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Agricultural Progress and Poverty Reduction

SYNTHESIS REPORT

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Abstract

AGRICULTURAL PROGRESS AND POVERTY REDUCTION

SYNTHESIS REPORT

by

Joe Dewbre, Dalila Cervantes-Godoy, and Silvia Sorescu
OECD Secretariat

Achieving the Millennium Development Goal to halve global poverty by 2015 looks increasingly likely, although many countries may fall far short of this goal. This study compares socio-economic characteristics of twenty-five countries that have posted exceptional progress in reducing poverty to better understand why some countries are doing better than others. Three key questions were addressed: 1) Is agriculture more important than other sources of earned income in reducing poverty? 2) Are the countries most successful in reducing poverty similar in other ways? 3) Which government policy actions seem to have contributed most? Both the overall rate and the sectoral composition of economic growth matter for poverty reduction, but remittances and other kinds of financial transfers are also important sources of income for the poor. The sectoral pattern of growth changes systematically as countries develop, posing challenges for governments searching for the best balance of macroeconomic, social and sectoral policies to foster poverty reduction.

Keywords: Poverty, growth, agriculture, remittances, socioeconomic and sectoral policy.

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The case studies on Ghana and Ethiopia were done under contract with the OECD by two teams of colleagues at the International Food Policy Research Institute. Xinshen Diao led both teams. The other members of the Ethiopia team were Alemayehu Seyoum Taffesse, Paul Dorosh, James Thurlow, Bingxin Yu and Alejandro Nin Pratt, while the Ghana team also included Clemens Breisinger, Shashidhara Kolavalli, Esteban Quinones and Vida Alpuerto. Charmeida Tjokrosuwarno, Advisor for Strategic Planning in the Ministry of Finance of Indonesia, and Nguyen Khanh Bao, Senior Official of the Economic Affairs Department of the Ministry of Foreign Affairs of Vietnam, were the direct contacts when preparing the case studies on Indonesia and Vietnam and provided valuable support. Nguyen Viet Cuong of the National Economics University in Hanoi assisted in the analysis of household data done for the Vietnam study.

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Executive Summary

The Millennium Declaration set 2015 as the target date for halving the number of people living in extreme poverty. Exceptional progress in some developing countries makes achieving that goal globally a realistic possibility. However, many countries will fall far short. Why are some countries doing better than others? This paper sought to answer this question by studying the development experiences of twenty-five developing countries deemed highly successful in reducing poverty during the past quarter-century.

The countries chosen for analysis include some of the poorest and some of the richest developing countries in the world, representing virtually all geographic regions. The countries differ greatly in their cultures, systems of governance and economic management. Yet, they are surprisingly similar in their achievements, not only in reducing poverty, but across a broad range of macroeconomic and agricultural economic performance measures used to compare them. Findings from quantitative analysis reveal that while economic growth generally was an important contributor to poverty reduction, the sector mix of growth mattered substantially.

In both econometric and counter-factual simulation analyses we found growth in agriculture to be an especially potent force for poverty alleviation. We estimated poverty elasticities for: 1) the entire sample of study countries; 2) two sub-samples created by dividing the countries into relatively poor and relatively non-poor groups; and 3) four individual case-study countries chosen for more in-depth analysis. Results show that agricultural growth was pro-poor for all these variants of the data used. We did not find such uniformity for growth in non-agricultural GDP/worker. Indeed, for some variants of the data used, findings reveal the possibility that isolated growth in a non-agricultural sector could have no effect, possibly even increase poverty.

As compared to results for the full sample, estimated poverty elasticities for agriculture and for remittances are significantly higher when using only the data for the relatively poor sub-group of countries. Moreover, for this group, the estimated poverty elasticity of non-agricultural GDP/worker was trivially small and statistically non significant. However, when using data only for the relatively well-off of the study countries the estimated poverty elasticity for non-agriculture was statistically significant and slightly greater than that obtained for agriculture.

Estimated poverty elasticities reveal the potential for this or that kind of income growth to reduce poverty – providing answers to ‘what if’ type questions. However, to attribute past success in poverty reduction to growth in the different sources of income requires both the elasticities and historical growth rates. The paper reports results of analysis taking both these factors into account. It shows that for the entire sample and for both sub-samples, past increases in income earned from farming

contributed more to poverty reduction than increased earnings from non-farm occupations. However, when restricting analysis to the sub-set of poorer countries we found that past growth in remittances per capita was more important than growth in earnings from agriculture. These results highlight the potential of cash transfers, in general, as cost effective alternatives to sectoral policies for combating extreme poverty.

The study countries achieved poverty reduction during years of increasing macroeconomic stability and a progressive opening to world markets and trade. In the great majority of cases those countries posting the fastest progress in reducing poverty also posted the greatest improvement in basic aspects of human development, with significant improvements in education. Government budgetary expenditures on agriculture averaged only around 5%-6% of total government budgets of the study countries. Moreover, in most countries, those shares fell throughout the study period. Many countries did increase expenditures on agricultural research and development but from relatively low initial levels.

Both agricultural labour productivity and total factor productivity increased significantly in the countries selected for study. This improved agricultural performance accompanied major makeovers of agricultural policy. In many of the study countries, regulations limiting farmer access to internal and external markets were lifted; export taxes were slashed or eliminated altogether and discriminatory exchange rate regimes were dismantled. There were major reforms to the systems of ownership rights to land and other assets in some of the countries. Collectively, these developments reduced or eliminated government biases against the sector thereby improving the economic situation for farmers – improvements that were further boosted by strong growth in domestic and export demand. And this all occurred in an era when rich country trading partners reduced substantially the most production and trade distorting kinds of support offered their farmers. Many of the countries would also have benefitted from trade agreements granting preferential access to OECD markets.

A near universal phenomenon of economic development is that when economies grow, incomes earned by those who farm for living rise faster than incomes earned from working in other sectors. Typically, the less developed the country, the lower are earnings per worker in agriculture compared to other sectors – a gap that progressively narrows as countries develop. Economic growth is thereby naturally pro-poor. Agricultural progress in the study countries, and the poverty achievements that accompanied it, seems due rather more to the success of macroeconomic, trade and socioeconomic policies in fostering balanced economic growth than to government policies aimed at tilting the sectoral pattern of that growth.

Introduction

Most people who depend on agriculture for their living are poor and most of the world's poor depend on agriculture for their living. Achieving the Millennium Development Goal (MDG) of halving poverty by 2015 requires finding ways to increase the incomes of those people. What can governments do to foster that kind of income growth? Governments' role in nurturing economic progress through appropriately designed domestic policies and well-chosen public investments is vital. But coherent OECD development co-operation, trade and agricultural policies can also make a difference.

Globally, the percentage rate of poverty (though not in all countries the total number of poor people) has declined steadily during the past thirty years, an achievement credited largely to economic growth (World Bank, 2008a). However, it is not just the economy-wide pace of growth that matters for poverty reduction but also its sectoral composition, with agricultural growth known to be especially "pro-poor." But what determines growth and, of particular relevance to this report, what determines agricultural growth?

There is widespread agreement on a general list of contributory factors, e.g. access to output and input markets accommodated by a good transportation, marketing and processing infrastructure; non-discriminatory tax and trade policy; investment in agricultural research and extension; a system of ownership rights that encourages initiative; employment creating non-agricultural growth; well functioning institutions; good governance and so on. However, too little is known about how to measure those things, their relative importance and what governments ought to do to achieve them.

The approach we adopted in seeking to better inform such debate was to look for shared characteristics of developing countries posting exceptional success in reducing poverty over the past twenty to twenty-five years. Inspired by the World Bank's *2008 Growth Report* (Commission on Growth and Development), our method is based on the premise that a limited number of pre-conditions are necessary everywhere, if not always sufficient, for sustained progress in reducing poverty. We compared the countries using indicators of macroeconomic stability, trade openness, agricultural policy, public expenditures on agriculture and total factor productivity – a list created in the light of data availability and of findings from related past studies, e.g. World Bank (2005a); Kees van Donge, Henley and Lewis (2009).

The Growth Report examined common features of thirteen countries that since 1950 grew their economies at an average annual rate of 7% or more for 25 years or longer. In like fashion, we chose a list of twenty-five countries that in recent years achieved reductions in national poverty rates at a pace consistent with achieving the MDG of halving poverty by the 2015 target year. We then chose four countries (Ethiopia, Ghana, Indonesia and Vietnam) for more in-depth study. The analysis done for these four countries took greater account of the rural versus urban and the sectoral dimensions of linkages between growth and poverty.

In the next section we describe the particulars of our procedure for selecting study countries then move directly to analysis aimed at quantifying the relative importance for poverty reduction of different sources of income received by poor

people. In that analysis we estimated poverty elasticities and used the results to attribute historical poverty achievements by source of income. We then compared the countries in a search for common macroeconomic, socio-economic and agricultural characteristics that might explain their poverty achievements. The final section summarises and draws policy implications.

Measuring poverty and success in reducing it

Our method requires first choosing a list of countries that can be judged successful in reducing poverty. To proceed we therefore need both a definition of poverty and a way of ranking countries according to their progress in reducing it. The Copenhagen Declaration issued at the UN's World Summit on Social Development in 1995, described poverty as "…a condition characterised by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information." While evocative as a description of the human condition of those suffering from poverty, such definitions do not provide a quantitative basis for tracking progress in reducing it.

In the early 1990s the World Bank developed a way of measuring poverty using a common international definition (Chen and Ravallion, 2008). This method defines a poverty line based on the estimated money cost of a basket of goods considered necessary to cover basic needs – enough food for adequate nutrition and a minimum allowance for clothing and shelter. Those whose spending or income is not enough to cover basic needs are considered poor. The basket of goods that is used to calculate poverty lines is the same from year to year, but varies from country to country.

To measure progress against the MDGs the Bank uses a reference line set at USD 1.25 per day (at 2005 purchasing power parity [PPP]). This corresponds to the *mean* of the national poverty lines for the 10-20 poorest countries of the world. A common alternative choice is USD 2.00 per day - the one we used in this analysis, which corresponds to the *median* poverty line for all developing countries (Chen and Ravallion, 2008).

We chose the USD 2.00 threshold after experimenting with lower cut-off points, including the USD 1.25 one. The problem was that too few developing countries had both high rates of initial year poverty (first year for which poverty survey data were available) and showed rapid progress in reducing them when measured using lower poverty thresholds. For example, Chile posted spectacular gains in reducing USD 2 per day poverty during the past quarter century, outpacing most other countries when using that standard. However, when using the USD 1.25 standard, initial year poverty rates in Chile were already too low to show much gain from that exceptional performance.[1]

In what is purportedly the world's largest single statistical endeavour the World Bank collects and harmonises consumption estimates obtained from living standards surveys done by national statistical offices. The frequency of the surveys and the country coverage has increased sharply in recent years. Current estimates

1. In the empirical analysis reported subsequently we examined whether agricultural income is more important for the poorer segments of the population of those earning less than the USD 2/day threshold.

are based on 700 surveys for 119 countries (POVCALNET, World Bank online Poverty Database, accessed March 2011). Their main data source for prices and exchange rates has been the price surveys within countries done for the International Comparison Program (ICP) managed by the World Bank's Development Data Group. Local currency expenditures are converted to dollars using PPP exchange rates in order to assure international comparability of consumer expenditures, i.e. those USD 2 have the same command over goods and services in one country as another (and irrespective of whether the goods and services are tradable or not). In 2008, the PPP exchange rates were updated based on price surveys from 2005, a year for which country coverage of the cost of living surveys was much greater than in the past. Accordingly, 2005 is also the base year for price information.

With this information in hand one then calculates the level of an individual's *real* expenditures in a particular survey year by, in effect, multiplying each item in his/her consumption basket by its 2005 USD PPP price. If expenditures are less than the chosen poverty threshold – e.g. the USD 2.00 per day figure which we use, that individual is considered to be in poverty. The results for individual survey respondents are then extrapolated to the whole population to obtain estimates of the total number of people in poverty (the poverty headcount) as well as the percentage of the population in poverty (the poverty headcount rate). Thus, in comparing between two time periods the poverty headcount and the poverty rate both rise and fall as real expenditures rise and fall around the poverty threshold.

In equation form, total real expenditures by a given individual in some chosen time period is given by:

$$1)\quad E_t = \sum_{i=1}^{n} P_{i,2005} * Q_{i,t}$$

where:

E_t is real expenditures in period t

$P_{i,2005}$ is the 2005 USD price (at 2005 purchasing power parity) of the i'th good in the basket

$Q_{i,t}$ is the current quantity consumed of the i'th good in the basket

The change in quantities consumed and thus real expenditures between any two time periods will reflect changes in income or prices between those two periods:

$$2)\quad Q_t = f(P_t, Y_t)$$

where:

$f(P_t, Y_t)$ is the consumer demand function

$\mathbf{P_t}$ is a vector of prices of all goods and services relevant to consumption decisions by the individual

$\mathbf{Y_t}$ is a vector comprising the various sources of income received by the consumer.

The relationship between consumption and own price is negative and, for normal goods, that between consumption and income is positive. Accordingly, if

between the base year and a subsequent poverty survey year real prices of goods comprising the basket fall, the quantity consumed should increase (in the aggregate if not for every individual good). Thus, by Equation 1, real expenditures should increase. Likewise, if per capita income rises, expenditures on basic needs should rise, also lifting real expenditures.

Selecting success stories

We turn now to the specifics of the procedure we used to identify those countries achieving the most progress in reducing poverty and the results obtained in applying it. There were four distinct steps. First, we identified a list of countries that: a) in the first year for which a poverty estimate is available had a USD 2.00 per day poverty headcount rate of more than 10%; b) had at least two years of poverty survey data in order to measure changes over time; and c) posted reductions in that rate over the entire range of years for which poverty data are available from 1980 to 2005. This meant we automatically excluded countries where poverty was already relatively low or where the poverty rate either stayed the same or increased.

In the second step we calculated the average annual reduction in the poverty headcount rate posted by each of those countries over the entire range of years for which their poverty estimates are available. The third step in the selection process was based on the observed pace of poverty reduction. For this step we chose only those countries where the annual average decline in the poverty rate from the year of the first to the year of the last observation (survey) would permit a halving of their respective initial poverty rate in 30 years or less. Finally, we dropped countries which for one reason or another (oil rich countries, small island states, etc.) we judged unrepresentative for drawing general conclusions.

Twenty-five countries made the final cut. The first column of Table 1 lists them. The two subsequent columns show the rate of poverty observed in the first and final survey years respectively. The third column contains the estimated annual average reduction in the poverty rate for the years of data availability while the final column presents the year ranges and number of annual surveys used in making the calculations. Notice here that although we chose only countries having at least two years of poverty survey data, there are three cases: Cameroon, Gambia and Mali where there are only two survey years of data and others where there are only three or four. Moreover, in some cases, e.g. Egypt, the interval between survey years is rather short. These characteristics of the data limit both the comparability of results across countries and the generality of the conclusions that can be drawn; a point repeatedly emphasised by Chen and Ravallion (2008) in documenting latest revisions to the World Bank poverty data.

Although the selection procedure guarantees that every country in the list achieved some progress in reducing poverty there are large differences among them in just how much progress was actually achieved. China represents an overwhelmingly important extreme case. In 1981, the first year of poverty data availability for that country, 98% of the population was living below the USD 2.00 per day standard whereas by 2005 that percentage had fallen to only 36%. Including China, eight countries in the list halved poverty rates in the years between their respective first and last poverty surveys and others are on pace to achieve similar reductions in the next few years. In other countries though,

e.g. Mali, the poverty rate was extremely high in the first year of data availability and has been declining only very slowly since.

The selection constitutes a highly diverse mix representing most geographical regions of the developing world and spanning the range from some of the poorest countries (e.g. Mali) to some of the richest (e.g. Chile). The countries also differ greatly amongst themselves in terms of culture, religion and political systems. It is unsurprising to find growth powerhouses such as China, Brazil, Thailand and Vietnam on that roster. It may surprise, however, given widespread concerns over the lack of progress in reducing poverty in Sub-Saharan Africa, to see fully seven countries from that region on the list: Cameroon, The Gambia, Ghana, Kenya, Mali, Mauritania and Senegal. Using their own method for measuring progress Pinkovskiy and Sala-i-Martin (2010) reach even more optimistic conclusions about the pace of poverty reduction across the whole of the Sub-Saharan region.

Table 1. Selected countries and their poverty achievements, 1980-2005

	Country	Poverty rate (%) in		Average annual reduction achieved	Year range and number of surveys
		Initial survey year	Last survey year		
1	Brazil	31.2	18.4	-0.58	1981-2005 (21)
2	Cameroon	74.5	57.8	-3.35	1996-2001 (2)
3	Chile	23.5	3.1	-0.90	1987-2005 (8)
4	China	97.8	36.4	-2.39	1981-2005 (9)
5	Costa Rica	35.8	8.6	-0.93	1981-2005 (10)
6	Dominican Republic	30.5	15.1	-0.77	1986-2005 (7)
7	Egypt	27.8	18.6	-0.82	1990-2004 (4)
8	Gambia, The	82.1	56.8	-3.60	1998-2003 (2)
9	Ghana	79.1	53.7	-1.56	1987-2005 (5)
10	Guatemala	70.5	29.8	-2.67	1987-2002 (5)
11	Honduras	61.7	34.8	-1.78	1990-2005 (7)
12	Indonesia	88.4	54.0	-1.47	1984-2005 (8)
13	Kenya	59.4	40.1	-1.44	1992-2005 (4)
14	Malaysia	12.3	7.8	-0.30	1984-2004 (7)
15	Mali	93.8	82.1	-1.68	1994-2001 (2)
16	Mauritania	64.7	44.2	-2.15	1987-2000 (4)
17	Mexico	28.5	7.0	-0.66	1984-2004 (9)
18	Nicaragua	49.3	31.9	-1.31	1993-2005 (4)
19	Panama	26.8	17.9	-0.46	1991-2005 (8)
20	Philippines	62.1	43.92	-1.09	1985-2003 (7)
21	Senegal	81.6	60.5	-1.44	1991-2005 (4)
22	Tajikistan	78.6	51.1	-4.62	1999-2004 (3)
23	Thailand	44.1	11.6	-1.60	1981-2004 (7)
24	Tunisia	25.2	12.9	-0.59	1985-2000 (4)
25	Vietnam	85.7	52.7	-2.35	1992-2004 (4)

Source: OECD calculations based on data from POVCALNET, 2009.

The channels through which agriculture may contribute to poverty reduction

Developments in agriculture can lead to changes in real expenditures and thereby the poverty status of poor people through both the income and price channels as identified in equation 2 above. As noted earlier most of the poor in developing countries earn at least some of their income from farming. This direct income connection between agriculture and poverty constitutes the main focus of attention in this report. In measuring the importance of this relationship, we compare the poverty reducing impacts of income growth in agriculture with that of other sectors. We also compare the poverty reducing impacts of farm and non-farm income with that of remittances from overseas. Findings and further discussion of this analysis comes later in the report. First though some discussion of two potentially important but less direct links between agricultural performance and poverty is warranted: 1) growth multipliers and 2) food prices.

Agricultural growth multipliers

It is widely believed that one reason agricultural growth is so strongly pro-poor is because it induces income growth in other sectors of the economy through multiplier effects (Suryahadi *et al.*, 2006; Haggblade, Hazell and Dorosh, 2007; Christiaensen *et al.*, 2010). Such effects could be an important source of poverty reduction since income from off-farm sources often constitutes a significant share of total income of poor farm families and since many poor people depend entirely on non-farm income (de Janvry and Sadoulet, 2002). However, objective quantification of agricultural growth multipliers has proven difficult (World Bank, 2008b).

To clarify the idea, consider that the contribution of agriculture to economy-wide growth in the absence of multiplier effects could be no greater than one for one, e.g. a one dollar increase in agricultural GDP would show up as, at most, a one dollar increase in the economy-wide total. An induced increase in economy-wide GDP greater than one dollar indicates that a multiplier effect is at work. There have been many attempts over the years to verify the existence of such effects. Haggblade, Hazell and Dorosh (2007) review findings from a large number of past studies focused on quantifying agricultural growth multipliers. Some of these studies employed cross-section, time-series analysis with non-agricultural growth as the left hand side, dependent variable and agricultural growth as a right hand side, independent variable. A greater number of those past studies used counter-factual simulations of economic models. Each method poses both conceptual and empirical difficulties (World Bank, 2008b).

Econometric estimation confronts a conceptual problem (endogeneity) that makes it difficult to cleanly identify causal relationships using historical data (Gollin, 2009). Growth in both the agricultural and non-agricultural sectors of an economy depends on developments in a common sub-set of factors, including, e.g. interest rates, inflation, exchange rates and so on, i.e. both are simultaneously determined, endogenous variables. In economics, however, a multiplier is supposed to measure the proportional relationship between an *endogenous* and an *exogenous* variable. After reviewing numerous past attempts, Tsakok and Gardner (2007) concluded that economists will have to accept the fact that econometric studies of country data will not be able to establish whether agriculture or some other sector is the primary engine of economic growth. Collier and Dercon (2009) assert that the

available econometric evidence is far weaker than generally supposed. They suggest that, if anything, it is growth in demand stemming from other parts of the economy that drives agricultural growth, and not the other way around.

In estimating the effect of agricultural on non-agricultural growth econometrically, the analyst typically ignores what specific factor or factors drove agricultural growth in the first place. The analyst estimating such effects from counter-factual simulations of economic models must however nominate a specific parameter, policy instrument or exogenous variable as the underlying cause of growth. A common choice, and the one made for the Ethiopia and Ghana case studies (Box 1), is a parameter regulating agricultural productivity growth – yields or total factor productivity.

Numerical estimates of growth multipliers obtained from counter-factual simulations of economic models are also highly sensitive to a broad range of assumptions the modeller makes about the structure of markets and the behavioural parameters gauging supply and demand responses. Haggblade, Hazell and Dorosh (2007) point in particular to the implausibility of supply elasticities for both farm and non-farm goods that characterise some of the historically popular models used to estimate agricultural growth multipliers. Many of the studies they reviewed employed input-output (IO) models or simulations using social accounting matrices (SAMs) that assumed perfectly elastic supplies of all products. Other models, such as the semi-input-output (SIO), employ 'either-or' type assumptions whereby some productive factors, land for example, are assumed completely fixed in supply while all the others are assumed in perfectly elastic supply. Using endogenous price CGE models adds realism to the simulations, but nonetheless requires assuming the existence of slack resources in the economy – frequently some category of agriculturally specific labour.

Christiaensen *et al.* (2010) estimate growth multipliers using time series, cross-section analysis of data measuring poverty and sector GDP growth rates in 100 developing countries over the period 1960 to 2005. They find that growth linkages from agriculture to non-agriculture were largely limited to low income countries in Sub-Saharan Africa. However, even for this group of countries, the estimated linkage coefficients were quite small thus explaining only a tiny fraction of changes in poverty.

Box 1. Productivity growth and poverty in Ethiopia and Ghana

The Ethiopia and Ghana case studies (Diao *et al*., 2010a and 2010b respectively), compare the growth and poverty outcomes of hypothetical improvements in total factor productivity (TFP) in agriculture versus other sectors. Both studies used similarly structured, price endogenous, CGE models. Dorosh and Thurlow (2009) document the Ethiopia model; Breisinger *et al.* (2008) the Ghana one. The models each contain highly disaggregated representations of the agricultural and non-agricultural economies of the two countries, distinguishing e.g. agricultural production systems by agro-climatic zone for extensive lists of crop and livestock commodities. In the Ethiopia study, supplies of one category of agriculture specific labour and one category of non-sector specific unskilled labour were flexible, i.e. could adjust with variations in labour demand. In the Ghana study supplies of all categories of labour were exogenous.

Analysis comprises comparing growth and poverty outcomes for a multi-year baseline scenario (to year 2015) with alternatives derived by changing TFP assumptions for agriculture with those derived by changing TFP assumptions for non-agriculture sectors. The baseline scenarios reflect best-guess assumptions of values for all exogenous variables in the models.

There are two components to the household structure built into the models. First, there are 'representative' households, distinguished by geographic location (rural versus urban for multiple sub-national regions) and by income level (by income decile and thus poor or non-poor status). Every time the model is solved it automatically generates changes in prices, consumption quantities and real expenditures for these representative households.

Corresponding to each representative household there is a sub-group of survey households for whom it is possible to calculate real expenditures and poverty status. These expenditure equations are iteratively updated with the new price and consumption data generated by the various model scenarios. Each time happens there can be thus a re-evaluation of the expected poverty status of each and every one of the survey households. This information is used in its turn to re-calculate poverty headcounts and rates enabling conclusions about whether this or that hypothetical policy change was pro-poor.

The table below synthesises some key findings. The second column contains baseline growth scenarios and poverty headcount rates. By design, the baseline calls for rates of economy-wide and sectoral growth similar to those experienced by the two countries in recent years – somewhat higher for Ethiopia than for Ghana. The projected rates of growth for the agricultural sector are somewhat more modest than for non-agricultural sectors – a pattern consistent with the usual path of development in successfully developing countries.

Agricultural growth is more pro-poor

Ethiopia case	***Annual growth rates by scenario***		
	Base-run	***Change due to higher TFP in:***	
GDP		Agriculture	Non-agriculture
Agriculture	4.2	1.7	0.2
Non-agriculture	7.5	0.0	1.9
Total	6.1	0.7	1.1
Poverty headcount rate (by 2015)			
Urban	23.5	-2.8	1.0
Rural	29.6	-4.0	-2.1
National	28.6	-3.8	-1.6

Ghana case	***Annual growth rates by scenario***			
	Base-run	***Change due to higher TFP in:***		
GDP		Agriculture	Industry	Services
Agriculture	4.5	1.6	-0.6	-0.5
Industry	4.5	-0.2	2.8	0.0
Services	6.1	0.0	0.0	2.3
Total	5.2	0.5	0.8	0.8
Poverty headcount rate (by 2015)				
National	20.2	-1.9	0.1	-0.5
Urban	7.6	-0.5	-0.5	-1
Rural	29.6	-2.9	0.4	-0.3

Findings from the respective TFP scenarios are in the right most columns of the table, e.g. those under the column heading 'Agriculture' refer to marginal growth and poverty impacts obtained when only agricultural TFP rates are increased. Economy wide growth is, of course, higher in all the higher TFP scenarios. This is largely due however to growth only in the sector benefitting from the assumed boost in TFP, i.e. the spill-over effects from one sector to another are either zero or quite small.

The simulated marginal impacts of sectoral on economy wide growth are more or less in line with respective GDP shares. Agricultural growth produces a relatively smaller boost to total GDP because agriculture's share of GDP is smaller. Despite those smaller growth impacts however, agriculture is a substantially more powerful source of poverty reduction. The projected poverty impacts of agricultural growth dwarf the corresponding effects obtained from non agriculture. Indeed, in two cases – that of aggregate non-agricultural growth in Ethiopia and that of industry growth in Ghana – the poverty impacts are marginally positive. In both these cases, growth in the non agricultural sectors induces increases in consumer demand and prices whose effects on real expenditures by the poor are greater than any corresponding boost to their income.

Food prices and poverty

There is no more telling indicator of global agricultural progress over the long term than the steadily declining real price of food – a trend reflecting technology induced growth in agricultural productivity outstripping population and income driven increases in demand for food (Alston *et al.*, 2009). Because the poor spend a relatively much higher percentage of their income on food than do non-poor people, variations in prices of food commodities may also have special significance for poverty outcomes (Gollin, 2009).

However, variations in food commodity prices also affect farm income. Thus, for some poor people, both the income they earn and the prices they pay for foodstuffs would be affected - with opposite implications for poverty. In some countries higher food prices undoubtedly increase poverty while in others they lessen it. As Chandy and Gretz (2011) point out, the widely held view that higher food prices are an unmitigated bad for the world's poor is certainly not true.

To illustrate, consider how input subsidies might affect poverty. A popular rationale for giving subsidies to developing country farmers to purchase modern inputs is the notion of "win-win" whereby both farmers and consumers are supposed to benefit. Farmers benefit from lower effective prices of the subsidised inputs, encouraging them to use more of them, leading to higher production and net farm income. The extra production forces market prices down yielding lower food prices for consumers. Such developments are seen as 'pro-poor' since both the farmers who benefit most from the cost savings and the consumers who benefit most from the induced lower food prices are poorer than the rest of society.

Hidden in the above narrative is a closed economy assumption. If food commodities were imported or exported in significant quantities by a small developing country domestic market prices might be little affected by variations in a country's own production of them (Dercon, 2009; Gollin, 2009). Nonetheless, there are countries and regions within countries where it seems safe to assume that the main food staples are, whether by reason of geographic isolation or commodity specificities, essentially non-tradeable. An oft-cited example is Ethiopia (Dercon, 2009; Collier and Dercon, 2009). It is a land-locked country where high transport and other marketing costs, partly due to considerable geographic distances between

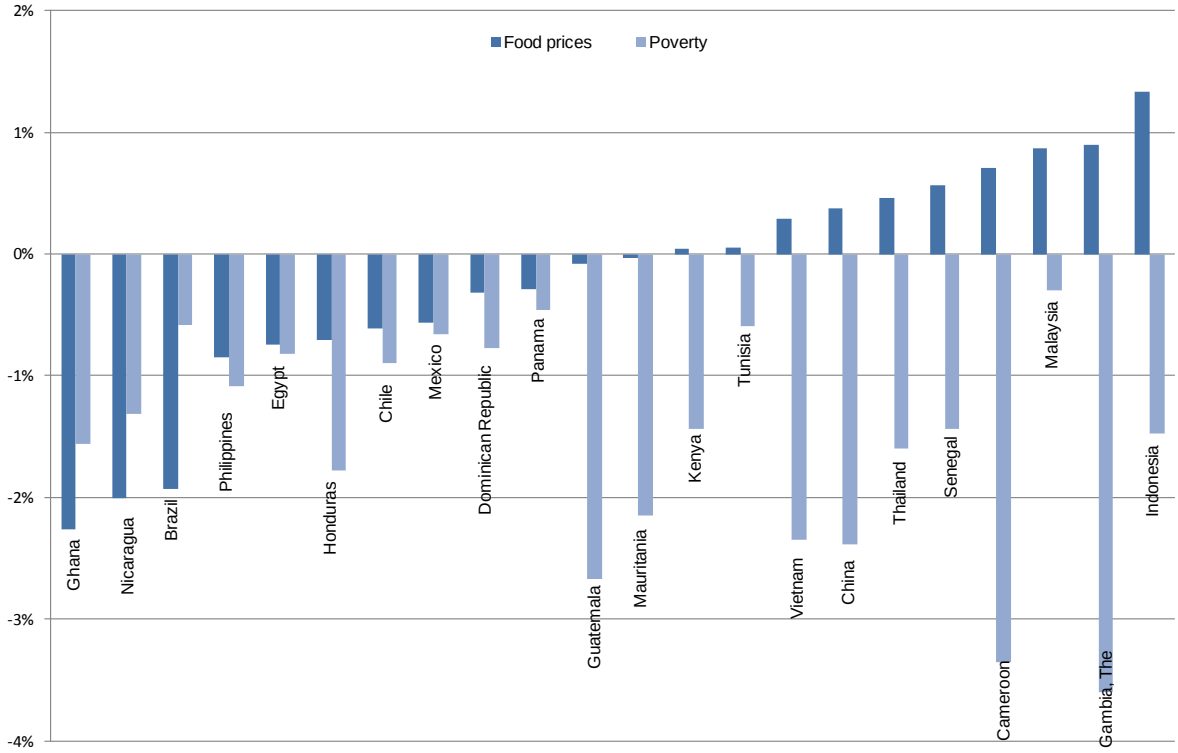
markets, prevent transmission of price signals. Moreover, one of the major staple crops – teff, is consumed largely only in Ethiopia and neighbouring Eritrea, thus effectively a non-tradable.

There is more to the story though. It is theoretically possible that the induced fall in market prices could be greater than the unit cost savings, for some or all producers. Alston and Martin (1995) show that under plausible assumptions about the nature of the induced supply shift and relative magnitudes of supply and demand elasticities, agricultural technical change can reduce national welfare. Even more likely is the possibility that the cost savings from input subsidies will not be equally spread among all farmers. In particular, there are often good reasons (existence of scale economies, willingness and capacity to undertake risk, access to finance) to expect that poor farmers are less likely than their better off neighbours to use modern inputs (Collier and Dercon, 2009). If only non-poor farmers benefit from the subsidies and if their resulting extra production does lead to lower market prices, some poor farmers could become even poorer. Further complicating this picture is the fact that some poor farmers are net sellers and some net buyers of the food commodities they produce.

It is thus impossible to draw general conclusions about whether in any given instance lower food commodity prices are good or bad for poverty (Aksoy and Hoekman, 2010). Lower food prices will inevitably lift some poor people above the poverty line and push some below it. It all depends on what caused the prices to fall in the first place, the degree to which price changes are transmitted to different groups of producers and consumers, the commodity mix and so on. The two case studies using price endogenous CGE models to measure poverty-growth linkages (Box 1) took account of the effects of higher agricultural productivity on food prices. They both found that, while food commodity prices did generally go down with higher agricultural productivity, the falls were not enough to offset the beneficial effects of assumed productivity improvements for farm incomes.

In neither the multi-country analysis, to be described below, nor in the two case studies using regression analysis to identify growth – poverty connections (Indonesia and Vietnam) did we detect a systematic relationship between food prices and poverty. Figure 1 illustrates the difficulty. During the period when the study countries posted rapid progress in reducing poverty real food prices either went up, often significantly, or stayed the same in roughly half the countries. They declined, often significantly, in the remaining countries.

Figure 1. Poverty versus food prices, average annual changes



Data cover the periods from the initial to the last survey year for which poverty estimates are available in the case of each of the countries in the sample.

Source: International Labour Organization, 2010; POVCALNET, 2010.

Quantifying poverty and income linkages

Previous studies

It is generally accepted that the only sustainable cure for poverty is economic growth and most empirical studies indeed find that poverty tends to fall with growth (World Bank, 2008a; Chandy and Gertz, 2011). But some kinds of growth reduce poverty more than others and many studies document that a given rate of growth can deliver diverse outcomes for the poor, suggesting that the pattern of growth (sectoral and/or geographical) matters independently of the overall growth. Poverty might be little affected if economic growth occurs in sectors that do not employ very many poor people (Christiaensen and Demery, 2007). If, for example, the poor live mostly in remote rural areas and depend mainly on agriculture for living, a booming high-tech sector in a distant metropolitan area may not have much of an impact on poverty.

Findings from the Ghana case study illustrate the point. The incidence of poverty in the Northern Savannah region of Ghana is much greater than it is in the rest of the country. Yet, in the analysis, the simulated reduction in poverty was much lower in that region than elsewhere in the country, e.g. while the estimated rural poverty reduction nationally was 3.5 percentage points, rural poverty declined only 2 percentage points in the North. This result is consistent with cross-country

empirical studies showing that the elasticity of poverty reduction to income growth is lower for low initial per capita income groups (Easterly, 2007).

In a paper done as background for the World Bank's 2008 World Development report, Ligon and Sadoulet (2008) combine time-series and cross-section data to estimate regression coefficients connecting consumer expenditures by decile to agriculture and non-agriculture GDP. Their findings are consistent with claims that agricultural sector growth is substantially more important than non-agricultural sector growth for those households in the lower deciles of the expenditure distribution, i.e. the poorer segments of the population. They find the opposite result for richer households, i.e. that the expenditure elasticity of non-agricultural growth is much higher than for agricultural growth leading them to conclude that their findings are consistent with claims that agricultural sector growth is pro-poor.

Christiaensen and Demery (2007) find that growth originating in agriculture is on average significantly more poverty reducing than growth originating outside agriculture. Christiaensen *et al.* (2010) analyse the same data but with the model augmented to include, among other variables, an indicator of income inequality. They find that agricultural growth is more effective in reducing poverty among the poorest of the poor (judged so by the USD 1 per day standard). However, non-agricultural growth seems to be more powerful in reducing poverty for the "better-off" poor (judged so by the USD 2 per day standard). Montalvo and Ravallion (2009) find that the primary sector rather than the secondary (manufacturing) or tertiary sectors was the real driving force in China's spectacular success against absolute poverty. They dismiss the idea of a trade-off between these sectors in terms of overall progress against poverty in China, given how little evidence of any poverty impact of non-primary sector growth.

While most empirical studies show that agricultural growth is relatively more important than growth in other sectors there are exceptions, underscoring the existence of potentially important differences in the sectoral GDP elasticities of poverty across countries, depending on the stage of development, structure and institutional organisation of their economies (Loayza and Raddatz, 2006). Ravallion and Datt (1996, 2002) showed that while rural economic growth had more impact on poverty in India than urban growth this was due to growth in the rural services sector rather than agriculture. That same study also found that growth in the manufacturing sector appeared to have brought little direct gain to India's poor.

A common finding is that the poverty reducing power of agriculture declines as countries get richer (Christiaensen and Demery, 2007; Ligon and Sadoulet, 2008). This possibly explains why Gardner (2000) found that gains in income from off-farm sources was the main reason rural poverty declined in the United States from the 1960s. Suryahadi *et al.* (2009) found that while agricultural growth strongly reduces rural poverty in Indonesia, urban services growth has the largest effect on poverty in both urban and rural locations. Contrastingly, their results also indicate that industrial sector growth had almost no impact at all on poverty in either rural or urban populations.

Though few countries have achieved rapid poverty reduction without it, a nation's economic growth is not essential to progress in reducing poverty. Earnings from work are of course the most important source of spending money for most poor people but some get money from other sources. Ravallion (2009) using the USD 1.25 per day indicator shows that sustainable poverty reduction is

theoretically possible through financial transfers from higher to lower income people in all but the poorest of developing countries. Chandy and Gertz (2011) report results suggesting that providing every person in the world in 2005 with a minimum income of USD 1.25/day would have cost less than the total volume of total aid disbursed in that year. They observe that this simple idea of fighting poverty by just giving money to the poor is gaining favour amongst many development specialists and policy makers.

One source of extra money known to be especially effective in reducing poverty is remittances from people who work abroad (Gubert *et al.*, 2009). Acosta *et al*. (2007) identify two different channels through which remittances can reduce poverty: a direct and short term effect when remittances flow to the poorest segments of the population and an indirect effect in the medium term by helping low-income households or small-scale entrepreneurs increase their investment in human and physical capital.

Migration of farm workers to higher paying off-farm jobs, either in rural or urban areas, constitutes another potentially important route to poverty reduction. Gollin (2010) finds that in many developing countries growth in per capita GDP, economy-wide, is driven more by re-allocation of labour from agricultural to non-agricultural sectors than by agricultural productivity improvements. He notes moreover that for many countries where the marginal productivity of agricultural labour is low the movement of workers out of agriculture is a significant force in improving the average product of the labour that remains in the sector.

Christiaensen and Todo (2008) observe that as countries develop: a) their economies restructure away from agriculture into manufacturing and services and b) people move from rural to urban areas. They emphasise however that, while intertwined, these structural and spatial transformation processes typically do not fully overlap. They find that migration from farm to non-farm work in rural areas is poverty reducing but not migration from farm to non-farm jobs in urban areas. Byerlee, de Janvry and Sadoulet (2009) report findings from World Bank (World Bank, 2008b) analysis showing that migration from rural to urban areas accounted for less than 20% of the reduction in rural poverty during 1993-2002. The other 80% came from improvements in economic conditions in rural areas, including in agriculture.

McCulloch, Weisbrod and Timmer (2007) utilise cross-section data in an attempt to determine whether productivity growth in agriculture, productivity growth in non-agriculture activities or migration from rural to urban areas was most successful in reducing rural poverty in Indonesia from 1993 to 2002. They find that while increased engagement of farmers in rural non-farm enterprises is an important pathway out of poverty, most of the rural agricultural poor that escape poverty still do so while remaining in rural areas, employed in agriculture. Interestingly, they conclude that rural to urban migration seems not to have been an important route out of poverty. This leads them to conclude that changes in agricultural prices, earnings and productivity still play a critical role in reducing poverty.

Data

Table 2 displays growth rates of real agricultural GDP per worker, non-agricultural GDP per worker and remittances per capita, for the full range of years for which poverty data are available. The agricultural GDP per worker series is, as the name implies, the ratio of total GDP for the sector divided by the estimated number of economically active workers claiming agriculture as their main source of income. Non-agricultural GDP per worker was defined residually, i.e. as the difference between total national and agricultural GDP divided by the difference between total national and agricultural employment. Agricultural GDP comprises the returns to land, labour and capital used in agriculture. It constitutes a good indicator of farm income trends assuming farmers own most of the land and capital and supply most of the labour used in the sector.

There are known biases and measurement problems with the data (Schmitt, 1990; Gollin, 2009). Particularly troubling is the fact that the annual estimates of economically active workers are too often extrapolations from very few, sometimes only one, actual employment surveys. Additionally, using the number of workers rather than, say, the number of hours or days worked to measure labour input, overstates actual labour input in agriculture - a measurement problem that is more severe the less developed is the country in question (Schmitt, 1990). There are two reasons. First, the number of hours worked by agricultural workers tends to be less than that of other workers (Gollin, 2010). Second, in many employment surveys an individual is counted as employed in a particular sector of the economy if he/she earns more than 50% of their income from or devotes more than 50% their working time to that sector. Because the incidence of part-time work is typically much higher in agriculture than in other sectors the employment statistics thus simultaneously overstate employment in agriculture and understate employment in other sectors. This leads, in turn, to estimates of average labour productivity that are biased downward for agriculture and upward for non-agriculture.

The data in Table 2 show that GDP per worker grew in 23 of the 25 countries while average per worker GDP in non-agriculture grew in 17 of the 25 countries. Agricultural GDP per worker also grew faster than non-agricultural GDP per worker in the great majority of countries - a trend characteristic of economic progress (Byerlee, de Janvry and Sadoulet, 2009).

Figures 2 to 4 plot the complete dataset of time-series and cross-section observations for the three income variables and poverty rates. Each dot in these Figures pairs a year by country observation for the poverty rate and, respectively: agricultural GDP per worker (Figure 2); non-agricultural GDP per worker (Figure 3); remittances per capita (Figure 4), for each year of survey data available.

These plots reveal the expected negative relationships between poverty rates and the three income categories. But, among the three, which has been the most important source of reduction in observed poverty rates? Answering such a question requires quantitative estimates of the causal relationship between each of the three variables and poverty.

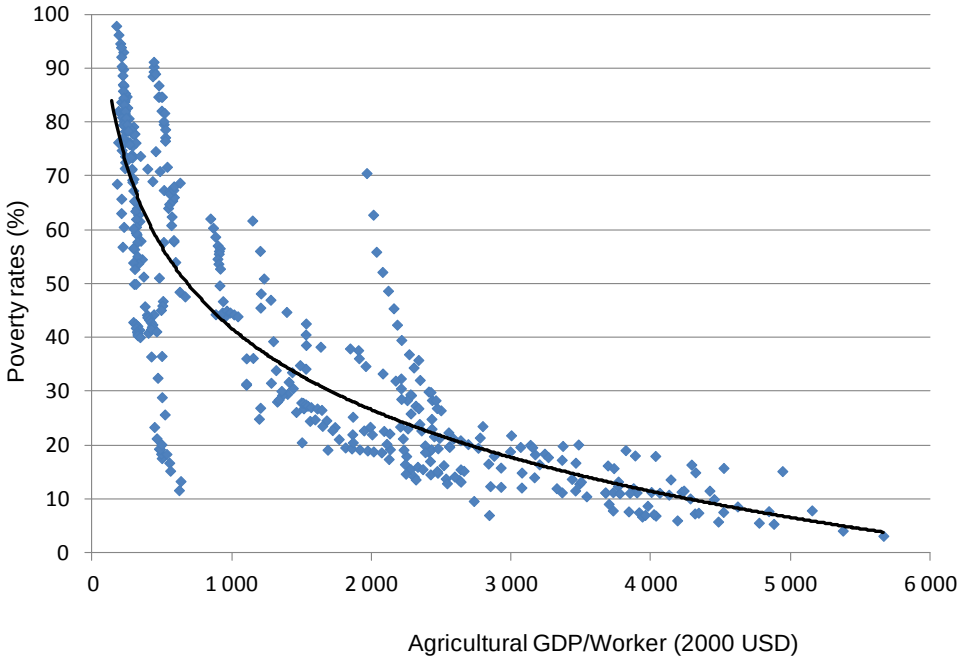
Table 2. Annual growth in income by source, 1980-2005

Country	Agriculture GDP per worker	Non-Agriculture GDP per worker	International remittances
	Annual average growth rates (%)*		
Brazil	4.71	-1.05	19.39
Cameroon	5.25	-1.36	-3.96
Chile	3.22	3.12	-3.70
China	3.35	8.56	16.96
Costa Rica	3.35	0.50	18.19
Dominican Republic	4.71	1.44	11.05
Egypt	2.37	0.59	-7.32
Gambia	0.37	-0.81	30.71
Ghana	0.61	1.54	16.20
Guatemala	1.60	0.44	15.27
Honduras	1.59	-1.00	19.63
Indonesia	1.40	1.64	17.03
Kenya	0.95	-2.54	9.71
Malaysia	2.32	2.14	12.02
Mali	1.19	2.83	-8.88
Mauritania	-1.30	-0.14	-17.25
Mexico	1.21	-0.76	7.89
Nicaragua	4.67	0.21	22.97
Panama	4.21	0.59	-5.58
Philippines	0.80	-0.15	10.66
Senegal	-0.52	0.28	7.04
Tajikistan	11.71	5.37	72.42
Thailand	1.67	2.94	0.71
Tunisia	2.63	0.71	1.54
Vietnam	2.83	5.11	10.97

* Year ranges of data used in calculating average growth rates vary by country. In each case, the range included only those years beginning with the initial and ending with the last survey year for which poverty estimates are available. Growth rates are calculated as the annual average differences in the logarithms of the indicators.

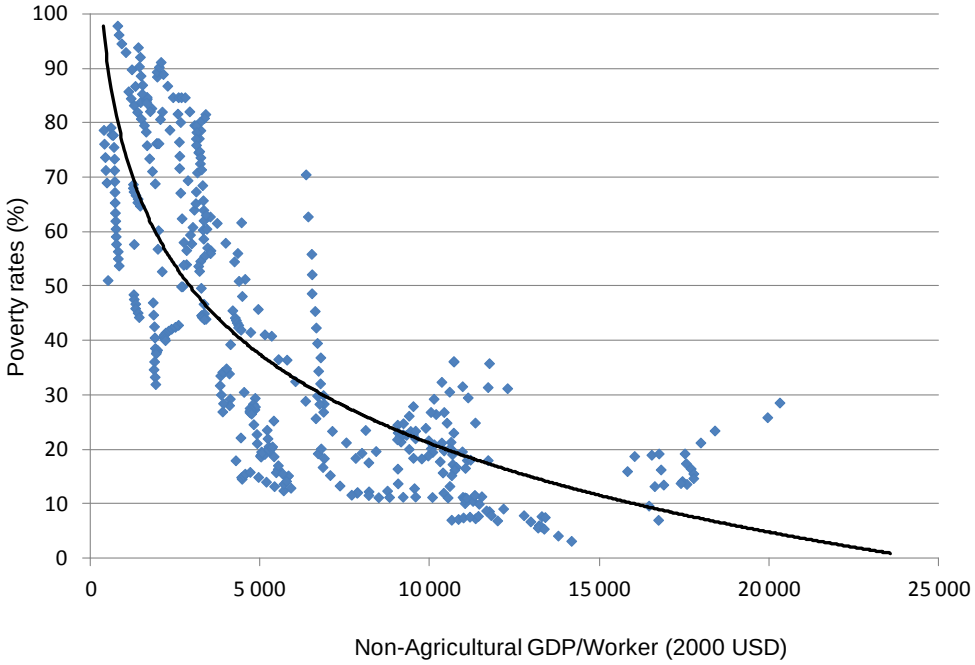
Source: OECD calculations based on data from WDI, 2009; FAO, 2009.

Figure 2. Poverty and agricultural GDP per worker



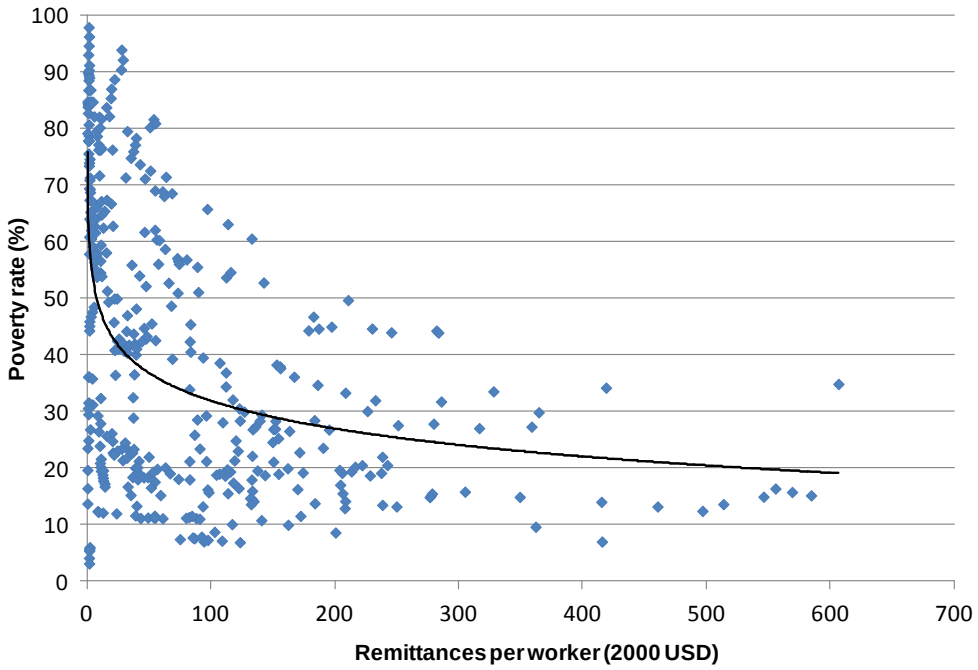
Number of observations: 147.
Source: OECD calculations based on data from POVCALNET, 2009 and WDI, 2009.

Figure 3. Poverty and non-agricultural GDP per worker



Number of observations:47.
Source: OECD calculations based on data from POVCALNET, 2009 and WDI, 2009.

Figure 4. Poverty and remittances per capita



Number of observations: 147. International remittances only.

Source: OECD calculations based on data from POVCALNET, 2009 and WDI, 2009.

Analysis

We estimate the relationship between poverty and agriculture by regression analysis using a dataset that combined the cross-section and time-series observations for all the years for which poverty survey data was available, 1980 to 2005. We used two different poverty indicators – the headcount rate and the squared poverty gap. Though it features most frequently in poverty discussions and analyses, the way the poverty headcount rate is calculated obscures information about the depth of poverty — it does not reveal just how poor the poor are. This is because when calculating the percentage of the population living below a specific poverty line, e.g. USD 1.00/day, a poor person spending just USD 0.10/day or less counts the same as one spending USD 0.99/day. Thus, the percentage rate does not change when people living below the poverty line become richer or poorer. During periods of economic prosperity, many poor people might experience an improvement in income but not by enough to clear the poverty threshold. Likewise, during periods of economic downturn many people already living below the poverty line might be spending less but that would not show up as an increase in the poverty rate.

An indicator which overcomes some of these problems is the poverty gap - the difference between a poverty line and actual expenditures by a poor individual. As the gap closes (tends to zero) it means that expenditures by the poor population are progressively closer to the poverty line, i.e. that poor people are becoming progressively less poor – a development that would not show up by looking only at the poverty headcount. The World Bank calculates a poverty gap indicator by

averaging poverty gaps of all those falling below the poverty line. This indicator is often used to estimate how much money would be required to lift spending levels for all poor people to just above the poverty threshold. An even more revealing indicator of the depth of poverty is the squared poverty gap. Its advantage over the poverty gap is in giving greater weight to the poorest of poor – those for whom the gap between their expenditures and the poverty threshold is the greatest. We used this indicator in the regressions to compare the pro-poorness of agricultural versus non-agricultural GDP/worker and remittances.

We also assessed the pro-poorness of the different sources of income by splitting the full sample of observations into two sub-samples according to the poverty status of the country. One sub-sample contains observations for those exhibiting an average for the period 1980-2005 of the ratio of the poverty line to mean per capita income smaller than 1 – i.e. the relatively well-off countries. The other sub-sample contained therefore observations for those countries in the sample exhibiting an average ratio of poverty line to mean per capita income higher than 1 – i.e. the relatively poor countries.

The specification of the regression equation follows closely that of Montalvo and Ravallion (2009) in their analysis of economic growth and poverty in China. However, our approach differs in one fundamental respect from that study and many other past attempts to econometrically estimate the relationship between poverty and sector incomes.[2] The research question motivating the Montalvo and Ravallion study and much prior analysis of the link between economic growth and poverty is whether the sectoral or regional pattern as distinct from the economy-wide rate of growth matters. The associated regression analyses featured two broad types of estimating equations, differing according to the choice of right hand side variables, but with many variations on the theme. In one of those two general categories, the right hand side variables comprise per capita income and GDP sector shares. In the other, the right hand side variables comprise simply per capita GDP separately for each economic sector, i.e. sector GDP divided by population.

We chose instead to use as right hand side variables sector GDP per worker, i.e. total sector GDP divided, not by population, but by the associated number of workers in the sector. Sector GDP per worker corresponds more closely to earnings or income per worker. Two contrasting trends characterise countries undergoing economic development: 1) agricultural GDP in total grows more slowly than GDP in other sectors, but 2) agricultural GDP per worker grows faster than in other sectors. It is the latter rather than the former that explains why poverty rates among those who depend on agriculture for a living decline sharply with economic growth. This crucial distinction is blurred when using either sector shares or sector GDP per capita as explanators in poverty regressions since, for agriculture, both these indicators tend to trend downward with economic progress.

2. Another, less fundamental, difference is that the regression equation in their study most closely resembling ours (their Equation 2) included country dummy variables to account for possibly systematic differences in the poverty rate between countries due to factors other than differences in income. (They do not explain what these other factors might be.) We estimated a version of this, the so-called 'fixed effects' model, finding a substantial deterioration in the efficiency and plausibility of some of the coefficient estimates for only a marginal improvement in the explanatory power of the model.

The data plots in Figures 2 to 4 reveal a non-linear relationship between the various categories of income and the poverty rate. Specifically, for all three types of income, the poverty rate seems to decline much more rapidly for marginal increments from low than from high per capita rates. This is unsurprising as the poverty rate measured in absolute terms has a lower bound of zero per cent beyond which further increments in income naturally have no effect on poverty. The semi-logarithmic function exhibits this sort of asymptotic behaviour making it a natural choice for specifying the regression relationship.

$$P_{it} = \alpha_0 + \alpha_1 \ln(AgGDP/Wk_{it}) + \alpha_2 \ln(NonAgGDP/Wk_{it}) + \alpha_3 \ln(Remit/Capita_{it}) + \epsilon_{it}$$

$$PGI^2_{it} = \gamma_0 + \gamma_1 \ln(AgGDP/Wk_{it}) + \gamma_2 \ln(NonAgGDP/Wk_{it}) + \gamma_3 \ln(Remit/Capita_{it}) + \epsilon_{it}$$

P_{it} is the poverty headcount for country i in year t

PGI^2_{it} is the poverty gap squared for country i in year t

$ln(AgGDP/Wk_{it})$ is the natural logarithm of agricultural GDP per worker for country i in year t

$ln(NonAgGDP/Wk_{it})$ is the natural logarithm of non-agricultural GDP per worker, country i in year t

$ln(Remit/Capita_{it})$ is the natural logarithm of remittances per capita for country i in year t

ϵ *i*s the error term.

Regression results

Tables 3 and 4 below contain summaries of regression results when using the full and split samples respectively.[3] A more complete presentation of results can be found in the Annex. The poverty rate regression equation explains a high percentage of variation (R^2 = 80%) in the pooled time series, cross-section poverty rate data. The estimated relationships between the poverty rate and the three income variables are negative and statistically significant.

The estimated coefficient on agricultural GDP/worker is significantly higher than that for non-agricultural GDP/worker. This means that, all other things the same, a given percentage growth in agriculture would reduce poverty more than the same percentage growth in the aggregated non-agricultural sectors of a country's economy. The estimated coefficient for the remittances variable cannot be directly compared to those for the GDP variables because of the different basis for

3. Several tests were undertaken to assess the statistical validity and robustness of the estimated results. The *Wooldridge* test used to test for auto-correlation when using panel data showed no evidence of problems. The *Likelihood-Ratio* test failed to indicate the presence of heteroskedasticity. The Variance Inflation Factors test indicated an absence of multicollinearity despite high correlation between the two GDP per worker. A panel is described as unbalanced if, as in the present case, some of the time series observations are missing. When using an unbalanced panel, one needs to take note of the possibility that the causes of missing observations are endogenous to the model. We employed a statistical procedure to check for selection bias due to missing observations of some years. The results were negative i.e. there was no evidence of such bias.

measurement (per capita instead of per worker). We develop a basis for facilitating such comparisons subsequently.

Results for the squared poverty gap version of the regression equation are in the right most columns of Table 3. Again, all the estimated coefficients are negative and statistically significant. And, as for the poverty rate, agricultural GDP/worker is shown to be more important than non-agricultural GDP/worker for reducing poverty amongst the poorest of the poor. We obtained corroborating support for this conclusion from regressions using the two sub-samples of observations. Those results are in Table 4 below.

Table 3. Regression results for poverty headcount and poverty gap squared

	Poverty headcount rate	Squared poverty gap
AgGDP/Wk	-0.137***	-0.043***
NonAgGDP/Wk	-0.103***	-0.028***
Remit/Capita	-0.018***	-0.007**
R-squared	0.80	0.58
Number of observations	147	145

Coefficient ** significant at 5%; *** significant at 1%.
Source: OECD calculations.

Table 4 compares estimated poverty elasticities for the relatively poor versus non-poor countries[4]. For the relatively poorest countries the estimated coefficients for agricultural GDP/worker and remittances per capita are both negative and statistically significant but the one for non-agricultural GDP is, though negative, trivially small and statistically insignificant. Moreover, both the agriculture and the remittances coefficients are greater for this sub-sample than for the full sample. All three coefficients are negative and significant when using the data for the relatively non-poor countries. Moreover, the coefficient estimated for the non-agricultural GDP/worker variable is greater than that for the agricultural GDP/worker variable. Overall then, this evidence confirms that implied when using the squared poverty-gap indicator – agricultural growth is potentially much more important than non-agricultural growth for reducing poverty among the poorest of the poor.

Table 4. Regression results for relatively poor vs. relatively rich countries

	Poverty line / mean income > 1	Poverty line / mean income < 1
AgGDP/Wk	-0.162***	-0.094***
NonAgGDP/Wk	-0.005	-0.117***
Remit/Capita	-0.046***	-0.011**
R-squared	0.35	0.55
Number of observations	44	103

Coefficient ** significant at 5%; *** significant at 1%.
Source: OECD calculations.

4. This first group – the relatively poorer countries, comprises 11 out of the 25 countries: Cameroon, China, Gambia, Ghana, Indonesia, Kenya, Mali, Mauritania, Senegal, Tajikistan, and Vietnam. The second group – the relatively well-off countries, comprises the remaining 14 countries: Brazil, Chile, Costa Rica, Dominican Republic, Egypt, Guatemala, Honduras, Malaysia, Mexico, Nicaragua, Panama, Philippines, Thailand, and Tunisia.

Box 2. Agriculture and poverty in Indonesia and Vietnam: Case study findings

The contribution of economic growth to poverty reduction might differ across sectors or regions because the benefits of growth might be easier for poor people to obtain if growth occurs where they are located (Christiaensen and Demery, 2007). Employing a regression strategy similar to that used for the 25 country sample, the analysis of agriculture's contribution to poverty was done for the Indonesia and Vietnam case studies (Cervantes-Godoy and Dewbre, 2010a and 2010b, respectively).

In Indonesia the cross-sectional observations for the dataset were constructed from provincial poverty rate estimates and corresponding aggregates of GDP/worker. The main source of data for estimating poverty in Indonesia is the National Socio-Economic Survey (SUSENAS) collected by Statistics Indonesia between 1996 and 2008. Similarly, the cross-sectional observations in the Vietnam case comprised aggregates for the eight regions of the country. The Vietnam dataset uses information provided by the Vietnam Household Living Standard Surveys (VHLSS) conducted in 1993, 1998, 2002, 2004 and 2006.

In both cases we used the national poverty line rather than the USD 2.00/day one to measure headcount rates. These were ~USD 1.55/day for Indonesia and ~USD 1.25/day for Vietnam. For both countries we distinguished the non-agriculture GDP aggregate between services and industry. Finally, for the Indonesia case we also distinguished between rural and urban poverty rates. Though we did not make that distinction for Vietnam, poverty in Vietnam is overwhelmingly rural.

The first table below summarises the main regression results for Vietnam and the following table summarises those for Indonesia. For Vietnam, the estimated regression coefficient for agricultural GDP/worker is negative and statistically significant. The finding that neither industry nor services were statistically significant contributors to poverty reduction in Vietnam echoes similar findings for China in the Montalvo and Ravallion (2009) study. Thus agricultural growth in earnings per worker is the overwhelmingly most important proximate cause of the poverty reduction achieved in Vietnam in recent years.

Regression results Vietnam

	Poverty headcount rate
In agriculture income per worker	-0.249***
In industry income per worker	-0.120
In services income per worker	0.015
R-squared	0.767
Observations	40

Coefficient *** significant at 1%.
Source: OECD calculations based on VHLSS statistics.

For Indonesia, the estimated regression coefficient for agricultural GDP/worker is also negative and statistically significant. However, there is greater variety in the results for Indonesia, as shown below.

Regression results Indonesia

	Poverty headcount rate	
	Urban poverty	Rural poverty
In agriculture income per worker	-0.033***	-0.117***
In industry income per worker	-0.007	0.049***
In services income per worker	-0.061***	-0.006*
R-squared	0.362	0.220
Observations	182	175

Coefficient * significant at 10%; ** significant at 5%; *** significant at 1%.
Source: OECD calculations based on BPS statistics.

Services GDP/worker is seen to have a greater effect on urban poverty than agricultural GDP/worker but it is the other way around for rural poverty. The finding that growth in industrial GDP per worker might have only a small impact on urban poverty and perhaps even a slightly positive impact on rural poverty in Indonesia brings to mind qualitatively similar results found in the Ethiopia and Ghana case studies (Box 1). Additionally, both Suryahadi et al. (2009, 2006, and 2003) and Warr (2006) found that growth in industry GDP in Indonesia had only a small influence on poverty. Suryahadi et al. (2009) speculated this was because: a) the industrial sector in Indonesia is much less labour intensive than either services or agriculture and b) most of the poor in the country are employed either in agriculture or in services. Warr

(2006) blames protection of the industrial sector that encouraged expansion of capital intensive manufacturing, driving down the demand for unskilled labour.

Indonesia's achievements in reducing poverty were substantial in the period leading up to the Asian economic crisis of 1997- 98. The pace of poverty reduction subsequent to the crisis has been slower than before it – period during which agricultural growth performance has been especially weak. As for the twenty-five countries analysis we used the regression results to simulate historical data in order to attribute reductions in predicted poverty rates to the three income sources. That analysis showed that growth in services GDP per worker explains most of the reduction in poverty headcount rates in the recent past. Although less important, agricultural GDP per worker growth still contributed significantly to poverty reduction. Growth in agriculture can be credited with 16% of the predicted reduction in rural poverty and 5% of the predicted reduction in urban poverty

Relative contribution of three income sources to poverty achievements

The basis for interpreting the regression coefficients in Tables 3 and 4 was a hypothetical percentage change in sector GDP per worker or remittances per capita, i.e. they answer the hypothetical question "what would happen to the poverty rate if one or the other sources of income were to change by 1%?" Those results are also useful in addressing another important, more concrete, question frequently posed in analyses of economic growth and poverty. That question is: "How important was past growth in agriculture versus other kinds of income as a source of poverty reduction?" To make such judgements requires both the estimated coefficients linking sector growth rates to poverty and knowledge of the historical rates of growth.

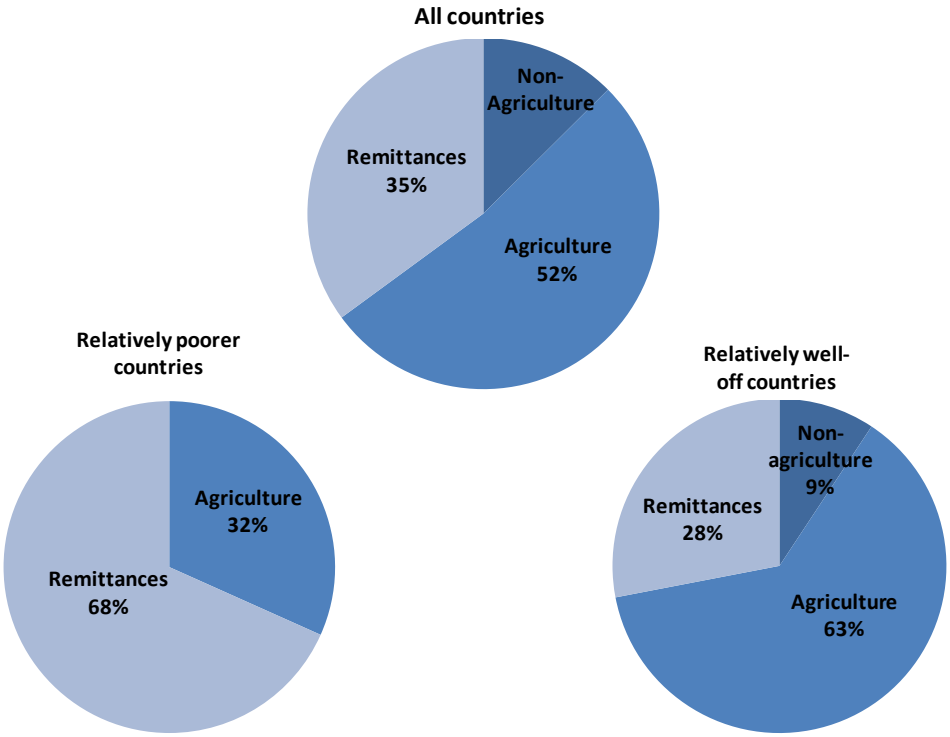
We used the estimated regression equations to simulate historical data and then attribute reductions in the resulting predicted poverty rates among the three variables. There were three steps. In the first step we generated a baseline of predicted poverty rates by plugging into the regression equations observed values for each of the three income variables for each year of the entire study period 1980-2005. In the second step, we created three alternatives to that baseline by sequentially replacing actual observations for two of the three income variables by their sample means. This procedure offers one important additional advantage. Recall, because of differences in their units of measure we could not meaningfully compare estimated regression coefficients between the sectoral income variables (which are measured in per worker terms) and remittances (which are measured in per capita terms). However, the simulation results are comparable between these categories of income.

An example might help to clarify. Imagine that we wanted to isolate the changes in the predicted poverty rate due only to observed changes during the study period in agricultural GDP/worker. In this case we would replace the complete time series of observed values of remittances per capita and non-agricultural GDP/worker by constants – their respective sample period averages in this case, thereby insuring that any trends in the predicted poverty rate could only be due to changed values for agricultural GDP per worker. In the final step we compared, one by one, the predicted values obtained in the three alternative scenarios to those from the baseline.

We use these results to ask, what proportion of the reduction in predicted poverty rates was due to each of the income variables individually. Figure 5 shows these results for the whole sample of study countries and separately for the relatively poor and relatively well-off sub-samples. Overall, more than half of the

predicted reduction in poverty was due to growth in agricultural incomes, over one-third to growth in remittances with the rest due to growth in non-farm incomes.

Figure 5. Average contribution to poverty reduction by income source: all 25 countries vs. divided sample



Source: OECD calculations based on data from POVCALNET, 2010 and WDI, 2010.

However, the picture is quite different for the two sub-samples.[5] For the relatively well-off group, (bottom right panel of Figure 5) growth in agricultural GDP/worker was an even more dominant source of poverty reduction than in the full sample with correspondingly much smaller shares of predicted poverty reduction attributable to growth in non-agriculture and remittances. Agriculture's dominance comes about not because the estimated poverty elasticity for agricultural GDP/worker is higher - in fact it is slightly lower than the one obtained for non-agricultural GDP/worker (Table 4). Rather, agriculture dominates because per worker GDP in agriculture grew faster over the study period than GDP/worker in other sectors in most of countries in this sub-group. All of the countries in this, the relatively well-off group, are today middle income countries as conventionally defined within the World Bank classification. Sumner (2010) emphasises that, contrary to popular perception, most poor people (three-quarters of the global total) now live in middle income countries. Among the implications he draws from analysis of this development is that policies to promote long-term poverty reduction will require more focus on structural transformation.

5. When comparing the attribution by source of income between top and bottom panels of Figure 5 bear in mind that the estimated poverty elasticities are unique for each of the sub-samples. This means that, while they are closely related, the attributions in the top panel cannot be inferred directly from those in the bottom panel.

The bottom left panel of Figure 5 shows that growth in remittances was overwhelmingly more important than agricultural growth as a source of poverty reduction for the poorest countries. No part of the poverty reduction achieved by these countries can be credited directly to growth in non-agricultural incomes. The finding that remittances were the dominant source of poverty reduction for this sub-group of countries points to the significant potential of financial transfers in general as a way of combating extreme poverty.

Characteristics of countries achieving rapid poverty reduction

The above analysis is consistent with prior analyses in showing that agricultural progress contributes strongly to poverty reduction. Now we want to see if there are other characteristics shared by the countries achieving rapid progress in reducing poverty that point to policies governments might wish to emphasise in their development efforts. First though a caveat is in order. We did not endeavour to quantify the impacts on agricultural progress or poverty reduction of the various characteristics we studied. The data and conceptual challenges that confront any attempt to do so are formidable; the record of past efforts using, e.g. cross-country growth regressions, is discouraging (Easterly, Levine and Roodman, 2003; Gardner and Tsakok, 2007; Gollin, 2010). Attributing credit to this or that policy change is made especially difficult by the fact that, typically, there were multiple reforms in many domains of government policy all occurring at the same time. Our approach generates additional circumstantial evidence which may help to corroborate or refute conventional wisdom about what matters for agricultural progress and poverty reduction but it cannot prove causality.

Macroeconomic characteristics

Table 5 contains a short list of macroeconomic indicators that often feature in descriptions of a country's economic performance. The list begins with an estimate of the economy-wide growth in GDP per capita. These data refer only to those years spanning the range from the first to the last year of poverty availability for each country. With two minor exceptions, all the study countries experienced positive per capita income growth during the years when their poverty rates were falling.

The World Bank's Growth Report (World Bank, 2008a) singled out trade openness as the most important shared characteristics of the high growth countries studied. The middle columns of Table 5 compare the evolution from 1980 to 2005 of an index of trade openness — the sum of exports and imports expressed as a percentage of national GDP.[6] The higher the value of this percentage, the less restrictive trade policy is seen to be. Interpreted in this way, almost all countries improved their performance (became more "trade friendly") during the period when their poverty scores were also improving. Where this did not occur, the declines were small and, for the most part, in countries already exhibiting a high degree of trade openness.

6. The use of trade flows as an indicator of trade openness, though common in analysing economic growth, is not without critics. Some analysts prefer composite indicators, such as the famous Sachs-Warner index, thought to be less vulnerable to endogeneity problems. We chose not to use the Sachs-Warner index because the available time series do not cover a sufficient number of years for the period of study.

The final columns of Table 5 show the evolution of an indicator of macroeconomic performance based on data from the International Country Risk Guide (PRS-Group, 2009) and used as a barometer of overall economic health of a country. A country's score on this indicator is based on the average of three measures: the budget balance score, inflation score, and exchange rate stability score. This index too indicates significant improvement in economic conditions in virtually every one of the study countries from the mid-1980s to present times.

Table 5. Macroeconomic indicators

Country	GDP per capita annual growth (%)	Trade openness (trade as % of GDP)		Composite macroeconomic stability index	
	Initial to last survey year (varies)	1980	2005	1984	2005
Brazil	0.71	20	27	2.10	7.83
Cameroon	2.16	55	42	5.78	9.31
Chile	4.23	50	74	3.50	9.33
China	8.63	22	69	6.85	8.50
Costa Rica	2.14	63	103	3.90	7.83
Dominican Republic	2.89	48	72	4.77	7.17
Egypt	2.46	73	63	5.01	7.36
Gambia	0.46	106	110	4.33**	8.00
Ghana	1.79	18	98	2.73	7.44
Guatemala	1.60	47	66	5.57	8.33
Honduras	1.14	81	136	4.90	8.00
Indonesia	3.37	54	64	5.10	8.00
Kenya	-0.10	65	64	4.98	7.99
Malaysia	4.05	111	218	7.43	8.50
Mali	3.13	44	63	5.65**	8.26
Mauritania	-0.17	103	132	n.a.	n.a.
Mexico	1.18	24	62	3.83	8.67
Nicaragua	2.40	67	88	3.27	8.67
Panama	2.03	187	144	7.40	8.33
Philippines	1.14	52	99	3.07	8.00
Senegal	1.29	62	69	5.71	8.60
Tajikistan	8.42	81*	79	n.a.	n.a.
Thailand	5.01	54	149	7.07	9.00
Tunisia	2.47	86	98	5.07	8.49
Vietnam	5.86	23*	143	4.60**	8.00

* Tajikistan 1988 and Vietnam 1986. ** Gambia 1985, Mali 1996, Vietnam 1985.

Source: WDI, 2009; PRS-Group, 2009.

The overall picture that comes into focus when looking at the figures in Table 5, corroborated by findings from other analyses, World Bank (2005a, 2008a); Ravallion (2009); Kees van Donge, Henley and Lewis (2009) is that countries achieving success in reducing poverty did so while posting impressive progress in macro-economic performance. These findings thus contribute to the accumulated

body of past research on the subject showing that successful macroeconomic performance is, if not strictly causal, a necessary pre-condition to success in combating poverty.

Socio-economic characteristics

Human development

Did the countries chosen on the basis of their achievement in reducing poverty perform well on other indicators of socioeconomic progress? Table 6 contains estimates of a development indicator monitored by the UN Development Program called the Human Development Index (HDI). The HDI index is a summary composite index that measures a country's average achievements in three basic aspects of human development: health, knowledge, and a decent standard of living.

Table 6. Human Development Index

HDI rank	Country	1980	1985	1990	1995	2000	2005
High Human Development							
40/179	Chile	0.743	0.761	0.788	0.819	0.845	0.867
48/179	Costa Rica	0.772	0.774	0.794	0.814	0.83	0.846
52/179	Mexico	0.739	0.758	0.768	0.786	0.814	0.829
62/179	Panama	0.737	0.751	0.752	0.775	0.797	0.812
63/179	Malaysia	0.662	0.696	0.725	0.763	0.79	0.811
70/179	Brazil	0.685	0.7	0.723	0.753	0.789	0.8
Medium Human Development							
78/179	Thailand	0.654	0.679	0.712	0.745	0.761	0.781
79/179	Dominican Republic	0.66	0.684	0.697	0.723	0.757	0.779
81/179	China	0.559	0.595	0.634	0.691	0.732	0.777
90/179	Philippines	0.688	0.692	0.721	0.739	0.758	0.771
91/179	Tunisia	0.575	0.626	0.662	0.702	0.741	0.766
105/179	Vietnam	n.a.	0.59	0.62	0.672	0.711	0.733
107/179	Indonesia	0.533	0.585	0.626	0.67	0.692	0.728
110/179	Nicaragua	0.593	0.601	0.61	0.637	0.671	0.71
112/179	Egypt	0.482	0.532	0.575	0.613	0.659	0.708
115/179	Honduras	0.578	0.611	0.634	0.653	0.668	0.7
118/179	Guatemala	0.55	0.566	0.592	0.626	0.667	0.689
122/179	Tajikistan	n.a.	0.705	0.703	0.638	0.64	0.673
135/179	Ghana	0.471	0.486	0.517	0.542	0.568	0.553
137/179	Mauritania	0.41	0.435	0.455	0.487	0.509	0.55
144/179	Cameroon	0.468	0.523	0.529	0.513	0.525	0.532
148/179	Kenya	0.514	0.534	0.556	0.544	0.529	0.521
155/179	Gambia	n.a.	n.a.	n.a.	0.436	0.472	0.502
Low Human Development							
156/179	Senegal	0.367	0.401	0.428	0.449	0.473	0.499
173/179	Mali	0.268	0.272	0.296	0.321	0.352	0.38

Source: UNDP, 2009.

Health is measured by life expectancy at birth; knowledge is measured by a combination of the adult literacy rate and the combined primary, secondary, and tertiary gross enrolment ratio; and standard of living by GDP per capita (PPP USD). It is expressed as a value between 0 and 1. The closer a country's index is to 1 the higher its rank on the HDI. By measuring basic human capabilities in these three dimensions, the index gives a broader picture of the average achievements of human development within these countries. With two exceptions (Tajikistan and Kenya) all twenty-five countries chosen for their exceptional progress in reducing poverty also posted improvements in their HDI scores. In most cases those countries posting the fastest progress in reducing poverty also posted the greatest improvement in their HDI scores.

Education

The emphasis on education of poor people in rural areas as a driving force for improvements in the quality of agricultural labour and the growth of agricultural productivity dates from the early 1960s (Griliches, 1963; Schultz, 1964). More recent studies show that rural education is important because it can offer people the necessary skills expected to foster adoption of innovation and risk-taking (Knight *et al.*, 2003), as well as those that will provide them with opportunities to pursue better remunerated non-farm activities (World Bank, 2008b).

A rough indicator of the success of the education system is primary school completion[7] (UN, 2005). Table 7 shows estimates for the study countries with comparisons to regional averages. Study countries from the Asian region posted the highest overall rates of completion in primary education. With the exception of Guatemala and Nicaragua, Latin American countries come close to the Asian levels. As for many indicators of social and economic performance, countries from the Sub-Saharan Africa region registered the lowest primary education completion rates - only around one-half those in other regions.

Looking at trends however reveals significant progress in nearly every one of the countries – with remarkable improvements in some of them (Ghana, Mali, Nicaragua, Egypt, Tunisia). Given that many are predominantly rural, progress in closing the rural-urban education gap could be one of the most important factors explaining the upward trends in primary school completion rates (UN, 2005).

As for other indicators, it is difficult to establish econometrically a line of causation between education, economic success, agricultural growth and poverty reduction. Are achievements in education a function of income or is it the other way around? Overall, statistics on school enrolment or completion capture only part of the picture and the quality of rural education in particular remains difficult to assess.

7. Primary completion rate is the percentage of students completing the last year of primary school. It is calculated by taking the total number of students in the last grade of primary school, minus the number of repeaters in that grade, divided by the total number of children of official graduation age. Primary completion rates higher than 100% are an indication of under-aged or over-aged students completing primary education level. However, it does not automatically mean that all the children of official graduation age have completed primary school.

Table 7. Primary school completion rates (% of relevant age group) (averages, 1980-2005)

Country	Primary school completion rate (%)		
	1980-89	1990-99	2000-05
Latin America & Caribbean (developing only)	n.a.	90.16	98.41
Brazil	73.95	91.44	108.06
Chile	n.a.	94.11	97.75
Costa Rica	79.78	80.71	90.39
Dominican Republic	n.a.	65.70	84.29
Guatemala	36.44	50.21	65.14
Honduras	44.58	67.87	81.25
Mexico	86.21	94.01	100.70
Nicaragua	32.75	50.83	70.16
Panama	83.82	92.47	95.45
Sub-Saharan Africa (developing only)	n.a.	51.22	55.13
Cameroon	50.32	51.96	53.92
Gambia, The	62.46	65.33	68.70
Ghana	37.92	52.97	77.87
Kenya	86.05	n.a.	88.77
Mali	10.89	16.26	37.65
Mauritania	24.80	33.38	45.89
Senegal	31.96	40.72	45.26
East Asia and Pacific (developing only)	n.a.	100.99	n.a.
China	n.a.	101.51	n.a.
Indonesia	80.64	96.58	101.26
Malaysia	92.19	92.24	94.19
Philippines	88.05	86.89	95.91
Thailand	n.a.	86.80	n.a.
Vietnam	n.a.	96.17	99.36
Middle East & North Africa (developing only)	n.a.	n.a.	n.a.
Egypt, Arab Rep.	44.60	86.74	87.43
Tunisia	63.46	82.29	94.47
Europe and Central Asia (developing only)	n.a.	93.82	94.73
Tajikistan	n.a.	90.18	96.50

Source: WDI, 2010.

Agricultural trade and trade distortion

The discussion of macroeconomic context above used the ratio of a country's total trade volume to its economy-wide GDP to show trends in trade openness. Table 8 below contains an agricultural version of that indicator using data on agriculture-only trade and GDP. In almost all the countries this index trended upward over the years during which their poverty rates declined: less so in the African countries than elsewhere (with the notable exception of Ghana). Generally

speaking, scores on this indicator were highest and trending upward faster for countries in the list that are important *exporters* of some agricultural commodity or commodities actively traded on world markets (Brazil, Chile, Costa Rica, Ghana, Malaysia, Thailand and Vietnam). The indicator shows some countries, *e.g.* China, as having both relatively low and declining agricultural trade openness. In some instances, low and declining scores could result from increasingly restrictive agricultural trade policies. In others, those same scores would merely reveal a country's comparative advantage in agriculture or the relative importance of the domestic as compared to the export market for the agricultural commodities it produces. Below we present a better indicator of the effects of agricultural trade policy interventions.

Table 8. Total value of agricultural trade as a percentage of agricultural GDP (%)

Country	1980	1985	1990	1995	2000	2005
Brazil	50	46	35	51	54	79
Cameroon	43	35	30	38	29	34
Chile	60	67	63	61	100	136
China	22	13	21	22	16	19
Costa Rica	92	141	116	130	143	163
Dominican Republic	56	99	70	57	52	43
Egypt, Arab Republic	76	65	44	41	26	41
Gambia	109	108	103	99	64	139
Ghana	34	24	23	24	50	53
Guatemala	60	37	50	48	50	91
Honduras	141	93	124	102	101	130
Indonesia	23	17	20	30	35	43
Kenya	45	48	42	64	42	48
Malaysia	94	82	97	105	120	145
Mali	34	53	34	35	39	32
Mauritania	64	112	66	35	65	49
Mexico	31	24	42	74	76	81
Nicaragua	n.a.	n.a.	n.a.	68	93	118
Panama	110	91	96	93	88	88
Philippines	32	23	27	27	34	46
Senegal	60	57	65	61	72	83
Tajikistan	n.a.	n.a.	n.a.	85	116	93
Thailand	53	61	66	75	90	91
Tunisia	53	43	48	75	49	66
Vietnam	n.a.	7	39	50	49	54

Source: OECD calculations based on FAOSTAT Trade Statistics, 2010 and WDI, 2010.

Until recently, the governments of many developing countries intervened in trade in ways that resulted in farmers paying more than world market prices for their inputs and receiving less than world market prices for their outputs. Eliminating such distortions not only increases farm income but also farmer incentives to adopt new productivity-enhancing technologies (Thompson, 2010). Table 9 contains data measuring Nominal Rates of Assistance (NRA), an estimate of the percentage by which government policies have raised/lowered gross returns

to farmers above what they would be without the government's intervention (Anderson and Valenzuela, 2008). Data was available for seventeen of the study countries. The last row contains NRA results for high-income OECD countries, included to show how much trade protection and support farmers in these important trading partner countries received.

Table 9. Evolution of Agricultural Nominal Rate of Assistance

Country	Average NRA 1980-89	Average NRA 1990-99	Average NRA 2000-05
Brazil	-23.41	-1.64	4.13
Cameroon	-6.84	-1.19	-0.13
Chile	10.09	8.04	5.34
China	-39.80	-3.83	6.02
Dominican Republic	-33.55	4.08	6.79
Egypt	23.72	-1.05	-5.50
Ghana	-12.92	-2.36	-1.35
Indonesia	3.74	-7.58	12.00
Kenya	-4.01	-1.73	9.27
Malaysia	-1.66	1.03	1.20
Mali	-1.43	-1.59	0.12
Mexico	3.40	17.49	11.32
Nicaragua	n.a.	-7.69	-4.22
Philippines	8.83	25.68	21.97
Senegal	-7.88	-0.24	-7.15
Thailand	-4.13	-2.04	-0.20
Vietnam	-13.87	-12.39	19.42
OECD-high income countries (average)	93.95	75.71	52.27

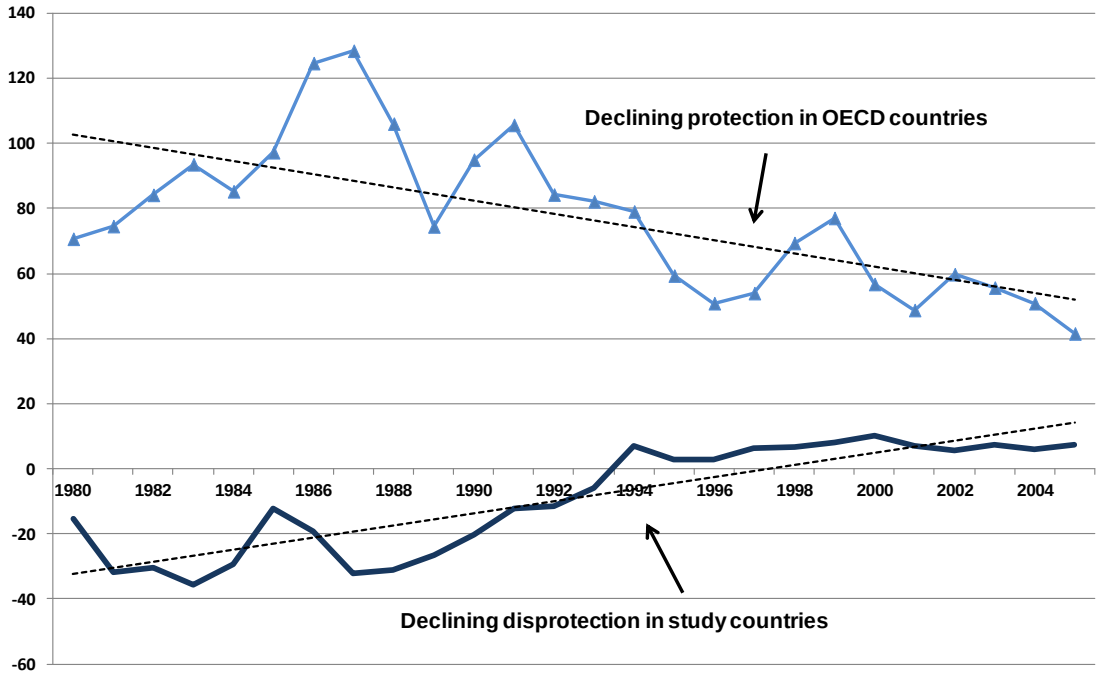
Source: Anderson and Valenzuela, 2008.

Interpreting the 2000-05 averages as indicating the current state of affairs we see that farmers now receive rates of government price support that are generally positive. This contrasts sharply with the situation in the 1980's when NRAs were mostly negative, often significantly so. In general then, over the entire period and for most of the countries the loss of income farmers suffered because of export taxes, overvalued exchange rates and so on was declining. The turnarounds were especially dramatic in Brazil, China, and Vietnam, three countries also posting exceptionally rapid declines in poverty.

Now, looking at the final row in the table we see that the high, positive rates of trade protection and price subsidy afforded rich country farmers were also generally declining. The protection confronting developing countries in rich country markets since the 1980s has progressively and significantly declined, a development borne out when looking at more comprehensive estimates of OECD farm support reported in the annual Monitoring and Evaluation Report (OECD, 2011). Note that these latter will substantially overstate OECD trade protection confronting those developing countries in the list who benefit from preferential access to OECD markets under a wide variety of preferential trading agreements.

Taken together, the trading environment confronting farmers was characterised by declining negative protection in the home country and declining positive protection in the rich country trading partners. These general tendencies are illustrated in Figure 6. Trade agreements offering greater market access to OECD markets for agricultural products originating in developing countries would have further enhanced the trading environment in which many of the countries were operating.

Figure 6. Nominal rate of assistance in OECD countries versus selected developing countries (1980-2005, averages)



A weighted average is constructed for the 17 countries for which NRA data is available using weights based on the gross value of agricultural production at undistorted farm gate prices (in current USD).

Source: OECD calculations based on Anderson and Valenzuela, 2008.

Land rights

Previous research has shown that transparent, equitable and legally enforceable ownership rights encourage productivity improving agricultural investments. Marketable titles to land also foster the structural adjustments that accompany economic growth by making it easier for some poor people to sell or rent their land to more efficient farmers in order to pursue more remunerative employment off the farm (World Bank, 2008b). During the study period there were major land reforms in quite a number of the countries including China, Mexico and Vietnam (Box 3 discusses the especially important case of Vietnam). However there are no data available suitable for doing the 'across country and over time' comparisons we achieved with indicators of the other characteristics studied.[8] The following review

8. We considered using the Index of Economic Freedom (developed by the Fraser Institute). It covers the legal security of property rights and the enforcement of contracts. It is assembled from three primary sources: the *International Country Risk Guide*, different

of past studies of land reform efforts in some of them provides circumstantial evidence of their contribution to pro-poor development.

Malaysia, Thailand and Tunisia all undertook large-scale tenure regularisation during the last quarter century, providing formal titling with considerable positive impact on tenure security for the rural poor (Deininger, 2003). In Thailand, land ownership titles induced higher investment in farming capital stock and titled land had significantly higher productivity per unit (Deininger, 2003). Even in Indonesia, a country which has not benefited from a widespread land reform, systematic registration reported in Sulawesi region has led to increased investment in land improvements in the rural areas (USAID, 2010).

A problem common to many countries in Africa is the existence of a dual tenure and land management system, with statutory and customary systems being run in parallel. The customary system enjoys legitimacy at the level of rural communities as it is more accessible to rural people and more flexible to specific organisational issues of communities (Freudenberger, 2000), even if inconsistent with the official legislation. Recent reforms in some African study countries (Ghana, Kenya, Mali) have gone a long way toward recognising customary tenure, thereby providing the basis for integrating it into more formal systems (Deininger, 2003). Some countries such as Mali launched policies of decentralisation (1996) with the intent of facilitating the progressive transfer of land and natural resource management from the state to decentralised entities at the regional, district and local levels (USAID, 2010). Moreover, in different areas where cash crops are grown (e.g. Cameroon), land rights are increasingly determined by the market rather than the decisions of traditional leaders applying customary law (USAID, 2010).

The existence and well-functioning of land markets are also very important as they facilitate the exchange of land and, where supported by access to credit, also provide a basis for the use of land as collateral in credit markets. Allowing markets to reallocate land across households with differential endowments or abilities can improve both efficiency and equity. In the case of China and Vietnam, gradual abolitions of restrictions on land rentals enhanced the transfer of land to more productive and land poor producers through rental markets (Deininger, 2003). For some of the Latin American countries (e.g. Honduras, Nicaragua) there is evidence of the functioning of an "agricultural ladder" through rental markets, which allowed initially landless households to start as renters or share tenants, gradually build up knowledge and savings, and eventually became small landowners (Carter, 2002). Quisumbing and Otsuka (2001) show that in some parts of Western Ghana, tenancy transactions equalised the operational land distribution.

issues of the *Global Competitiveness Report* and the World Bank's *Doing Business* indicators. However, a country's score is based on the joint assessment of seven variables related to the issue of property rights in general so fails to capture the specific status of land rights alone. Moreover, changes over time in definitions and coverage make it difficult to interpret observed trends.

Box 3. Land tenure reform in Vietnam: "One of the most radical land reforms in modern times"

Major land reforms have usually pursued two objectives: equity and productivity (Groenewald, 2003). In many cases, the means did not manage to satisfy the objectives. What is then special about Vietnam's story? Termed as "one of the most radical land reforms in modern times" (Ravallion and van de Walle, 2008), it proved beneficial for the rural poor because it brought major changes over a short period of time but through a gradual process that identified in a sensible way the necessary steps to ensure flexibility and predictability in land use as well as synchronisation with the accompanying agricultural market reforms.

The first major step for reform was taken with the introduction of the 1988 Land Law. Two years after the *doi moi* reforms, Vietnam issued Resolution 10 allowing large co-operatives and collectives to be dismantled and calling for individual households to be assigned the use rights to some 80% to 85% of the country's agricultural land – comprising about 4 million hectares. In the initial phase of implementation, farm households were granted conditional long-term use rights over private land (for a period of up to 10 15 years). Along with granting secure use rights to land, enhancing the ability of people to cultivate that land was also important. With de-collectivisation co-operatives and collectives also relinquished their control of farm capital stock (tools, machinery, draft animals etc.) which they were obliged to allocate among households. Farm households were thus allowed to buy and sell animals, equipments and machinery as well as land. Collective work obligations, which also affected input availability and utilisation, were replaced by cash payments (Akram-Lodhi, 2003). However, the land remained the property of the state to be reverted to the government control when a household moved or stopped farming. This limited the potential effectiveness of the reforms since they ruled out the possibility of trading tenure rights thus forestalling the development of a land market.

Initially, the collectives and local cadres still set production quotas and allocated land across households for fixed periods. But farmers were allowed however to sell their output surplus. The change in "ownership" of land led to a massive increase in agricultural output. Soon after, Vietnam took the further step of abandoning the production quotas and allowing a private market in agricultural output.

In 1993, the Vietnamese government embarked on a second stage of land reform towards privatisation of land rights with the introduction of a new land law and issuance of land use certificates which increased security of tenure. Although land still remained the property of the state, under the new law usage rights could legally be transferred, sold, leased, inherited and used as collateral for loans. The duration of tenure rights was extended to 20 years for the production of annual crops and to 50 years for perennials. A degree of local intervention in land allocation was still allowed under the new law for equity reasons, as it stated that all households, including those that have lost land through indebtedness, were to be given sufficient land for survival.

Many recent studies provide strong empirical evidence for the positive effects of Vietnam's ambitious land reform. Using data from the 1993 and 1998 Vietnam Household Living Standard Surveys (VHLSS), Deininger and Jin (2003) find that the existence of markets allowing sale and rental of land had positive effects on productivity and provided opportunities for farm households with higher levels of ability to access land. Van de Broeck, Newman and Tarp (2007) studied the effects of land titles on rice yields and concluded that yields on plots for which there is a formal title are significantly higher than on plots with no defined land rights. Another study by Kompas *et al*. (2009) shows that total factor productivity (TFP) rises considerably in the major rice growing areas (the Mekong and Red River Delta areas) during the early years of reform and beyond.

Using a model of household consumption and data from the VHLSS, Ravallion and van de Walle (2008) examine the efficiency and equity benefits of the broadening of tenure rights under the 1993 change to the law. The efficiency gains achieved subsequent to those reforms have not come at the expense of increased inequality. Although there was an apparent rise in landlessness subsequent to the reforms there has been no rise in poverty attributable to the land market reforms. They conclude that, on the contrary, rising rural landlessness appears to have been poverty reducing as farm households take up new opportunities in the off-farm labour market. Markussen, Tarp and Van de Broeck (2009) also highlight the connection between the existence of an effective system of land rights and potential growth in non-farm employment. They find that the 1993 expansion of land tenure rights lead to an increase in the supply of off-farm work.

This outline is not intended to state that the entire process of the Vietnamese reform was flawless and there are enough critics that question its estimated pro-poor effects (Zhou, 1998; Akram-Lodhi, 2005). Nonetheless, the different land laws allowed the rural population to pass from subsistence agriculture to commercial agriculture and to have increased off-farm opportunities. With most of the poor living in rural areas during this period, it remains hard to believe that there was limited pro-poor coverage.

Expenditures on agriculture

Many development specialists bemoan the fact that, until recently, both developing country governments and donors were seriously neglecting agriculture and that budgetary allocations to the sector needed to be increased (World Bank, 2008b). Calls to increase public investment in the sector invariably refer to research findings, such as in the present study, showing that agricultural growth is strongly pro-poor. Kees van Donge, Henley and Lewis (2009) assert that additional public spending on agriculture constitutes an essential pre-condition to sustained growth and poverty reduction, arguing for an allocation to the sector of at least 10% of total public spending.

The widely endorsed African Union's Comprehensive Development Program for African Agriculture (CAADP) pledge African governments to spend a minimum of 10% of their national budgets on the sector. Likewise, donor countries have promised to substantially increase development assistance to promote agriculture and food security in fulfilment of the L'Aquila Declaration by the governments of the G8 - subsequently endorsed by the G20. Donor countries are being encouraged to provide important shares of this assistance in the form of direct budgetary support (Allen, 2009).

The IMF publishes estimates of public expenditures by function of government for a large number of countries in its Government Finance Statistics (GFS) database. We completed this data with the information provided in the World Bank Public Expenditure Reviews (PER)[9] for some of the countries. Table 10 compares estimates of the share of total budgetary outlays on agriculture for those countries for which data are available from these different sources (twenty-one out of the twenty-five countries). The data is generally not available as a continuous time-series of annual observations. Accordingly, we divided the comparisons between the averages of those observations which are available for three different ranges of years: 1990-94, 1995-99 and 2000-05 to give some idea of the progression.

The data in the table show that government expenditures on agriculture as a percentage of total budgetary expenditures averaged around 5%, with the sub-period average exceeding 10% in only one country in only one of the time ranges. To the extent there is a general trend in those shares it was downward throughout all the years of our study period (Figure 7).

Results showing relatively low and generally declining shares of public expenditures on agriculture are similar to those of a joint DFID/World Bank commissioned study by Akroyd and Smith (2007). While lamenting that situation they emphasise that it is not the overall level of spending that matters, but the quality of spending on agriculture, questioning the prescriptive, rule of thumb, approaches such as those embedded in CAADP. There are multiple factors affecting the actual quality of spending to agriculture. For instance, the involvement of separate ministries and agencies at the local level in handling different sides of the budget makes it difficult to know exactly how the sums are allocated and spent. In many countries, within the recurrent budget, wages tend to dominate. In Ghana for example more than two thirds of the Ministry of Food and Agriculture spending

9. Data coming from the following PERs was used: Honduras (1997), Vietnam (2000), Nicaragua (2001) and Mexico (2009).

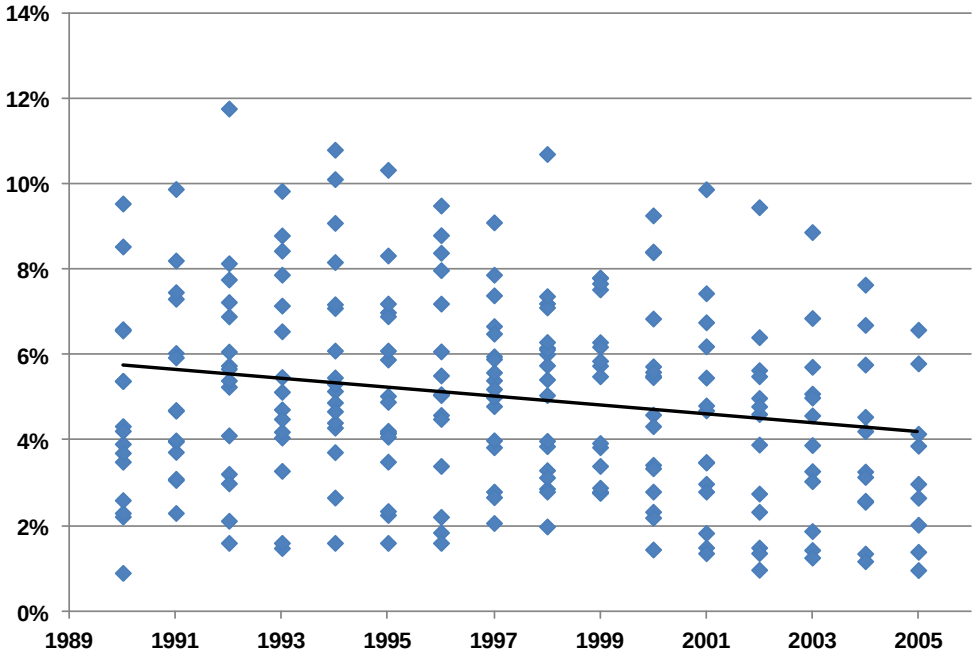
is accounted for by wages. Capital investments, often donor financed, are frequently made without provision of financing for recurrent costs required to properly service them.

Table 10. Evolution of per cent share of budgetary expenditures allocated to agriculture (1990-2005)

Country	Share of agricultural expenditures of total expenditures (average 1990-94)	Share of agricultural expenditures of total expenditures (average 1995-99)	Share of agricultural expenditures of total expenditures (average 2000-05)
Brazil	2.26	3.85	n.a.
Cameroon	4.77	3.27	n.a.
Chile	n.a.	n.a.	1.43
China	5.73	5.96	1.19
Costa Rica	4.17	2.19	2.12
Dominican Republic	6.38	6.32	5.28
Egypt	4.76	5.69	5.51
Ghana	n.a.	3.90	5.12
Guatemala	3.98	n.a.	2.93
Honduras	1.88	2.32	2.80
Indonesia	9.09	5.91	2.33
Kenya	6.42	5.74	4.66
Malaysia	6.60	4.02	n.a.
Mexico	4.94	4.75	3.35
Nicaragua	5.52	8.50	8.40
Panama	3.33	2.65	2.84
Philippines	7.53	6.44	4.28
Tajikistan	n.a.	5.09	3.90
Thailand	10.23	7.86	6.98
Tunisia	7.96	7.75	8.62
Vietnam	5.33	6.23	5.77

Source: IMF GFS Database, 2010; World Bank PERs (different countries and years); IFPRI Institutional and Public Expenditure Review of Ghana's Ministry of Food and Agriculture, 2010; Review of Public Spending to Agriculture DFID/World Bank, 2007.

Figure 7. Share of agriculture in total government expenditure (1990-2005)



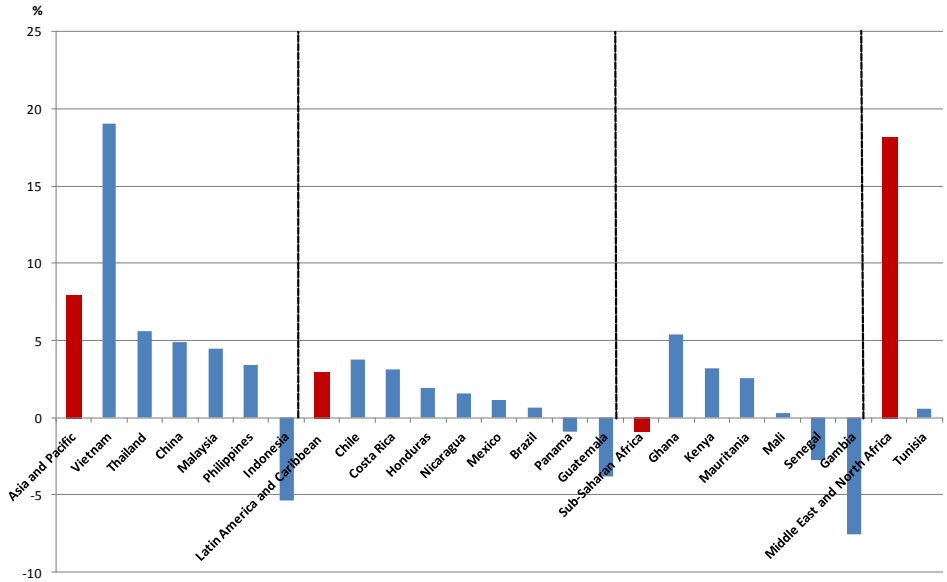
Number of observations: 234. Each dot represents the outcome in a particular country in a particular year. The estimated coefficient of the linear trend line is -0.01 and statistically significant at a 99% confidence level.

Source: IMF GFS Database, 2010; World Bank PERs (different countries and years); IFPRI *Institutional and Public Expenditure Review of Ghana's Ministry of Food and Agriculture*, 2010; *Review of Public Spending to Agriculture* DFID/World Bank, 2007.

Agricultural research

Agricultural progress in modern times has been driven more by technical advance attributable to public investment in agricultural research and development than by any other factor. Empirical analysis repeatedly confirms that the social rates of return to public investments in agricultural research, extension and education are high (Mundlak, 2000). Pardey *et al.* (2006) state that of all types of spending on agriculture, that spent on agricultural research and development is the most crucial to growth in agriculture. Figure 8 compares annual average growth rates of spending on agricultural research by governments of the study countries with the OECD. The data come from IFPRI's Agricultural Science and Technology Indicators (ASTI) database, and was available for twenty-one of the twenty-five countries. No general trend is evident. While some of the countries experienced fast growth in agricultural R&D expenditures, for others the average annual growth was lower than their regional average and several countries even saw a decrease in their real research expenditures. Moreover, in some of those countries registering exceptionally rapid growth, Vietnam for example, the growth spurt started only recently and from a very low base.

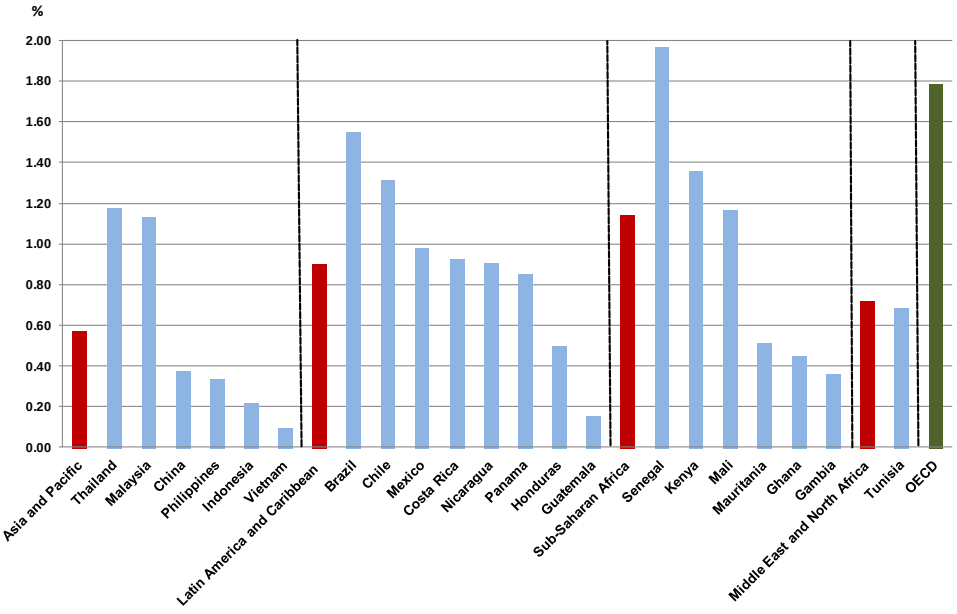
Figure 8. Growth in public expenditures on agricultural R&D, 1981-2005 (average, year ranges vary)



Source: ASTI-IFPRI, 2010.

Figure 9 plots the average intensity ratios of spending on agricultural research (i.e. agricultural R&D spending expressed as a percentage of agricultural GDP). For most of the countries, the average ratio for the period 1981-2005 is under 1% and, with only one exception, all the ratios are well under the average ratio for the OECD countries. Pardey *et al.* (2006) point out that there has been no significant growth in agricultural research intensity in the whole of the developing world since 1981.

Figure 9. Agriculture R&D intensity ratios, 1981-2005 (average, year ranges vary)



Source: ASTI-IFPRI, 2010 and OECD.Stat, 2010.

Agricultural productivity

Comparisons of agricultural performance among countries and over time are frequently made using partial productivity indicators such as crop yields or the GDP per worker measure we used in the poverty analysis above. We now take a closer look at this latter before turning to discussion of a more robust indicator of productivity performance – total factor productivity (TFP).

Reduced to its arithmetic essentials, agricultural GDP per worker grows when agricultural GDP grows faster than the number of workers. Thus, one possibility for increasing per worker productivity would be to reduce the number of workers in the sector. This works only if output does not go down proportionally with the number of workers. That is indeed the claim made by Nobel Prize winning economist Sir Arthur Lewis who argued that average productivity per worker in agriculture is low because, relative to the optimal, there are too many workers in the sector. According to that view growth and poverty objectives are best served by policies that encourage development of the non-agricultural sectors of the economy – even if this sometimes means the government needs to sweeten the pot through targeted trade protection and subsidies.

In our analysis, almost all of the improvements in per worker GDP in agriculture came about because of growth in GDP in circumstances of stable or growing numbers of workers. Figure 10 illustrates the point using averages of study country data. GDP/worker grew mainly because aggregate agricultural GDP grew. That leaves the question, "why did agricultural GDP grow?" An easy answer based on the accounting definition of GDP, is that agricultural GDP grew because: a) the quantities of non-labour factors used in agricultural production increased and b) productivity improved.

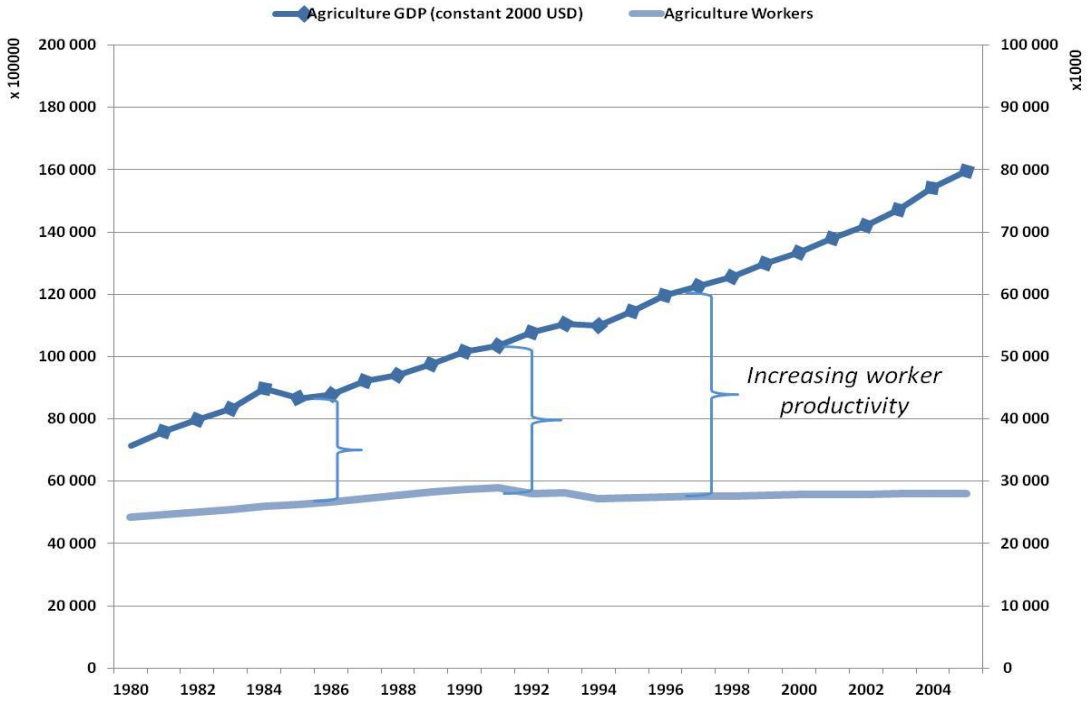
Partial productivity indicators reflect only the trends in output relative to one input and can be misleading in cases where the input mix is changing or, especially, where there are technical advances allowing increases in output for a given level of input use. A superior measure frequently used to overcome these problems is total factor productivity (TFP) mentioned in Box 1 when discussing the poverty outcomes of hypothetical improvements in TFP in agricultural versus other sectors obtained in the Ghana and Ethiopia case studies.

Fuglie (2008) reports findings from a comprehensive study of trends in total factor productivity covering 173 countries from 1961 to 2006. Figure 11 uses estimates taken from that analysis to compare performance of our selected countries and their respective regions. Notice that TFP growth rates were positive in the twenty of our chosen countries for which Fuglie made estimates. Estimated TFP growth rates in those countries averaged well above 1.6% per year - the global average estimated by Fuglie for the range 1991-2006. Furthermore more countries scored at or above their respective regional average than did not. Moreover, consistent with findings from Thirtle, Lin, and Piesse (2003) there is a strong correlation between rates of progress in TFP and in poverty reduction, i.e. those countries posting the fastest progress in TFP were generally those posting the fastest progress in reducing poverty.

An interesting contrast is that between the growth and intensity of agricultural research efforts and productivity performance, whether measured by increased GDP/worker or by TFP. Specifically, although many of the countries were

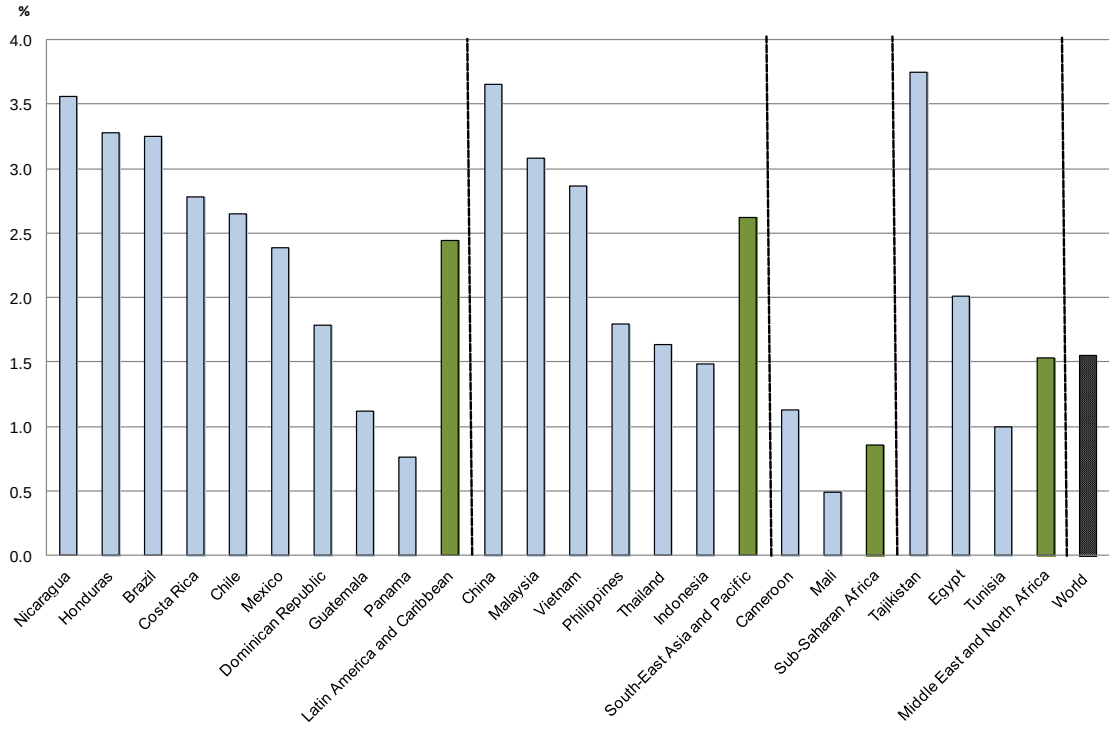
experiencing rapid growth in agricultural research spending during the study period, this growth was usually from a very small base. Moreover, the productivity payoffs from research investments typically are not realised except with multi-year delays (Block, 2010). We therefore must look elsewhere to explain the robustness of agricultural TFP growth during the study period. There must have been some other factor at play. The likely candidate seems to be induced innovation (Mundlak, 2000). It seems that farmers were able to rapidly increase their productivity by adapting improved techniques of production already on the shelf. Wiggins (2000) observes that most productivity improvements in farming come about as responses to market opportunities. When prices turn favourable, farmers look to the stock of available knowledge to help them react. He concluded that technology rarely drives change.

Figure 10. Evolution of agricultural GDP versus the number of agricultural workers, 1980-2005 (averages for all study countries)



Data cover the entire 1980-2005 period.
Source: OECD calculations based on data from WDI, 2009; FAO, 2009.

Figure 11. Average annual growth in agricultural Total Factor Productivity (TFP) 1991-2006



Source: Fuglie, 2008.

Summary of findings and policy implications

This paper set out to achieve a better understanding of how: 1) agricultural progress affects poverty and 2) how governments might foster poverty reducing agricultural progress. We pursued these objectives by examining the development experiences of twenty-five countries achieving exceptional progress in reducing poverty during the past quarter-century. We supplemented that analysis with in-depth case studies of four countries: Ethiopia, Ghana, Indonesia and Vietnam. The countries chosen for the multi-country analysis all succeeded in reducing poverty at a pace at least fast enough to halve the percentage of their populations living below the USD 2.00/day poverty line in less than 30 years. Many have already done so.

In both econometric and counter-factual simulation analyses using CGE models, estimated poverty elasticities for per worker growth in agricultural GDP were almost always higher than for growth in non-agriculture GDP/worker – a finding that accords with most past studies that examined whether the sectoral pattern of growth matters for poverty reduction. The poverty elasticities indicate the potential for sectoral growth to relieve poverty. We also need to ask "how important was actual past growth?" It is usual to see rates of worker productivity in agriculture growing faster than those of other sectors as economies develop and this was generally the case for our study countries. The combination of higher poverty elasticity and a typically higher rate of growth for agricultural GDP per worker give considerable advantage to agricultural progress as a source for poverty reduction.

Indeed, the analysis suggests that the greater share of poverty reduction achieved in the study countries was due to growth in agricultural GDP/worker. Agriculture's dominance was even greater when analysis was restricted just to the relatively well-off sub-set of countries, suggesting that agriculture is the main driver of poverty reduction even for middle income countries where most of today's world's poor live. Agriculture's contribution was also significant for the relatively poor sub-group of countries.

The lion's share of the credit for achievements in poverty reduction among the poorer sub-set of study countries goes to remittances. Moreover, remittances were more important than growth in non-agricultural incomes even for the richer sub-group. These finding point to the potential of cash transfers as the policy tool of choice for addressing extreme poverty in countries where logistical and political difficulties confronting implementation can be overcome. This is not to deny the necessity of agricultural progress for sustained poverty reduction in poor countries. Indeed, additional research is warranted to examine possibilities for using financial transfers to complement governmental policies and actions aimed specifically at fostering agricultural growth. Nonetheless, where they constitute a practical alternative to sectoral policies, cash transfers provide a benchmark for programme evaluation. Policy makers and donors should be prepared to answer the basic question: would it be better to just give the money to poor people?

Growth in non-agricultural labour productivity was found to have contributed directly to poverty reduction only for the relatively well-off countries. And even for this group, the share attributed to growth in non-agricultural GDP per worker was less than for either agriculture GDP/worker or remittances. Moreover, when looking at findings for the poorest sub-group of countries and in three of the case studies there was either no or a weakly positive impact of growth in industry GDP/worker on poverty – a warning sign that, even where successful in increasing average per capita incomes, growth strategies strongly favouring industry over other sectors may not reduce poverty.

Our search for characteristics that might help explain the study countries' outstanding success in reducing poverty uncovered several interesting regularities in their achievements on other indicators of social and economic progress. The years during which poverty rates fell were also characterised by strong per capita income growth, macroeconomic stability and a progressive opening to world markets and trade. All of the countries showed improvement in their human development scores using the UN indices and there was substantial progress in education in most of them. Simultaneously, governments were reducing disprotection of agriculture by discontinuing policies that contributed to over-valuation of their currencies and reducing export taxes. All of this occurred in an era when rich country trading partners were reducing substantially the most production and trade distorting kinds of support offered their farmers. Many of the countries also benefited from trade agreements offering privileged access to developed country markets.

For many countries, improved agricultural performance accompanied or followed major makeovers of domestic agricultural policy. In a number of them, policy reforms led to substantial improvements in systems of land use rights for farmers. Collectively, these developments substantially reduced or eliminated government biases against the sector - developments that would have improved

significantly farmer terms of trade and incomes. Total government expenditures on agriculture constituted usually only a small share of total budgetary expenditures – and in a goodly number of the countries studied that share fell during the study period.

Public expenditures on agricultural research grew rapidly in some of the study countries, but typically from a low historical base. Relative to OECD countries, spending on agricultural research constituted a much lower share of agricultural GDP over the study period. Besides, the productivity payoffs to investments in agricultural research usually occur only with time lags of more years than was included in the study periods used in the analysis. Nonetheless, total factor productivity in agriculture increased substantially in almost every country – at rates faster than the global average and usually faster than other countries in their respective regions.

If not due to increased investments in agricultural research what then explains the exceptional productivity performance witnessed in the study countries? The default answer to that question must be induced innovation. The improvements in the macroeconomic, trade, market and policy environment in which farmers operated would have encouraged the adoption of already available technologies. This is one of many issues deserving further work. In any event, our tentative answer to it should not be interpreted in a way that dampens government's enthusiasm for investing public money in agricultural research. A wealth of past research demonstrates that the social payoffs to such investments can be measured in multiples of the associated costs.

Two additional policy implications flow from the observation that farmers rationally put off adoption of already available technologies until market conditions are favourable. First, in many countries, there remain opportunities for government actions to foster improvements in farmer terms of trade by eliminating policies that discriminate against the sector, restrict trade or interfere in other ways with the proper functioning of agricultural input and output markets. Second, policy makers should keep in mind that there are public benefits to agricultural productivity improvements, whether they result from a publically funded research discovery or from publically funded knowledge transfer resulting in the implementation of an already available technology. The policy challenge rests in finding the right balance between those investments.

Growth in agricultural GDP per worker was due mainly to growth in total agricultural GDP, not to reduced numbers of workers in the sector. The share of agricultural workers fell as population growth boosted the total number of workers. However, few countries reach their full development potential except as the total number of workers in agriculture also declines. As the development process plays out the non-agricultural sectors grow faster than agriculture attracting even more labour to non-farm occupations, progressively eliminating the large productivity and wage gaps between agriculture and other sectors characteristic of countries at early stages of development. Often governments policies aimed at fostering such transformations are warranted. Our results do not deny the potential for such policy actions to promote economic development and growth. However they do show that progress against extreme poverty can be achieved without reducing the total number of workers in sector.

Those who advocate government and donor policy strongly favouring agriculture often cite research findings such as ours to bolster their case. We found that governments seem to have helped farmers more by reforming policies that discriminated against the sector (export taxes, overvalued exchange rates, restrictions on access to domestic and export markets and so on) than by the introduction of new ones. And these reforms were frequently implemented simultaneously with reforms that substantially improved the macroeconomic and socioeconomic context in which farmers operated. The share of total budgetary expenditures allocated to agriculture in the study countries averaged only around five percent and was generally declining – a finding that puts in question the wisdom of policy prescriptions that call for diverting scarce budgetary resources from spending on public goods: health, education and infrastructure towards agriculture as a way of achieving rapid progress in reducing poverty.

In many developing countries the agricultural sector is a huge beneficiary of spending on public goods, especially when such spending includes spending on public goods specifically targeting agriculture: agricultural research, market information, rural roads and so on. Rather than debate the need to shift expenditures from public goods to agriculture, it is better to acknowledge the role and importance of health, education, infrastructure, etc., for agricultural development and to apply a more inclusive concept of agriculture for targeting shares of public resources.

ANNEX

Table A.1. Regression results (poverty headcount rate)

Source	SS	df	MS		Number of observations	147
Model	7.2056	3	2.4019		F(3, 143)	199.38
Residual	1.7227	143	0.0120		Prob > F	0.0000
Total	8.9283	146	0.0612		R-squared	0.8071
					Adj R-squared	0.8030
					Root MSE	0.10976

Poverty headcount rate	Coefficient	Standard error	T	P>|t|	[95% Conf.	Interval]
AgGDP/Wk	-0.136921	0.0149132	-9.18	0.000	-0.1663998	-0.10744
NonAgGDP/Wk	-0.1032406	0.0163413	-6.32	0.000	-0.1355424	-0.07094
Remit/Capita	-0.0184977	0.0051364	-3.6	0.000	-0.0286507	-0.00834
_cons	2.271765	0.0916841	24.78	0.000	2.090534	2.452996

Table A.2. Multicollinearity test

Variables	VIF	1/VIF tolerance range
AgGDP/Wk	2.56	0.390591
NonAgGDP/Wk	2.36	0.424188
Remit/Capita	1.15	0.869076
Mean VIF	2.02	

Table A.3. Regression results (poverty gap squared)

Source	SS	df	MS		Number of observations	145
Model	0.6382	3	0.2127		F(3, 141)	67
Residual	0.4477	141	0.0032		Prob > F	0.0000
Total	1.0860	144	0.0075		R-squared	0.5877
					Adj R-squared	0.5789
					Root MSE	0.05635

Poverty gap squared	Coefficient	Standard error	T	P>|t|	[95% Conf.	Interval]
AgGDP/Wk	-0.042510	0.007746	-5.49	0.000	-0.0578228	-0.0271972
NonAgGDP/Wk	-0.028042	0.008390	-3.34	0.001	-0.0446290	-0.0114545
Remit/Capita	-0.006657	0.002682	-2.48	0.014	-0.0119600	-0.0013545
_cons	0.641784	0.047456	13.52	0.000	0.5479657	0.7356020

Table A.4. Multicollinearity test

Variables	VIF	1/VIF Tolerance range
AgGDP/Wk	1.13	0.884061
NonAgGDP/Wk	1.13	0.884528
Remit/Capita	1.02	0.981153
Mean VIF	1.09	

Table A.5. Regression results (divided sample, relatively poorer countries)

Source	SS	df	MS		Number of observations	44
Model	0.3773	3	0.1258		F(3, 40)	7.11
Residual	0.7072	40	0.0177		Prob > F	0.0006
Total	1.0844	43	0.0252		R-squared	0.3479
					Adj R-squared	0.299
					Root MSE	0.13296

Poverty headcount rate	Coefficient	Standard Error	T	P>|t|	[95% Conf.	Interval]
AgGDP/Wk	-0.162078	0.056581	-2.86	0.007	-0.2764326	-0.0477241
NonAgGDP/Wk	-0.004956	0.035171	-0.14	0.889	-0.0760396	0.0661276
Remit/Capita	-0.046142	0.012977	-3.56	0.001	-0.0723689	-0.0199150
_cons	1.731630	0.398302	4.35	0.000	0.9266322	2.5366290

Table A.6. Regression results (divided sample, relatively well-off countries)

Source	SS	df	MS		Number of observations	103
Model	0.9651	3	0.3217		F(3, 99)	42.93
Residual	0.7418	99	0.0075		Prob > F	0.0000
Total	1.7069	102	0.0167		R-squared	0.5654
					Adj R-squared	0.5522
					Root MSE	0.08656

Poverty headcount rate	Coefficient	Standard Error	T	P>|t|	[95% Conf.	Interval]
AgGDP/Wk	-0.093710	0.016494	-5.68	0.000	-0.1264381	-0.0609814
NonAgGDP/Wk	-0.116719	0.019933	-5.86	0.000	-0.1562701	-0.0771684
Remit/Capita	-0.011056	0.005323	-2.08	0.040	-0.0216166	-0.0004945
_cons	2.034251	0.166102	12.25	0.000	1.7046690	2.3638330

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