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ECONOMIC IMPORTANCE OF AGRICULTURE FOR POVERTY REDUCTION

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ABSTRACT **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, and up to 1 billion people are likely to remain destitute by the target date. Why are some countries doing better than others? This paper seeks to answer this question by looking for shared characteristics of twenty-five developing countries posting extraordinary success in reducing extreme poverty over the past twenty to twenty-five years. These countries were compared using indicators of their macroeconomic characteristics and, especially, their agricultural economic characteristics. The countries chosen for analysis constitute a highly diverse mix. The group includes some of the poorest and some of the richest developing countries in the world, representing virtually all geographic regions. The countries also differ greatly in their systems of governance and economic management. Yet, they are surprisingly similar in their achievements, not only in reducing poverty, but across the broad range of macroeconomic and agricultural economic performance measures used to compare them. Findings from time-series, cross-section regression analysis reveal that while economic growth generally was an important contributor to poverty reduction, the sector mix of growth mattered substantially, with growth in agricultural incomes being especially important.**

KEYWORDS :Poverty Reduction, Agricultural Development, Millennium Development

INTRODUCTION

Theodore Schultz began his acceptance speech for the 1979 Nobel Prize in Economics observing: *"Most of the people in the world are poor, so if we knew the economics of being poor we would know much of the economics that really matters. Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture we would know much of the economics of being poor" (Shultz, 1979).*

Thirty years on we still find that people in developing countries who depend on agriculture for their living are typically much poorer than people who work in other sectors of the economy and that they represent a significant share, often the majority, of the total number of poor people in the countries where they live.

Achieving the Millennium Development Goal (MDG) of halving poverty by 2015 requires finding ways to increase the incomes of those people. What can government do to foster that kind of income growth? Specifically, how can we improve development co-operation, trade and agricultural policy to better promote agriculture"s contribution to poverty reduction? This paper constitutes the first output from a research project seeking answers to that question.

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). But what causes economic growth and, more relevant for present purposes, what causes agricultural growth? There is widespread agreement on a general list of necessary conditions, *e.g.*: access to output and input markets accommodated by a good transportation, marketing and processing infrastructure; non-discriminatory tax and trade policy; high rates of 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, debate abounds on their relative importance and what government ought to do to promote 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 extreme 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 preconditions are necessary everywhere, if not always sufficient, for sustained progress in reducing poverty. 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 that might enable them to reach their respective MDG"s of halving poverty by the 2015 target year.

We start by looking at some indicators of economy-wide economic performance but then give particular emphasis to common features of the agricultural economies of the selected countries. We make no attempt to establish causality or to quantify the relationships between the various indicators and poverty. We aimed simply to see if those countries chosen on the basis of their exceptional success in reducing poverty were similar in other socioeconomic respects. The insights obtained from this multicountry overview are meant to inform the design of in-depth case studies of agriculture"s contribution to poverty reduction in four countries (Ethiopia, Ghana, Indonesia and Vietnam) wherein we may seek to quantify poverty impacts through econometric or simulation analysis. It is hoped that findings from the case studies will eventually provide the basis for development of policy principles and recommendations to foster progress in reducing poverty.

Literature review

Historically, few issues have attracted the attention of economists as has the role of agriculture in economic development and poverty reduction, generating an enormous literature of both theoretical and empirical studies. Much of this literature focuses on the process of structural transformation of economies, from the least developed in which economic activity is based largely on agriculture, to high-income countries where industry and services sectors dominate.

A declining share for agriculture in national employment and GDP is an inevitable consequence of economic progress (Byerlee, de Janvry and Sadoulet, 2009; Timmer, 1988; Cervantes and Brooks, 2009). This is largely due to higher income elasticities of demand for non-agricultural goods and services. As their incomes grow, consumers increase their consumption of manufactured goods and services faster than their consumption of food. Paradoxically, the process is usually accompanied by rising incomes and a lower incidence of poverty among those who depend on agriculture for a living.

Lewis (1955) was one of the first of many development economists attempting to explain the paradox. He viewed economic development as a process of relocating factors of production from an agricultural sector characterized by low productivity and the use of traditional technology to a modern industrial sector with higher productivity.

Lewis"s theory was interpreted as advocating industrialization and used to justify government policies that favoured protection for domestic industries and, explicitly or implicitly, taxed the agricultural sector (Kirkpatrick and Barrientos, 2004). That theory and it implications for policy have been largely debunked by later work and the degree to which economic policies of developing countries discriminate against agriculture has lessened dramatically in recent decades (Anderson and Valenzuela, 2008).

A paper produced by DFID (2004) emphasises the historically close correlation between different rates of poverty reduction over the past 40 years and differences in agricultural performance – particularly the rate of growth of agricultural productivity. The authors see links between agriculture and poverty reduction as being forged through four „transmission mechanisms": 1) direct impact of improved agricultural performance on rural incomes; 2) impact of cheaper food for both urban and rural poor; 3) agriculture"s contribution to growth and the generation of economic opportunity in the non-farm sector; and 4) agriculture"s fundamental role in stimulating and sustaining economic transition, as countries (and poor people"s livelihoods) shift away from being primarily agricultural towards a broader base of manufacturing and services. They go on to note that the potential for future poverty reduction through these transmission mechanisms depends on the extent to which agricultural productivity can be increased where it is most needed.

Many recent studies focus specifically on quantifying the relationship between agriculture and poverty. Bresciani and Valdes (2007) frame their analysis in terms of three key channels they say links agricultural growth to poverty: 1) labour market, 2) farm income, and 3) food prices. They provide a theoretical framework for investigating the quantitative importance of those various channels and then report findings from six country case studies. They conclude that when both the direct and indirect effects of agricultural growth are taken into account, such growth is more poverty reducing than growth in non- agricultural sectors.

Bresciani and Valdes emphasize especially that agriculture"s contribution to poverty reduction is consistently greater than is agriculture"s share of GDP. For their case study countries, agriculture"s contribution came mainly through the labour market channel. They caution however that growth strategies based on such findings may not be valid in circumstances where the agricultural output mix does not feature labour intensive crops and livestock activity. Equally problematic for such a strategy is that much progress in agriculture historically has come from the introduction of labour saving technical change.

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 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) point out that the contribution of economic growth to poverty reduction might differ across sectors because the benefits of growth might be easier for poor people to obtain if growth occurs where they are located. This reasoning implicitly assumes that transferring income generated in one economic sector or geographic location to another sector or location is difficult because of market segmentations or considerations of political economy. They too find that growth originating in agriculture is on average significantly more poverty reducing than growth originating outside agriculture. Similarly, 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 conclude that the idea of a trade-off between these sectors in terms of overall progress against poverty in China is moot, given how little evidence they found 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 structure and institutional organization of their economies (Loayza and Raddatz, 2006). A common finding is that the poverty reducing powers of agriculture declines as countries get richer (Christiaensen and Demery, 2007; Ligon and Sadoulet, 2008). Gardner (2000), for example, found that gains in income from off-farm sources was the main reason rural poverty declined in the US from the 1960s.

Econometric analysis by Warr (2002) based on pooled data for Indonesia, Thailand, Malaysia and the Philippines showed the services sector as having the greatest reduction on poverty. Time-series analysis for Taiwan reported in Warr and Wang (1999) found industrial growth to be most poverty reducing. Similarly, Ravallion and Datt (1996 and 2002) found that the elasticity of rural headcount poverty with respect to agricultural growth in India is less than half that for non-agricultural sector growth. They speculate that the latter occurs because of rapid growth in the informal sector of the Indian economy. Interestingly, using a similar method of analysis for China Ravallion and Chen (2007) estimate that agricultural growth had four times greater impact on poverty reduction than growth in the secondary and tertiary sectors.

Previous research suggests that agricultural income growth is more effective in reducing poverty than growth in other sectors because: 1) the incidence of poverty tends to be higher in agricultural and rural populations than elsewhere, and 2) most of the poor live in rural areas and a large share of them depend on agriculture for a living (World Bank, 2008b; Christiaensen and Demery, 2007; Ravallion and Chen, 2007). However, even if the incidence of poverty is lower within the population of non-farm people (whether rural or urban) growth in income from non-farm sources could be proportionally more effective in reducing poverty. Moreover, it could be that even for poor farm families, growth in income from non-farm sources is more important than growth in farm income.

We introduce another complication by acknowledging that perhaps growth in per capita income economy-wide is itself driven by growth in agricultural sector income, *i.e.* that agriculture is the engine of economy-wide performance (Irz and Tiffin, 2006). Gardner and Tsakok (2007) review past attempts to draw causal connections between economy-wide growth and growth in one or another economic sector. They conclude the task of explaining economic growth might be better served by searching for a common set of factors simultaneously driving growth in all sectors. Note that, purely in terms of the arithmetic of growth accounting, agricultural sector growth will be a more important driver of overall growth in countries where its sector share is large. Of course, the claim that agriculture is the engine of economic growth is not based solely on the growth accounting arithmetic. Many people believe there is more to the story because agricultural sector growth exhibits a higher multiplier than growth in other sectors (Bresciani and Valdes, 2007).

Though few countries have achieved rapid poverty reduction without it, a nation‟s economic growth is not absolutely essential to progress in reducing poverty. As we measure it, poverty refers to how much money poor people spend on goods and services. Earnings from work are of course the most important source of spending money for most poor people but some get money from other sources. For example 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. One source of extra money known to be especially effective in reducing poverty is remittances from people who work abroad (Acosta, Fajnzylber and Lopez, 2007). Data measuring remittances are conveniently available from the World Bank. Later we use this data to illustrate the more general point that poverty reduction may be achieved through channels other than pro-poor economic growth.

Another route by which poverty could be reduced even in the absence of economic growth is through migration of farm workers to off-farm jobs, either in rural or urban areas. 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 emphasize 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.

Measuring poverty and success in reducing it

Our method requires first choosing a list of countries that can be judged successful in reducing their national poverty rates. To proceed we therefore need both a definition of poverty and a way of ranking countries according to their progress in reducing it. In tracking progress for the MDG‟s, poverty in the developing world is measured by a standard representing the poverty lines found among the poorest countries of the world. That line was first set at USD 1.00 a day in 1985 prices. Although the term „dollar a day‟ still features in popular discussion, the line is now USD 1.25 a day in 2005 prices, which is the average of the poverty lines found in the poorest 15 countries in terms of per capita consumption (Chen and Ravallion, 2008).

Of course, depending on the purpose, other poverty thresholds are possible. A common choice is USD 2.00 per day - the one we used in this analysis. The USD 2.00 per day line 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 cut-off points. For example, Chile posted spectacular gains in reducing USD 2.00 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.

The procedure used to decide whether, in any given period of time, someone falls below a chosen poverty line requires three kinds of information: 1) the composition of the basket of goods and services consumed by that individual, including goods produced for self-consumption; 2) a local currency price to value each item in the basket in 2005; and 3) an exchange rate to convert from local currency to US dollars. The World Bank collects and harmonizes consumption estimates obtained from household surveys done by national statistical offices – purportedly the world‟s largest single statistical endeavour. The frequency of the surveys and the country coverage has increased sharply in recent years. Current estimates are based on 675 surveys, spanning 1979-2006 and 116 countries (Chen and Ravallion, 2008).

The 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 purchasing power parity (PPP) exchange rates in order to assure international comparability of consumer expenditures, *i.e.* those USD 2.00 have the same command of goods and services in one country as another (and irrespective of whether those 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 World Bank‟s cost of living surveys is 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 on goods and services in a particular survey year by, in effect if not in reality, multiplying each item in his/her consumption basket by its local currency price in 2005, then converting to dollars by multiplying by the dollar to local currency PPP exchange rate. If those 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 head-count) as well as the percentage of the population in poverty (the poverty rate). Thus, in comparing between two time periods the poverty head-count and the poverty rate both rise and fall as real expenditures rise and fall around the poverty threshold.

The change in real expenditures between any two time periods will reflect changes in income or prices between those two periods. If, per capita income rises, expenditures on goods and services will also rise. The mathematical relationship between consumer expenditures and income, the marginal propensity to consume, tends to be higher for poor than for rich people. Thus, as the incomes of poor people increase some of them begin to spend more than the threshold expenditure per day leading in turn to a lower poverty head count and poverty rate. Likewise, a reduction in consumer prices permits consumers to purchase more goods and services with the same budget and will also show up as an increase in real expenditures leading to a lower number of people judged to be in poverty.

Good agricultural performance operates to reduce measured poverty through both the income and the price channels. Because a high share of the poor depend on agriculture for their incomes, it is natural to think that an increase in farm income would be poverty reducing, perhaps as findings from previous research suggests, even more so than a general rise in incomes. Similarly, because food constitutes such a high share of consumer expenditures by the poor it is also tempting to think that lower food prices, such as might accompany increased food production per capita, would be poverty reducing.

However, this relationship is not guaranteed. An ambiguity arises precisely because so many poor people depend on farming for a living. Thus, depending on what causes prices to fall, how much they fall and the commodity composition, a decline in food prices might simultaneously reduce the earnings and purchasing power of some poor farmers while increasing the purchasing power of some poor consumers. These possibilities put a question mark on the relationship between poverty and food production as an area requiring further exploration.

Selection process

We turn now to the specifics of the selection procedure and results obtained in applying it. There were four distinct steps. First, we identified a list of countries that: a) exhibited an initial USD 2.00 per day and a poverty rate of more than 10%; b) posted reductions in that rate over the entire range of years for which poverty data are available, within the 1980-2005 range; and c) had at least two years of poverty survey data to calculate trends. This meant we automatically excluded countries where poverty was already relatively low and where the poverty rate either stayed the same or increased.

In the second step we calculated the average annual reduction in the poverty rate posted by each of those countries over the entire range of years for which poverty estimates are available. The range of years covered by poverty surveys (from the initial to the most recently published survey) and the number of annual surveys conducted within that range of years varies greatly from one country to another. Our third step in selection process was based on the observed *pace* of poverty reduction. In 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. Although our 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 survey year 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.

Table 1. Selected countries and poverty outcomes, 1980-2005

		Poverty rate (%) in:		
#	Country	Initial survey year	Last survey year	Average annual reduction achieved	Year range & number of surveys
1	Brazil	31.2	18.4	-0.58	
2	Cameroon	74.5	57.8	-3.35	
3	Chile	23.5	3.1	-0.90	
4	China	97.8	36.4	-2.39	
5	Costa Rica	35.8	8.6	-0.93	
6	Dominican Republic	30.5	15.1	-0.77	
7	Egypt	27.8	18.6	-0.82	
8	Gambia, The	82.1	56.8	-3.60	
9	Ghana	79.1	53.7	-1.56	
10	Guatemala	70.5	29.8	-2.67	
11	Honduras	61.7	34.8	-1.78	
12	Indonesia	88.4	54.0	-1.47	
13	Kenya	59.4	40.1	-1.44	
14	Malaysia	12.3	7.8	-0.30	
15	Mali	93.8	82.1	-1.68	
16	Mauritania	64.7	44.2	-2.15	
17	Mexico	28.5	7.0	-0.66	
18	Nicaragua	49.3	31.9	-1.31	
19	Panama	26.8	17.9	-0.46	
20	Philippines	62.1	43.92	-1.09	

1985-2003 (7)

21	Senegal	81.6	60.5	-1.44
22	Tajikistan	78.6	51.1	-4.62
23	Thailand	44.1	11.6	-1.60
24	Tunisia	25.2	12.9	-0.59
25	Vietnam	85.7	52.7	-2.35

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

General characteristics of selected countries

Did the countries chosen on the basis of their achievement in reducing poverty perform well on other indicators of socioeconomic progress? Table 2 contains estimates of a development indicator monitored by the United Nations 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. 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. We use the index here to corroborate, rather than to explain, the achievements made by our countries in reducing national poverty rates.

The rows of that table separate countries into High, Medium and Low groups. Interestingly the only two of our countries in the Low Human Development group are African countries while all but one of our countries appearing in the top group are Latin American countries. The middle group constitutes a mix of countries from different continents. 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.

Table 2. Human Development Index, selected countries

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	Dominica	0.66	0.684	0.697	0.723	0.757	0.779

81/179	China	0.559	0.595	n Republic	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.

We now turn to a comparison of the features of economy-wide economic performance of our twenty- five countries that might help to explain their achievements in poverty reduction and the corroborating improvements in their Human Development scores. Table 3 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/capita. Economic growth is viewed by many economists as the only sustainable cure for poverty. Unsurprisingly then, the majority of the countries in our list experienced positive per capita income growth during the years when their poverty rates were falling.

Some countries posted reductions in poverty even though per capita incomes were falling. In some cases, *e.g.* Tajikistan, this may be explained by differences in coverage of the poverty and income data. It could well be the case that achievements in poverty reduction occurred during sub-periods when per capita incomes were rising even if they fell when considering the entire range used in calculating income growth rates.1 Additionally, as already noted, economic growth is not strictly necessary for a country to achieve progress in reducing poverty.

Table 3. Selected countries macroeconomic indicators

Country	GDP per capita annual growth, 1980-2005	Trade openness (Trade as % of GDP)	Composite macroeconomic stability index
		Annual change	
1980	2005		1984
Brazil	0.62%	20	27
		03	
Cameroon	-1.44%	55	42
Chile	4.17%	50	74
China	8.61%	22	69
Costa Rica	1.96%	63	103
Dominican Republic	2.19%	48	72
Egypt	2.37%	73	63
Gambia, The	-0.28%	106	110
Ghana	1.35%	18	98
Guatemala	0.73%	47	66
Honduras	0.65%	81	136
Indonesia	3.64%	54	64
Kenya	-0.18%	65	64
Malaysia	3.80%	111	218
Mali	0.80%	44	63
Mauritania	-0.20%	103	132
Mexico	0.79%	24	62
Nicaragua	-0.98%	67	88
Panama	1.15%	187	144
Philippines	0.50%	52	99
Senegal	0.02%	62	69

-0.2

Tajikistan	-6.36%	81*	79
Thailand	4.94%	54	149
Tunisia	2.37%	86	98
Vietnam	5.22%	23*	143

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

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

The middle columns of Table 3 compare for each of the selected countries 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. 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. In the few cases where trade openness did not improve, the declines were relatively very small.

1 As it was not our intention to formally analyze causality we chose to keep the year ranges for calculation of indicators the same for all countries without regard to the year range of poverty data availability.

The final columns of Table 3 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 selected countries from the mid-1980s to present times.

The overall picture that comes into to focus when looking at the figures in Table 3, corroborated by findings from other analyses, *e.g.* in the World Bank"s development report on agriculture (World Bank, 2008b), is that countries achieving success in reducing poverty did so while posting impressive progress in macroeconomic performance. The accumulated body of research findings on the subject leaves little doubt that successful macroeconomic performance is, if not strictly causal, a necessary pre-condition to success in combating poverty.

How important was agricultural growth?

Table 4 tabulates growth rates of real agricultural GDP/worker, non-agricultural GDP/worker and remittances per capita. 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 in, and measurement problems with the data. 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. Moreover, because of a high incidence of part time farming, the number of workers in agriculture may be overestimated and thus estimates of agricultural GDP per worker in agriculture underestimated – a measurement problem that is more severe the less developed is the country in question (Schmitt, 1990). 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 over-state employment in agriculture and understate employment in other sectors. This leads, in turn, to estimates of average labour productivity (GDP/worker) that are biased downward for agriculture and upward for non-agriculture. These measurement problems are greater for developing than developed countries because agriculture"s share in total employment is typically higher in developing countries.

Table 4. Selected countries: key indicators, 1980-2005

Country	Annual growth in Ag GDP/Wk (%)	Annual growth in non-Ag GDP/Wk (%)	Annual growth in remittances (%)*
Brazil	4.66	-1.20	17.91
Cameroon	1.91	-4.11	-4.02
Chile	3.56	2.98	11.86
China	3.43	8.54	15.21
Costa Rica	3.30	0.29	17.33
Dominican Republic	3.37	0.74	8.45
Egypt	2.86	0.19	-3.93
Gambia, The	-1.26	-0.93	0.96
Ghana	-0.05	1.55	14.24
Guatemala	0.77	-0.27	25.16
Honduras	2.22	-1.89	26.75
Indonesia	1.33	2.06	18.82
Kenya	-0.40	-1.98	6.66
Malaysia	2.67	1.80	11.72
Mali	1.57	-1.44	-0.56
Mauritania	-1.04	-1.00	-6.58
Mexico	1.06	-1.18	7.44
Nicaragua	4.67	0.21	27.36
Panama	2.13	-0.29	-4.92
Philippines	0.61	-0.88	8.16
Senegal	-0.72	-0.89	3.01
Tajikistan	2.56	-2.96	72.94
Thailand	1.73	2.85	0.64
Tunisia	2.70	0.63	1.52
Vietnam	2.30	4.99	12.24

Notes: Growth rates calculated as the annual average differences in the logarithms of the indicators. * International remittances only.

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

The data in Table 4 reveal a widely varying pattern of per worker GDP growth rates among the selected countries over the study years. Strikingly, agriculture GDP per worker grew in 20 of the 25 countries. That proportion rises to 23 of 25 countries if we restrict our attention to only those ranges of years covered by the poverty data. On the other hand, average per worker GDP in non-agriculture grew in only 12 of 25, *i.e.* less than half of the countries studied. This pattern is consistent with two characteristics typifying the normal development process. First, it is usual that as countries develop, per worker agricultural GDP grows faster than per worker GDP in other sectors. Second, it is also common that in developing countries most poor people depend on agriculture for a living.

Figures 1 to 3 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 1); non-agricultural GDP per worker (Figure 2); remittances per

capita (Figure 3), for each year of survey data available. These plots reveal the expected negative relationships between poverty rates 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, first, quantitative estimates of the statistical relationship between each of the three variables and the poverty rate. We estimated these relationships using multiple regression analysis employing a dataset that combined all of the cross-section and time-series data for all available years of poverty surveys.

The estimating equation, estimated coefficients and their statistical properties are reproduced in the Annex. The regression equation explains a high percentage of variation in the time-series, cross-section poverty rate data. The regression coefficients for agricultural GDP/worker, non-agricultural GDP/worker and remittances per capita are all statistically significantly negative as suggested by theory and confirmed by the data plotted in Figures 1-3. The estimated coefficient on agricultural GDP/worker is significantly higher than that for either of the other two variables but this does not necessarily imply that growth in agricultural GDP/worker was more important than growth in the other two variables since the answer to that question also depends on actual rates of growth in the three variables over the study period.

To make judgements about the relative historical importance of agricultural versus non-agricultural growth versus remittances, we used the estimated regression equation to simulate historical data and then attribute reductions in 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 independent variables for each year of the entire study period 1980-2005. In the second step, we created three alternatives to that baseline by replacing actual observations for one or another of the three income variables by its sample mean. In the final step we compared, one by one, the predicted values obtained in the three alternative scenarios to those from the baseline. These comparisons allowed us to calculate how much of the predicted change in poverty could be attributed uniquely to each income source.

Table 5 shows the breakdown thus obtained, revealing that for 12 out of the 25 countries growth in agricultural GDP per worker was more important, followed by growth in remittances per capita (9 out of 25) with only four countries shown to have reduced poverty mainly because of growth in non-agricultural GDP per worker. Notice however that in some countries, *e.g.* Vietnam, there was little or no difference between the estimated contributions of growth in agricultural GDP per worker as compared to that of non-GDP/worker. As another example, in Mexico, the contribution was the same for agriculture as for remittances.

Table 5. Major contributor to poverty reduction

Agriculture	Non-agriculture	Remittances
Brazil	China	Gambia, The
Cameroon	Mauritania	Ghana
Chile	Thailand	Guatemala
Costa Rica	Vietnam	Honduras
Dominican Republic		Indonesia
Egypt		Kenya
Malaysia		Philippines
Mali		Senegal
Mexico		Mexico (same contribution as agriculture)
Nicaragua		Tajikistan
Panama		
Tunisia		
12	4	10

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

Another way of looking at these results is to ask, what *proportion* of the observed reduction in predicted poverty rates was due to each of the variables individually. Figure 4 shows these results, revealing basically the same pattern as suggested by the country lists in the table. Specifically, over one-half the reductions in poverty in the selected countries was due to growth in agricultural incomes, over one-third to growth in remittances and only just over 10% due to growth in non-farm incomes.

Characteristics of countries where agriculture contributed positively to poverty reduction

The above analysis is fully consistent with most prior analyses in showing that agricultural progress contributes strongly to poverty reduction. Now we want to see if there are common characteristics of the agricultural economies of those countries where agriculture contributed positively to reducing poverty that might help us better understand what features of agricultural performance government"s might wish to emphasize in their development efforts. Table 4 shows that agricultural GDP/worker grew, and thus contributed positively to poverty reduction, in twenty out of the twenty five countries.

Agricultural trade policy

A frequently cited essential ingredient in the recipe for agricultural success is access to world markets unfettered by too much interference either by home country or trading partner governments (Anderson and Valenzuela, 2008). So, what trading environment confronted the selected countries and how did it change over the twenty five year study period? The data in Table 6 provide a partial answer to this question. The numbers in the table are estimates of the 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 only for thirteen out of the twenty countries where agriculture contributed positively to poverty reduction. 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. 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.

Table 6. 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
Egypt	23.72	-1.05	-5.50
Indonesia	3.74	-7.58	12.00
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
Thailand	-4.13	-2.04	-0.20
Vietnam	-13.87	-12.39	19.42

OECD-High income countries average	93.05	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 in the selected countries now receive rates of government price support that are generally positive. Note moreover that the NRA"s during the 1980s were mostly negative, often significantly so, showing that on net, government interventions taxed rather than subsidised farmers. That is to say, in general over the entire period and for most all of the selected countries the rate of disprotection caused by government interventions (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 generally declining. That is to say, 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, 2009). Taken together then, the trading environment confronting farmers in the selected countries was one of declining disprotection in the home country and declining positive protection in the rich country trading partners.

Agricultural research

Agricultural progress in modern times, typically measured by growth in total factor productivity, has been driven more by technical advance 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). Figure 5 compares annual average growth rates of spending on agricultural research by governments of the selected countries with the OECD. These data come from IFPRI"s Agricultural Science and Technology Indicators (ASTI) database, and was available for sixteen out of the twenty countries. They show that, in general and with only three exceptions, rates of spending on agricultural research by the success story countries increased during the study period. Moreover, in most cases the pace of increase was much faster, albeit from a lower base, than on average in OECD countries.

The pattern of findings reported in Figure 5 for Brazil, China and Chile is confirmed by findings reported in in-depth studies of agricultural policies in those three countries done by the OECD. Those country studies report data showing annual average rates of increase in public spending on the entire package of research, extension and education of 3% (1995-2005), 16% (1993-2005) and 10% (1990-2005) for those three countries respectively. The comparable rate for the OECD region is only 1.3% (1986-2005).

Agricultural productivity and poverty

The payoff from investments in agricultural research, development, extension and education comes in the form of sustained increase in agricultural productivity. Comparisons of agricultural performance among countries and over time are frequently made using partial productivity indicators such as output, *e.g.* per unit of land, or head of livestock or agricultural worker. However these indicate 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). Thirtle, Lin and Piesse (2003) examine the impact of total factor productivity growth on the incidence of poverty in the LDCs, as measured by the percentage of the population living on less than USD 1.00 per day. Employing regression analysis their empirical analysis shows that agricultural productivity growth has a substantial impact on poverty reduction, whereas productivity growth in industry and services does not. They use their empirical findings to show that investment in agricultural R&D has had a substantial impact on poverty reduction in Africa and Asia, as well as paying for itself by being an extremely profitable investment.

We should expect therefore that our selection of countries where agriculture contributed to extraordinary progress in poverty reduction might also have posted strong productivity gains. Fuglie (2008) reports findings from a comprehensive study of trends in total factor productivity covering 173 countries from 1961 to 2006. Figure 6 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 all twenty of our chosen countries, with most averaging well above 1.6% per year which was 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. On the whole then it seems safe to conclude that agricultural TFP growth was a shared characteristic of the selected countries, undoubtedly contributing to poverty reduction.

Expenditures on agriculture

What about other kinds of government expenditures on agriculture? There is a widespread belief that agricultural success is systematically related to how high is the share of total budgetary expenditures that goes to agriculture. Indicative of this belief are the commitments embodied in the African Union"s Comprehensive Development Program for African Agriculture (CAADP) whereby African governments have agreed to spend a minimum of 10% of their national budgets on the sector.

The IMF publishes estimates of public expenditures by function of government for a large number of countries. Table 7 below compares estimates of the share of total budgetary outlays on agriculture for those countries for which data are available (fifteen out of the twenty 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 two different ranges of years 1989-97 and 1998-2005 to give some idea of the progression. There is wide variation amongst the countries and no consistent pattern of change over time. Bearing data limitations clearly in mind, we find that: a) government expenditures on agriculture as a percentage of total budgetary expenditures averaged well under 10% in most countries and b) were generally declining throughout all the years of our study period.

Table 7. Evolution of agricultural expenditure

Country	Share of agricultural expenditures of total expenditures (average 1989-97)	Share of agricultural expenditures of total expenditures (average 1998-2005)
Brazil	2.52%	3.86%
Cameroon	4.67%	2.82%

	China 5.43%	3.29%
Costa Rica	2.90%	2.18%
Dominican Republic	6.12%	6.10%
Egypt	4.98%	5.67%
Guatemala	3.98%	2.93%
Indonesia	7.19%	3.20%
Mexico	4.93%	4.11%
Nicaragua	3.57%	n.a.
Panama	2.98%	2.93%
Philippines	7.28%	4.66%
Tajikistan	n.a.	4.50%
Thailand	9.85%	6.65%
Tunisia	7.94%	8.34%

Source: IMF, 2009.

CONCLUSION

The countries we judged successful in achieving poverty reduction constitute a highly diverse mix. The selection includes some of the poorest and some of the richest developing countries in the world, representing virtually all geographic regions. The countries also differ greatly amongst themselves in their systems of governance and economic management.

During the period when they posted their impressive success in reducing poverty they were also experiencing substantially positive improvements on other economic performance indicators: 1) by most measures the macroeconomic context became progressively more favourable; 2) their own governments were reducing *disprotection* by lowering export taxes, overvalued exchange rates and by dismantling inefficient state interventions in agricultural markets; and 3) the governments of rich country trading partners were reducing the most production and trade distorting kinds of support offered their farmers.

The accumulated body of research on this issue is clear that successful macroeconomic performance is, if not strictly causal, a necessary pre-condition to success in combating poverty. At the same time, we found that while economic growth generally was an important contributor to poverty reduction, the sector mix of growth mattered substantially. Especially relevant to the objectives of the overall project of which this paper is part was the great importance of agricultural sector growth for poverty reduction in a majority of the selected countries. Looking at the question in that way permitted us to make a preliminary partition of the importance of growth in agricultural GDP/worker relative to that of growth in non-agricultural GDP/worker and remittances per capita. That analysis attributes to per worker growth in agricultural GDP the majority share of progress in reducing poverty in those countries posting the greatest progress in doing so.

During the study period public expenditures on agricultural research in the selected countries were increasing generally and significantly faster than in the OECD region. Perhaps as a reflection of that extra investment, in all of the countries where agriculture contributed to rapid progress in poverty reduction, total factor productivity rose, and at rates generally higher than other countries in their respective regions and globally. Although the data are somewhat shaky, the share of the total government budget spent on agriculture is not extraordinarily high and has generally been declining.

Due caution is needed in interpreting these findings, and in particular it is premature to draw policy conclusions. The purpose of this paper was simply to obtain an overall picture of the economic characteristics of those countries achieving the fastest progress in reducing poverty. It would be wrong to conclude on this basis of this paper, for example, that the more investment there is in agriculture, the more growth will follow and the more poverty will be reduced. Careful attention needs to be paid to the specific situation in individual countries, to the nature of investments in the sector, and in particular to the macroeconomic environment in which the sector operates.

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