asset wealth than those who experienced a decrease. The evidence does show a decline in overall poverty rates and they suggest that effective rural productivity increases and poverty reduction strategies require investments in health, education and agriculture that work together to increase household's ability to accumulate and make productive use of assets.[111]

Population Growth

Population growth can also affect the net impact of increased employment opportunities and productivity gains on poverty reduction. Using representative Indian data, Rao (1975) demonstrates that for a 10% increase in output, employment increases 3–6%. However, during the time required to realize such yield increases, population likely grows more than the resulting increase in employment leading to little poverty reduction.[112] 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.[113] 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.[114]

Technology

Barriers to Technology Adoption

When opportunities to increase productivity rely on improved technologies or technological innovation, several factors may limit the benefits to the poor. Firstly, the poor face many constraints that limit technology adoption including lack of access to inputs, lack of information and knowledge about how to use the technology, and scale bias in new technology favoring larger producers.[115] The poor face barriers to adoption especially when technologies are cash-intensive.[116] Secondly, market failures in rural economies limit smallholder access to inputs and credit. Risk aversion in the face of missing insurance markets or social safety nets also decreases the poor's likelihood to adopt new technologies. Finally, new technologies are not always well suited to the agro-climatic conditions of rainfed arid and semi-arid areas where many poor smallholders live.[117] Therefore, while there are many potential benefits of improved technology for the poor, they do not always materialize.

Distributional Considerations

Technological change can also have ambiguous effects on the distribution of income, especially where adoption is uneven (across households or regions). As Thirtle et al. (2001) state, there are many "conditioning factors" that determine how the benefits of technological change are distributed. The authors argue that while the poor may benefit indirectly from technological change, they may not benefit directly or could even be made worse off as a result. Furthermore, the net outcomes may be difficult to determine *a priori*.[118] Additionally, here technology-driven increases in output result in lower producer prices, non-adopting farmers will face lower returns and are made even worse off.[119] Hazell and Hadded (2001) also point out that technological change in (women's) food crops may translate into better nutritional outcomes than such change in (men's) cash crops.[120]

Dasgupta (1998) also argues that technological change in agriculture could result in a depletion of common lands that are often a significant source of livelihood for the poor.[121] Thus, the impact of technological change

is inherently linked to other institutions. As Thirtle et al. (2001) explicitly point out, technology alone will be insufficient to reduce poverty without infrastructure and education, and will be particularly ineffective where land ownership inequality is too great.[122] 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.[123]

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.[124] Udry (2010) argues that credit constraints, incomplete insurance markets, and insecure property rights are key reasons for poor agricultural yield in Africa.[125] Carter and Barrett (2006) similarly highlight the important of access to mechanisms of inter-temporal exchange, such as credit, insurance, savings or social networks in the movement out of poverty.[126] Based on their review of the literature, Jayne et al. (2010) suggest that low smallholder market participation is typically due to inadequate land and productive assets rather than isolation from markets.[127]

Income Inequality

Timmer (1997) finds that the distribution of income has a major effect on the poverty reducing impact of agricultural growth. He demonstrates that 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.[128] Birdsall et al. (1995) similarly find that high initial income inequality provides lower growth and less (or no) reduction in poverty. Ravallion (1997) finds, specifically, that with a Gini coefficient of 0.25 or below, the elasticity of poverty reduction with respect to growth is 3.33, however it drops by half (to 1.82) with a Gini coefficient of 0.59.[129]

Asset Wealth

Jayne et al. (2010) identify several factors that determine whether or not small farmers sell their output in grain markets. These include their asset endowment (land, labor, and capital), agro-ecological conditions and access to markets.[130] In related work, Muyunga, Jayne and Burke (2010) examine the predictors of asset wealth, for three categories of participants in the 10-year study: asset ascending households, asset descending households, and a non-poor comparison group.[131] They find that intergenerational asset endowments are a significant factor in the ability of households to make efficient use of productivity enhancing technologies. Specifically, fertilizer use and access to credit will only contribute to a rise out of poverty if households can productively use these inputs. They cite other evidence that "smallholders' ability to productively utilize modern agricultural inputs are related to public investments in improved crop science, viable extension systems to transfer agronomic and management knowledge to farmers, and investments in physical infrastructure to raise the returns to using purchased inputs" (Mellor 1976; Byerlee and Eicher 1997; Alston et al. 2000; Evenson 2001).[132] *Table 3* summarizes their findings.

Table 3. Significant Factors Determining Changes in Asset Wealth among Rural Kenyan Households

Asset Wealth Category	Significant Factors
Ascending asset wealth over 10-years	Gender and age of the household head

	Household size Number of wives of the initial household head Chronic illness during the panel period Loss as a result of other shocks Main occupation of the father to the initial household head Amount of land inherited by the household head from parents
Descending asset wealth over 10-years	Gender of the household head Number of wives of the initial household head Distance to the nearest health care facility Deaths before 1997 Loss as a result of other shocks Number of brothers of the initial household head Main occupation of the father to the initial household head Amount of land inherited by the household head from parents Duration in the current settlement
Non-poor households	Age of the household head Number of wives of the initial household head Number of brothers of the initial household head Rank at birth of the initial household head Main occupation of the father to the initial household head Land inheritance of the initial head from parents Duration in the current settlement

Source: Muyanga, Jayne & Burke, 2010[133]

Case studies from Byerlee et al. (2009) also find that "secure and equitable" access to assets is essential for pro-poor growth. While they note the importance of land, the authors suggest that access to education and capital are often more important determinants of rural incomes than access to land in emerging low and middle-income countries.[134] Carter and Barrett (2006) argue that focusing on assets can help distinguish between structural and stochastic poverty transitions and potentially identify a minimum configuration of assets (or economic conditions) necessary for households to engineer their emergence from poverty. They also argue that focusing on assets is important in designing safety net policies because it demonstrates that where households end up after a shock is more important (from the a poverty perspective) than the actual size of the shock..[135] Jayne et al. (2010) also find that female-headed households are much less likely to experience an upward asset trajectory than male-headed households.[136]

Access to Land

Increased agricultural productivity may increase poverty where elite command of productivity increasing technologies increases landlessness or appropriation of formerly common land.[137] Where land is scarce, higher land rents may reflect increased returns to agriculture. However, where property rights are unclear or the poor cultivate land belonging to others, price effects in the land rental market could seriously undermine the poverty reducing potential of increased agricultural output.[138]

Jayne et al. (2010) find that inadequate access to land constrains the potential for poverty reduction through smallholder driven agricultural development. They argue that poverty reduction is unlikely to result from low-input agricultural production on rainfed plots smaller than one hectare with a single growing season.[139] Byerlee et al. (2009) also underscore the importance of land assets in promoting pro-poor growth. They find that secure property rights and efficient land administration systems are particularly critical.[140] Similarly, using decade-long panel data from Kenya, Muyunga, Jayne and Burke (2010) find that households with larger land inheritance were more likely to accumulate assets.[141] Jayne et al. (2010) also find that the sale of traditional cash crops is highly related to the size of landholdings.[142]

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.[143] 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.[144]

Agricultural Research & Market Access

Limited commitment to and investment in crop science also limits farmer participation in staple food markets. Evidence from the Asian Green Revolution underscores the high returns to investment in research, development and infrastructure.[145] Gardner (2005) emphasizes that higher cereal yields and increases in multifactor productivity and agricultural GDP per worker provide evidence for the high returns to agricultural research from the Green Revolution.[146] In Eastern and Southern Africa, Jayne et al. (2010) show that sustained productivity growth and poverty reduction requires increased public goods investments in agriculture (research), in addition to improved governance and policy environments and market development.[147] However, such investment accounts for a very small percentage of many SSA governments, and often pales in comparison to large scale input subsidy programs with uncertain long-term effects.[148]

Unresponsive Areas & Lagging Regions

Generating a supply response of goods and services in the RNFE depends upon the availability of resources. Where entrepreneurship and excess capacity are not available or there is an unfavorable investment climate, the RNFE may not realize potential growth.[149] Hazell and Dubovitskaya (2010) further note that the heterogeneity of natural resource endowments, distance to market centers, and level of social and political integration affect the potential mechanisms to successfully include the lagging regions of otherwise prospering nations in the growth process.[150]

In areas that are unresponsive to improved crop technologies and are inappropriate for other agricultural opportunities such as high value crops, return on investment will be much lower than in more responsive areas. Mellor (1999) suggests that since much of the employment generated through agricultural growth takes place in the non-farm sectors, market towns in more responsive areas would have significant capacity to absorb migrants from other areas. He suggests education interventions to encourage migration would be a preferable poverty reduction strategy in unresponsive areas.[151]

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, 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. Specifically, 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.

Literature Review Methodology This review was conducted using Google Scholar and the University of Washington databases. Searches included combinations of the following terms: agriculture/al productivity, household income, poverty reduction, pathways (out of) poverty, linkages, and rural non-farm economy. In identifying the relevant literature, this review also relied heavily upon the citations of the meta-studies and the *2008 World Development Report* (World Bank, 2007).

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