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## **Rural development and poverty reduction: is agriculture still the key?**

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**Abstract:** *This paper examines the relationship between rurality and poverty, and the role the agricultural sector can play in rural development, poverty reduction, and overall development. The historical views regarding the role of the primary sector in development are presented, and then using original data, the paper argues that there was an historical misjudgment against the primary sector that served as a foundation for anti-agricultural bias in public policy until the late 80's. Finally, this paper explains how under certain conditions territorial/regional development strategies may prosper, but in other conditions, particularly in the least-developed countries rural space, agriculture is still necessarily the starting point for rural development.*

**Key Words:** *rural development, agricultural growth, poverty reduction, production linkages.*

**JEL:** *Q10, O10, O13.*

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## **I.- Introduction**

It is not an exaggeration to say that the battle to achieve the global society's stated objectives on hunger and poverty reduction will be won or lost in the rural areas of the developing countries. Globally, extreme poverty continues to be a rural phenomenon despite increasing urbanization. Of the world's 1.2 billion extremely poor people, 75 percent live in rural areas, and for the most part they depend on agriculture, forestry, fisheries and related activities for survival. The promotion of the rural economy in a sustainable way has the potential of increasing employment opportunities in rural areas, reducing regional income disparities, stemming pre-mature rural-urban migration, and ultimately reducing poverty at its very source. In addition, development of rural areas may contribute to the preservation of the rural landscape, the protection of indigenous cultures and traditions while rural societies could serve as a social buffer for the urban poor in periods of economic crisis or social urban unrest.

However, public policies at national level and resource mobilization at both national and international levels have not always recognized the multiple potential of the rural economy. Public policies and investments in developing countries have historically favored industrial, urban and service sectors at the expense of agricultural and other rural sector development. In many cases, a coherent rural development policy (by its very nature cross-cutting) has fallen victim to the lack of a cross-sectoral institutional framework.

The past 20 years have witnessed a steep decline in the availability of public resources for agriculture and rural development. Between 1983-1987 and 1998-2000, the annual average allocations of Official Development Assistance (ODA) for agriculture in the least-developed and other low-income countries fell by 57 percent from USD 5.14 billion (2002 prices) to USD 2.22 billion. Lending from international financial institutions followed a similar pattern while domestic public spending has remained stagnant at best. The result has been reduced incentives for rural investment. Serious questions have also been raised as to the efficiency and effectiveness of public resource mobilization for agriculture and the rural space. For example, López and Galinato (2007) show a consistent bias in rural spending in Latin America in favor of subsidies and against investment in public goods, which has translated into lower agricultural growth in the region.

An important question in the development debate regarding rural development has been the relationship between agriculture and the rural economy. In certain respects, past policy perceptions and practice have often equated rural development with agriculture, and rural development policies have been subsumed under an agricultural policy package. The issue of how and under what conditions agriculture is a driving force of rural growth has received scant attention or has given mixed messages including in the position of major multilateral financing institutions <sup>1</sup>.

Recently however, the emergence of national and international commitments on poverty and related targets (as for instance in the Millennium Development Goals and the Poverty Reduction Strategies at country level), coupled with the failure of past paradigms to make mass reductions in rural poverty, have given a new impetus to the role of agriculture in development and poverty reduction. While at the same time new rural development models have emerged (especially in the context of Latin America) emphasizing a more broad approach in which rural and urban space are viewed as a continuum and their interactions are emphasized (de Janvry and Sadoulet (2007)).

The principal objective of this paper is to present in a concise way, some of the conceptual issues regarding the role of agriculture in both rural and overall development, emphasizing its role in poverty reduction; and to explore if agricultural development can be an engine of growth and poverty reduction in developing countries, and under what conditions.

The paper is structured as follows: In the next section we deal with issues of definition of rurality and rural development. Next, we explore the link between poverty and rurality. Then we discuss the role of agriculture in development, rural development and poverty reduction. We then discuss contexts in which spatial constraints make a sectoral (agricultural) development entry point necessary. Finally some concluding remarks are provided.

## **II.- Definitions**

### ***A.- What is Rural Development?***

The definition of rural development has evolved through time as a result of changes in the perceived mechanisms and / or goals of development. A reasonable definition of rural

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<sup>1</sup> Compare for instance the World Bank's rural development strategy in the "Vision to Action" document (World Bank (1997)) which is heavily oriented towards agriculture to the latest strategy, "reaching the Rural poor" (World Bank (2003)) in which the role of agriculture is substantially less prominent.

development would be: development that benefits rural populations; where development is understood as the *sustained* improvement of the population's standards of living or welfare. This definition of rural development, however, has to be further qualified.

In the 1960's and early 1970's the consensus was that intense industrialization was the main characteristic of the perceived development path. In this context it seemed natural to define rural development as precisely leading into that path: "Rural development is essentially a part of structural transformation characterized by diversification of the economy away from agriculture. This process is facilitated by rapid agricultural growth, at least initially, but leads ultimately to a significant decline in the share of agriculture to total employment and output and in the proportion of rural population to total population. (Johnston, 1970)."

Later during the 70's, mostly based on equity considerations, the focus and definition of rural development turned to the provision of social services to the rural poor. This shift was partially founded on the recognition that even under rapid growth of income in rural areas, the availability or equitable access to social services and amenities was not guaranteed<sup>2</sup>. Lacroix (1985) exemplifies this line of thought when he explains the difference between agricultural and rural development: "Agricultural Development generally tries to raise agricultural production and productivity and is of a technical nature. It is similar to other efforts to develop physical capital as a means for economic growth... Rural Development, though, by definition is oriented more toward benefiting primarily the poor... Thus, the fundamental distinction between pure agricultural and rural development is the emphasis on capital development for the former, and human capital development for the latter."

Since the 1970's rural development as a concept has been highly associated with the promotion of standards of living and as a precondition for reducing rural poverty. This pro-poor bias was born from the understanding that, particularly in societies where wealth is extremely concentrated, mean incomes could grow without improving the well being of the most dispossessed. Thus, if the general definition of rural development is accepted, i.e. the improvement of the welfare of *all* members of the rural populations, then this pro-poor bias is justified.

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<sup>2</sup> See Ruttan (1984).

On the other hand, the focus on human capital formation, through the provision of social services in rural areas has been constantly stressed since the 1970's. Originally, this focus stemmed from social equity considerations: it is fair that all of society's members have access to services like education and health. However, the development of endogenous growth theory in the late 1980's provided macro-foundations for this priority, as this theory proved how permanent growth / development is possible (even in the presence of constant returns to scale) when there is balanced investment in both human and physical capital at the same time.

### ***B.- What is Rural?***

Having defined rural development it is essential to define what is rural. Unfortunately there does not exist a single methodology, much less a single definition of what constitutes rural. The problem is that patterns of spatial occupation are, *inter alia*, culturally and historically determined and vary among regions of the world. A natural definition of rurality is to define it by exclusion, as that which is not urban, where urban is defined on the basis of population agglomerations.

In practice there are two main methodologies to define rural. The first methodology is to use a geopolitical definition. First, urban is defined by law as all of the state, region, and district capitals (centers), and by exclusion all the rest is defined as rural. Countries like Colombia, El Salvador, Dominican Republic, and Paraguay follow this methodology<sup>3</sup>. In all of these countries urban population is defined as that living within the "*cabecera municipal*" the municipality's head or center. The drawbacks of this methodology are obvious: populations that live outside the geopolitical limit of a city (specially in a growing city) are miscounted as rural; while population living in tiny municipalities in sparsely populated regions is miscounted as urban.

The other popular methodology is to use observed population agglomeration to define urban. In this case populations that live within an area where contiguous households form populations larger than, say 2,000 inhabitants are considered urban, while by exclusion the rest is defined as rural. This methodology seems more attractive because it establishes a clear threshold; unfortunately this threshold varies widely around the world. In countries like

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<sup>3</sup> A complete list of definitions of urban/rural for Latin American countries is available at <http://www.eclac.cl/Celade/publica/bol63/BD63def00e.html> . United Nations has the same information available for most countries in their demographic yearbook, available at: <http://unstats.un.org/unsd/demographic/products/dyb/DYB2000/NoteTable06.pdf> .

Uganda, an agglomeration of only 100 inhabitants constitutes an urban settlement, while in countries like Nigeria and Mauritius the minimum agglomeration for urban areas is 20,000, and even 30,000 in Japan. In spite of these large variations certain thresholds are popular, like 2,000 in Chile, Argentina, Bolivia, Israel, and France; 2,500 Mexico and USA; and 5,000 in Belgium and Switzerland.

Other less popular methodologies consist of counting agglomerations of homes; for example, 100 contiguous dwellings constitutes an urban area in Peru. Other countries consider the availability of services as defining urban. For example in Honduras, an area is urban if, in addition to having a population of 2,000 inhabitants, it possesses services of water, electricity, education and health infrastructure. This definition is relevant from a poverty analysis standpoint because the absence of these services is usually associated with poverty; thus, this particular definition of rurality provides elements for characterizing poverty. In comparison, rural areas in developed nations have availability of all of the above mentioned services, spatially more scattered, but still available.

The limitations in comparability imposed by the differing definitions of rurality have spurred efforts to create internationally comparable measures of rurality. These projects merge satellite imagery, which shows population agglomerations, together with census data to spatially distribute populations. The GRUMP project (Global Rural Urban Mapping Project) is one major effort of the type, identifying cities with night-light satellite imagery and using census data to distribute population inside and outside those cities<sup>4</sup>. Although the effort is important, it is still not an ideal measure because it depends on the reliability of the original census (and its degree of sub-administrative unit detail), and because it uses official (and therefore different) rurality figures in the model used to assign rural and urban populations. For Latin America, Chomnitz et al. (2004) created a rurality indicator based on population densities and distance to a major city. The cutoff point to define rurality is areas with populations living in densities below 150 inhabitants per squared kilometer *and* living more than 1 hour of travel away from a major city (defined as an agglomeration larger than 100,000 inhabitants). In Table 1 we summarize these different measures of rurality. The table shows that there is less variation of rurality in the internationally comparable figures; but more importantly, it also shows that rurality is under-reported in official figures. These

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<sup>4</sup> More information available at the GRUMP site: <http://sedac.ciesin.columbia.edu/gpw/>.

underreporting is more pronounced in Latin America where GRUMP-measured rurality is about 10% higher than the official numbers. The averages weighted by population, (i.e. absolute rurality for the region) in parenthesis in the tables, show that the underreporting is even higher in Sub Saharan Africa and in Latin America.

Although it seems easy to think of what is urban and rural, the multiplicity of definitions shows that it is not as easy to define. Furthermore, the fact that the definitions vary so greatly, creates a problem for making meaningful comparisons, when “rural” refers to a variety of different contexts. Also, if “rural” characterizes a variety of contexts, it is hard to see how one single rural development strategy even in the same country may be applied. Finally, the beneficiaries of a successful rural development strategy, the rural populations could be larger than what official figures indicate.

**Table 1. Internationally Comparable Measures of Rurality**

<b>Region</b>		<b>Official</b>	<b>GRUMP</b>	<b>Chomnitz et al. (2004)</b>
Sub Saharan Africa	Average (%)	64.1 (66.9)	67.8 (72.0)	
	Coeff. of Var.	0.26	0.22	
Latin America and Caribbean	Average (%)	33.4 (24.1)	36.3 (30.3)	42.2 (42.8)
	Coeff. of Var.	0.47	0.43	0.27
Asia	Average (%)	45.5 (62.1)	47.9 (62.0)	
	Coeff. of Var.	0.61	0.58	

Note: Averages weighted by population are in parenthesis.

**III.- Rurality and Poverty**

Most of the world’s poor live in rural areas. IFAD estimated in 2001 that among the poorest 1.2 billion people in the world, surviving with less than a dollar per day, three out of four lived in rural areas<sup>5</sup>. They constitute the poorest fifth of world population and do not earn enough to cover their food needs. In a recent World Bank study, Ravallion et al. (2007) estimate that in 2002, 75% of the developing world poor still live in rural areas. Part of this correlation between rurality and poverty is given by the fact that some countries, as we have

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<sup>5</sup> IFAD, 2001.

seen, indirectly define the poor as rural. As one of the most accepted characteristics of development is a secular decline in the share of agriculture, countries with larger rural populations shares are expected to be poorer since the main activity in the rural economies is likely to be agriculture (we explore the depth of this link below).

However, the question begs an answer: how much are poverty and rurality correlated? To get a measure of correlation we collect all the available figures of poverty measured as the percentage of population in each country living under 2 Purchasing Power Parity (PPP) US dollars per day<sup>6</sup>. The benefit of this measure of poverty is that it is comparable, because it offers a comparable poverty line which accounts for the differences of purchasing power of 1 dollar in each different country. Recognizing the limitations associated with the measure<sup>7</sup>, we regressed the percentage of rural population against poverty, as presented in Table 2<sup>8</sup>. We are obviously not surprised to find a positive, significant and high correlation. The coefficient of 0.83 translates to an elasticity of 0.86; that is, for each percentage point of reduction in the relative share of rural population, poverty is reduced by 0.9 percentage points. What is truly surprising is to find such a high fit for this simple regression. About 85% of the differences in poverty rates are explained by the rurality level alone. The surprise should be compounded if one considers the differences in the definition of rurality between countries.

**Table 2. Under PPP 2 US\$ / Day Poverty**

<b>Explanatory Variable</b>		<b>Explanatory Variable</b>	
% Rural	0.83	% Ag. GDP	1.88
	(0.04)		(0.09)
Std. error of regression = 20.0 R <sup>2</sup> = 0.84 Observations = 90		Std. error of regression = 21.1 R <sup>2</sup> = 0.82 Observations = 90	

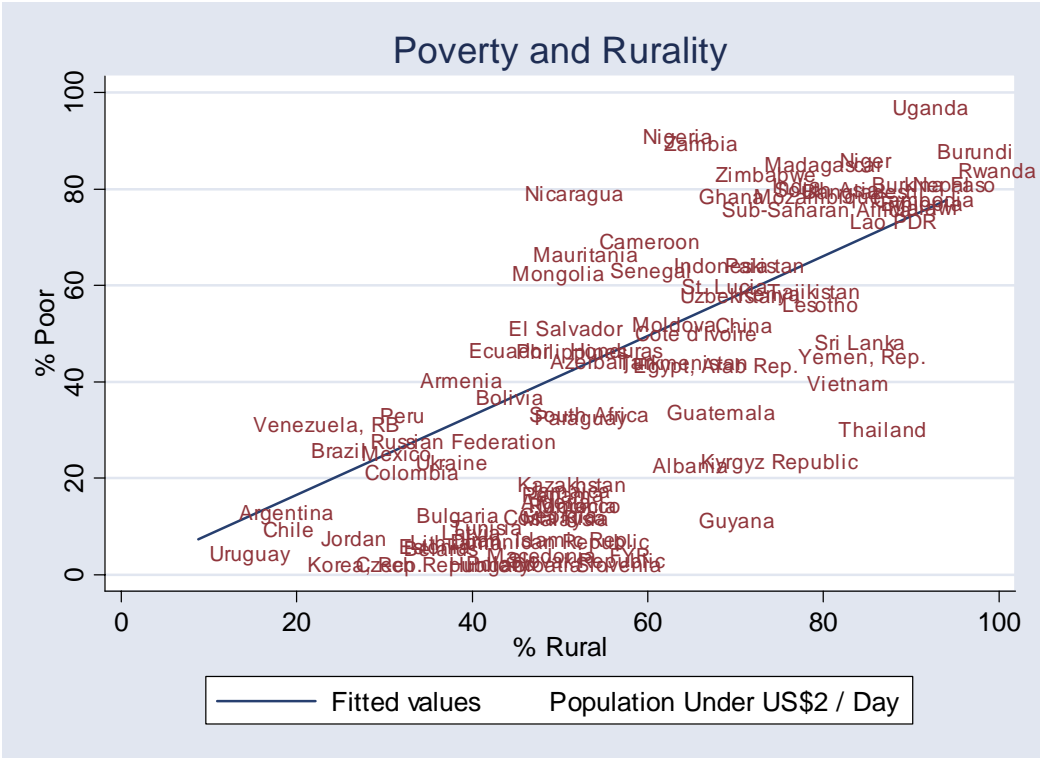
Note: Standard Errors in parentheses.

<sup>6</sup> We use all countries with available data between 1995 and 2000, the source is World Development Indicators of the World Bank.

<sup>7</sup> In particular it is not a perfectly comparable measure, because not all differences in the real price of food, which is the generic commodity relevant for poverty measures, are captured in PPP equivalent currency.

<sup>8</sup> We used the percentage of rural population (averages for 1995 – 2000) as defined by each country with all of the limitations this measure has, as described in the previous section.

**Figure 1. Poverty and Rurality**



Given the goodness of fit, the poverty levels of only 6 countries lie outside the 90% probability bounds. These countries are statistically separated from the regression line in Figure 1. With lower poverty levels than that predicted by their rurality are Slovenia, Thailand and Guyana; and with statistically higher poverty than predicted are Nigeria, Zambia and Nicaragua<sup>9</sup>.

This surprisingly high correlation of poverty and rurality only highlights the importance of rural development, and an adequate rural development strategy in any poverty reduction plan.

**IV.- The Importance of Agriculture in Development**

**A.- Historical Perspectives**

In this section we provide a brief historical account of some of the most significant views about the role of agriculture in development.

<sup>9</sup> The case of Nigeria is particularly noteworthy, because an extremely high urban/rural threshold of 20,000 inhabitants is used. Thus, if Nigeria used a more commonly applied threshold of 2,000 inhabitants, its observed rurality would be even lower, and Nigeria would be even further away from the regression line in Figure 1.

Economists as early as the beginning of the 20<sup>th</sup> century observed that wealthier countries were characterized by a smaller portion of their output coming from agriculture and relatively less labor resources tied to the same sector. They also noted that the process of development itself was characterized by a monotonic decline in the relative importance of agriculture and the primary sector in the economy, both in terms of GDP and employment. One of the first economists to point this out was G. B. Fisher (1939). Later, this same generalization was formalized by Kuznets (1957), showing that this secular decline of the primary sector with development can be observed both across countries and across time. In Table 3, we document this feature of development with recent data.

Therefore, if the process of development is characterized by a shrinking agricultural sector, should the development “recipe” then suggest policies that are biased against agriculture (in favor of other sectors of the economy) to accelerate development? Or should agricultural growth be promoted to facilitate this structural transformation? If one looks at history, and recounts the policies that developing countries implemented from the late 1950s until the 1980s (particularly in Africa and Latin America), it would seem that they followed the first strategy.

**Table 3. Income and the Relative Size of Agriculture**

<b>PPP Per Capita GDP in US\$ (2000)</b>	<b>PPP per Capita GDP</b>		<b>Share of Agriculture in GDP</b>		<b>Share of Employment in Agriculture</b>	
Les than 1,500	953	[31]	37	[31]	45	[9]
Between 1,500 and 3,500	2,304	[38]	26	[37]	40	[20]
Between 3,500 and 6,500	5,105	[38]	15	[37]	24	[24]
Between 6,500 and 15,500	10,142	[29]	6	[28]	13	[24]
More than 15,500	23,399	[35]	3	[27]	4	[34]
Average	8,328	[171]	18	[160]	20	[111]

Note: Number of observations in brackets. Variables are averages for the available values in the period 1995-2000. Source: World Bank’s World Development Indicators.

Some economists argued that agriculture plays an important role in development. One of the first arguments in favor of the role of agriculture in development was placed by Lewis (1954)

who suggested that “there are large sectors of the economy where the marginal productivity of labor is negligible, zero, or even negative.” Of course these labor resources are tied to the primary sector, and are a key ingredient for industrial growth, which will occur thanks to a growing labor force coming from the primary sector. Hence, the primary sector plays, although passive, an important role in development. Later, Johnston and Mellor (1961), identified some active roles that the agricultural sector performs throughout the development path: *i*) agriculture provides food necessary for a growing economy, as food demand, although at a decreasing rate, grows with income (Engel’s Law); *ii*) agricultural exports generate the foreign exchange necessary to import capital goods; *iii*) agriculture, as the larger sector in less developed countries, is the only sector capable of generating the savings mass that the non-agricultural sector needs for capital accumulation; and *iv*) a growing agricultural sector creates a larger local market for the non-agricultural sector. These Johnston-Mellor linkages still remain relevant for developing economies with a large primary sector.

Johnston and Mellor were perhaps also the first to note that successful industrialization experiences are usually preceded by periods of dynamic agricultural growth. Although this does not amount to a causality link, the authors observed that countries that embark on a successful industrialization path, first experience fast agricultural expansion, fueled, not by absorbing resources from the rest of the economy, but by rapid increases in productivity. The authors tell the story of Japan in the early 20<sup>th</sup> century. Many others have mentioned this feature of development; today for example, we can tell a similar story for the Asian giants of India and China, with fast industrialization preceded by fast productivity growth in the agricultural sector, i.e. the “green revolution”. As a matter of fact, countries that have been able to industrialize without having first an agricultural expansion are the exception (Hong Kong, Singapore).

However this was not a widely accepted message. During the second half of the 20<sup>th</sup> century there was no widely shared optimism concerning the role of agriculture in development. Agriculture was in practice condemned mainly by two separate schools of thought. The *structuralist* school (particularly strong in Latin America) provided arguments against agriculture. What eventually became to be known as the Prebisch-Singer hypothesis (Prebisch (1951) and Singer (1950)), states that the commodities that developing countries (the periphery) produce and export (i.e. primary commodities) have an income elasticity of demand less than one; as opposed to the demand elasticity of the industrial goods produced by

the developed countries (the center) that have income demand elasticity that is not less than unity. Therefore in the long run the price of the primary commodities exported by developing countries relative to the price of the industrial goods imported by these same countries (i.e. the barter terms of trade) is doomed to fall. Thus, specializing and exporting these primary commodities is a losing development proposition.

This hypothesis was disseminated before reliable price time series were available. Today with good statistics it is a contentious debate if this hypothesis holds or not; principally because it depends on the primary commodity and the industrial/manufactures price index used as deflator. Also, should one account for changes in quality? Recent long-term analysis (Ocampo and Parra (2003)) suggest that for most commodities the hypothesis does not hold. In the short-run most commodity prices are pro-cyclical. In the long-run some commodity real prices are non-stationary and thus move around a stable mean, while other commodities show one time falls in early 1920s and 1980s, and some other commodities show an upward trend like the relative price of meat. Therefore, the Prebisch-Singer hypothesis may apply to explain the failed development experience of any one particular country, dependent on a particular commodity, but it can not be generalized to all developing countries and to all commodities.

The second main hypothesis that condemned agriculture is related to the belief that agriculture has low potential for growth and its multiplier effect, its ability to “pull” the rest of the economy, is very low. The first part of this hypothesis can be traced back to Rosenstein-Rodan (1943). He proposed that industrialization can be achieved by investing in several different industries separately, even if none of them *alone* generates enough rents to break even. This is possible because there exist economies external to the industry (i.e. increasing returns to scale) that spill-over to the rest of the economy<sup>10</sup>. If there are enough industries generating this type of positive externalities, the “big push” into industrialization can be generated. Agriculture here lies in its absence, it is a sector that does not generate these economies external to the industry.

Also part of this agro-pessimism, and perhaps more influential in condemning the sector is Hirschman’s (1958) work *The Strategy of Economic Development*. Hirschman opposed what he called a “balanced growth” strategy, of all sectors growing at the same rate, i.e.

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<sup>10</sup> Rosenstein-Rodan did not identify these externalities as increasing returns to scale. Krugman (1994) provides neo-classical support to the Big-Push idea with the increasing returns argument.

Rosenstein-Rodan “big-push” argument. Hirschman advised promoting the growth of the sector with the greatest ability to pull the rest of the economy. He focused on the production backward linkages, that is the links in production that one sector has with the rest of the economy as a purchaser of inputs<sup>11</sup>. If a sector A with high backward linkages expands, the rest of the economy will consequently experience a larger expansion, as it sells the inputs that sector A needs to grow. To uncover the backward linkages, Hirschman analyzed the input-output matrices of countries with available data: Italy, United States and Japan (note that all are developed countries, and this is not inconsequential as we show below), and discovered that agriculture has high forward linkages, but among the lowest backward linkages of any other sector. “Agriculture – argues Hirschman – certainly stands convicted on the count of its lack of direct stimulus to the setting up of new activities through linkage effects: the superiority of manufacturing in this respect is crushing”<sup>12</sup>. This indictment, re-examined using recent data, turns out to be a historical misjudgment, as we show below.

Below, evidence is presented to show that neither of these two propositions is really corroborated by the data. If (other) industries are inherently superior to agriculture, they would manifest a long-term productivity growth rate higher than agriculture. This appears not to be the case. Faruqui et al. (2003), for example, estimate the annual labor productivity growth of the primary industries in the USA at 3.1% while that of the manufacturing sector at 3.3% per year. A simple observation of the development process, in which labor employed in the agricultural sector falls, while output still grows, shows how there is a considerable increase in labor productivity in the primary sector during development. This simple observation is corroborated in studies like Parry (1999) that show high labor productivity growth in resource industries. Of course, one can find examples of the contrary, low or even negative productivity growth in primary industries, but this is by no means an inherent characteristic of the sector. The other “count” of low backward linkages, also does not hold as we proceed to show.

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<sup>11</sup> Economists usually refer to the connection between sectors as “linkages”, and differentiate between “forward” and “backward” linkages. Forward linkages of a sector refers to the connections that sector has with the rest of the economy by serving as an input. The backward linkages refer to the connections of a sector as a purchaser of inputs from the rest of the economy.

<sup>12</sup> Hirschman (1959), pp. 109-110.

## ***B.- Towards a New Perspective of the Role of Agriculture in Development***

### *Agriculture's Production Linkages and Development*

Linkages in the agricultural sector are easy to identify: forward linkages are mainly in the agricultural and food processing industries, in the service industry with the restaurant and hotel industries and, sometimes, public schooling. Similarly the main backward linkages are with the agricultural industries that produce animal feed, with the chemical and mineral industry for purchased fertilizers, and, depending on the degree of sophistication of the agricultural sector with the financial and business services sector and the industry of machinery manufacture. In many developing countries, backward industries consist of a large number of small firms (fertilizer mixing, small scale transport, agricultural implement repair, commerce, etc.) largely labor intensive and vital for the rural economy.

Common wisdom, as reflected in Hirschman's indictment of agriculture, suggests that as the agricultural sector becomes more developed, its backward linkages increase, by requiring more financial services, machinery and other purchased inputs. Also, the forward linkages are more important in a developed economy, where there is an existing and more developed food industry, and equivalently a hotel and restaurant industry. Therefore, common wisdom suggests that in terms of linkages, agriculture would not be a good sector to promote in early stages of development, because its linkages (and thus its multiplying effect) is low. These are important questions of rural and overall development that have rarely been studied systematically.

### *Testing the "linkages" hypothesis*

The place where the linkages between sectors are recorded in an economy is the input-output (I-O) matrix, which shows how the total output of each sector is distributed between final consumption, from households and the government, and intermediate inputs sales; describing how each sector sells inputs to all the other sectors of the economy. In the 1950's, when there was more faith in planning, these I-O matrices were used to discover the sector with the higher backward linkages, that is the sector that could have a greater effect in "pulling" the rest of the economy. The method applied was to calculate and find the higher Leontief multiplier. When a sector expands, it demands inputs from other sectors to grow; in turn, these other sectors to supply these inputs need to expand and demand more inputs from yet some other sectors. This process continues infinitely, but in each round the size of the

expansion is smaller. The limit of this process of expansions generated by the growth in one sector is given by inverting a transformation of the I-O matrix, which solves for the Leontief multipliers<sup>13</sup>. This method has been usually criticized because as inputs are calculated in values, and not in units, any I-O analysis assumes fixed relative prices, an unrealistic assumption when the relative size of sectors change significantly. This criticism is valid, but the I-O analysis still provides relationships that are valid at the margin.

In spite of the mathematical beauty of the inverted Leontief multiplier matrix, the problem with the multiplier analysis is that the second, third and  $n$ th round of backward linkage caused expansions, although progressively smaller, may not realize; either because of frictions in the economy, or because these rounds take time to complete, and by the time they do, the economy may have changed. Furthermore, this multiplier analysis does not take into account the relative importance of sectors in the economy. For example, the sectors “multiplied” by another sector may be relatively insignificant for the economy in terms of income generated.

To deal with these drawbacks of the multiplier analysis, Anríquez et al. (2003) proposed an alternative method to calculate both forward and backward linkages. To value the backward linkages of a sector  $k$ , the authors proposed:

$$\sum_{i \neq k} \frac{X_{i,k}}{\sum_j X_{i,j}} \cdot VA_i \quad (1),$$

where  $X_{i,j}$  denotes intermediate demand of inputs of sector  $i$  by sector  $j$ ; and  $VA_i$  denotes value added by sector  $i$ . Equation (1) indicates that we value as backward linkage only a portion of the value added of sector  $i$ . That portion is equivalent to the ratio intermediate demand from the sector  $k$  to total intermediate demand of sector  $i$ . Equation (1) can be interpreted as giving a monetary figure in terms of value added to the economy, to all of the first round backward linkage effects caused by an expansion of sector  $k$ . To value the forward linkages of sector  $k$  the authors also proposed:

$$\sum_{j \neq k} \frac{X_{k,j}}{\sum_i X_{i,j}} \cdot VA_j \quad (2),$$

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<sup>13</sup> The Leontief multipliers are calculated from the following identity:  $\mathbf{X} = \mathbf{A}\mathbf{X} + \mathbf{Y}$ ; where  $\mathbf{X}$  is total (gross) production,  $\mathbf{A}$  is the input requirement matrix, and  $\mathbf{Y}$  is final goods output (demand). Rearranging terms and applying the change operator the identity can be expressed as:  $\Delta\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1} \times \Delta\mathbf{Y}$ , where  $(\mathbf{I} - \mathbf{A})^{-1}$  is the Leontief multipliers matrix. It follows from the last expression that an increase in the final demand of the sector with the highest Leontief multipliers will have the greatest effect on gross output.

Equation (2) shows that the portion of the value added of sector  $j$  that is considered as a forward linkage is the ratio of inputs from sector  $k$  to total inputs used in sector  $j$ .

**Table 4. Value of Agriculture and its Linkages to the Rest of the Economy**

Country	Year	PPP per Capita GDP	Ag. GDP per Rural Inhabitant	Share of Ag. GDP in Nat'l GDP	Value of Forward Linkages (% of GDP)	Value of Backward Linkages (% of GDP)
Tanzania	2001	535	173	46	8	7
Malawi	1998	595	57	36	4	13
Mozambique	1995	679	61	29	6	4
Zambia	2001	798	104	22	4	5
Kenya	2001	993	89	29	1	12
Uganda	1999	1209	98	46	8	1
Bangladesh	1994	1279	99	22	7	15
Vietnam	1997	1778	115	31	5	5
Bolivia	1996	2288	336	17	8	3
Honduras	1997	2602	281	44	5	5
Zimbabwe	1991	2795	116	15	11	19
Indonesia	1995	3011	195	18	12	5
Egypt	1998	3269	412	18	5	4
Morocco	1994	3497	554	19	5	3
Peru	1994	4329	522	11	4	4
El Salvador	2000	4702	521	10	6	4
Paraguay	1998	4816	699	19	5	4
Colombia	1990	5916	1129	18	4	2
Thailand	1998	6011	210	13	4	5
Colombia	2000	6110	1023	14	4	1
Brazil	1995	6930	833	8	3	3
Mexico	1996	7753	857	6	3	3
Uruguay	1995	8228	4229	7	3	4
Chile	1996	8438	2333	4	2	2
South Africa	2000	9434	198	3	2	2
Argentina	2000	12253	3144	6	2	3

For the purpose of this study we have collected as many I-O matrices as we could find to measure forward and backward linkages of the agricultural sector and to study any relations they may have with development. Table 4 presents the results for all the 26 countries for which we could find public information<sup>14</sup>. As countries have been sorted by per capita GDP, the table shows the well known fact that the share of agriculture in total GDP tends to fall as countries get richer. What happens with the value of linkages, on the other hand is not known, and rather surprising. Backward linkages, contradicting “common wisdom” seem to be much

<sup>14</sup> The main source for I-O matrices was IFPRI’s database of Social Accounting Matrices (SAMs), publicly available at <http://www.ifpri.org/data/dataset.htm>. The Input Output Matrix is one of the accounts in the SAM structure.

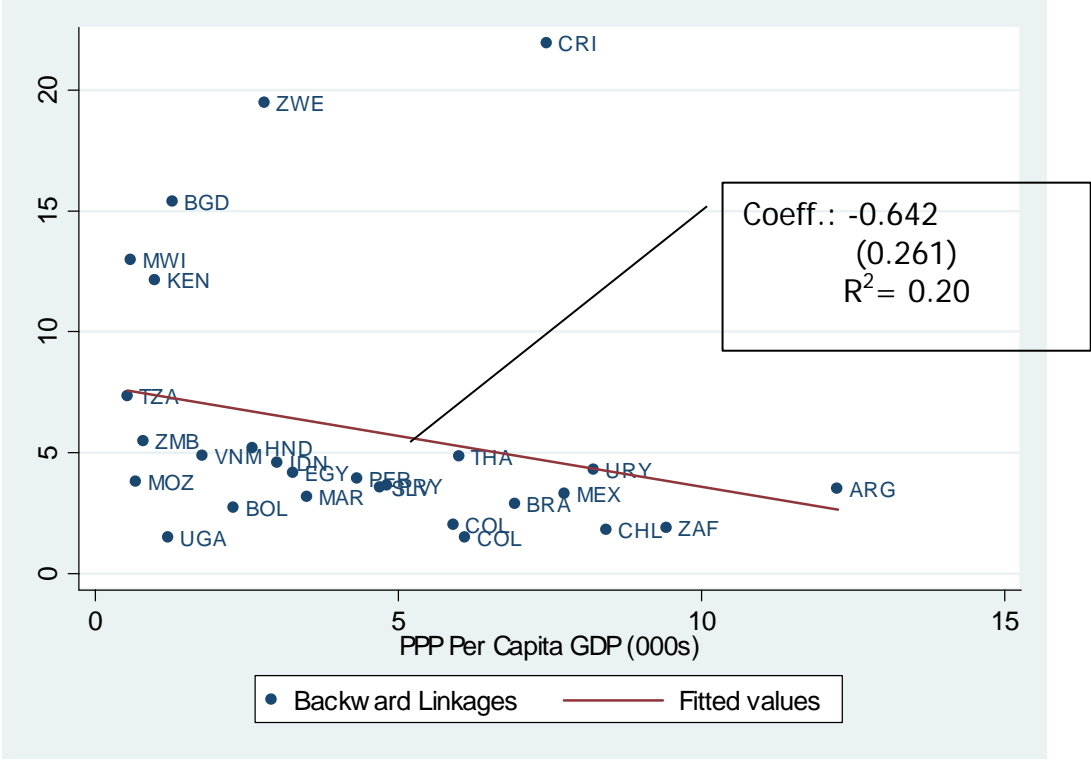
higher at *earlier* stages of development and not later. On the other hand, forward linkages seem to be larger at medium income levels in our sample.

The fact that the value of linkages drops at higher levels of income makes sense, because the share of agriculture in total income is falling, and so does the value of the connections with the rest of the economy. Simple regression analysis, as shown in Figures 2 and 3, demonstrate that this correlation is statistically significant. That is, both forward and backward linkages are higher for countries at earlier stages of development (note that no causality is implied). Thus as countries are in their earlier stages of development, agriculture has a higher effect in national non-agricultural income<sup>15</sup>. These results seem to contradict the intuition that as agriculture modernizes, forward linkages should become more important, as countries develop an industrial food processing sector. This intuition, though, can be supported by looking at the relative size of the backward with respect to the size of agriculture. Additional regressions reported in Appendix I show that both the ratio of forward linkages to agricultural GDP and the ratio of backward linkages to agricultural GDP grow with development (as measured by per capita income). These latter results altogether convey that although linkages fall with development, the size of these linkages fall less than the decline in the relative size of agriculture.

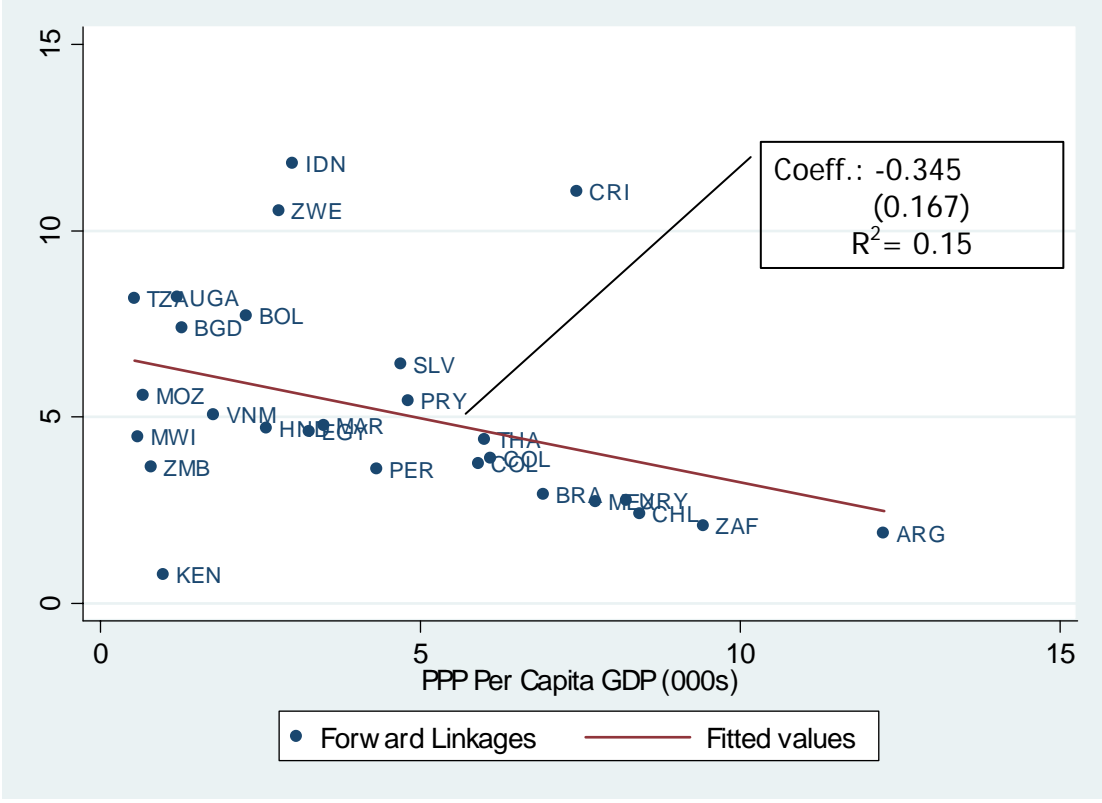
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<sup>15</sup> Our results should be compared with Vogel (1994) results. The author calculated multipliers for 27 countries using SAMs from the 1970s and early 1980s. He found that the total (including household accounts) forward multiplier declines with income, while he did not find any statistical relationship with respect to backward multipliers and income.

**Figure 2. Backward Linkages and Development**



**Figure 3. Forward Linkages and Development**



These results are rather surprising, and deserve a closer inspection. We need to compare the forward and backward linkages of agriculture, with the equivalently calculated linkages of other sectors. In Table 5, we present the sectors with the highest forward and backward linkages for two countries: one a developing country with high backward linkages, Bangladesh; and the other a middle-income country with low linkages for agriculture, Chile (more details available in Anríquez et al. (2003) and Anríquez et al. (2005)). The table is very revealing, because it reinforces the results previously found. The backward linkages, the focus of early development economists, not only are higher at earlier stages of development, but these linkages are among the highest of any sector at earlier stages of development. In the case of Bangladesh actually the highest, since Rice Milling is totally linked to agriculture, and agriculture itself is second in the ranking. Furthermore, even in middle-income countries, agriculture still has high backward linkages, as in the case of Chile, where the sector represents 4% of national GDP, but ranks 10<sup>th</sup> out of 71 sectors in importance of its backward linkages.

**Table 5. Value of Forward and Backward Linkage by Sector**

**a) Bangladesh 1994, 34 Sectors.**

Rank	Sector	Backward Linkage (% GDP)	Rank	Sector	Forward Linkage (% GDP)
1	Rice Milling	16.0	1	Trade	27.7
2	Agriculture	15.4	2	Agriculture	7.4
3	Trade	10.6	3	Transportation	7.4
4	Financial Services	6.1	4	Housing	4.4
5	Transportation	5.5	5	Miscellaneous Industries	3.7

**b) Chile 1996, 71 Sectors.**

Rank	Sector	Backward Linkage (% GDP)	Rank	Sector	Forward Linkage (% GDP)
1	Trade	10.0	1	Service to Industries	14.5
2	Public Administration	5.2	2	Construction	9.7
3	Construction	4.7	3	Truck Transportation	4.6
4	Real State Ownership	4.3	4	Real State Activities	4.2
5	Other Service Activities	3.4	5	Fuel Refining	4.1
10	Agriculture	2.4	9	Agriculture	3.0

### *Understanding Structural Transformation as a General Equilibrium Process*

The section above points to agriculture as a key sector to promote development as its backward linkages are highest at earlier stages of development. Therefore, a development strategy that promotes agriculture will indirectly “pull” the rest of the economy towards development. However, looking at output linkages may not be the key for the design of long-term development policies. As Timmer (2005) states, part of the controversy of the role of agriculture in development stems from the fact that structural transformation is a general equilibrium process that can not be explained by looking at agriculture alone.

López et al. (2007), explain the process of reduction of the relative size of agriculture, i.e. structural change within the context of a two sector endogenous growth model. The authors show that even when labor productivity grows at the same rate in agriculture as in the industrial sector, and even if there is no declining income demand elasticity for the agricultural good, agriculture will relatively contract because one of its production assets can not be indefinitely accumulated. This asset is of course a renewable resource, which can be understood as water, land, soil quality, etc., which is limited in its supply by nature. The income maximizing path is achieved by equating the returns to assets. The relative contraction of agriculture, and the migration of assets from agriculture into the industrial sector is a result of this equating of marginal returns to assets that can be employed in agriculture or industry, like labor.

It is the equation of marginal returns to assets, that at the aggregate level are always decreasing, that can be considered as the *golden rule of development*, not the promotion of the sector with high multiplier effect. While this rule has rather obvious policy implications and is one that most economists would intuitively recommend, unfortunately if one looks at the “import substitution” era one finds the most egregious anti-agricultural bias and incredible disparities of returns to assets within the rural and urban world. For example, in China and India, the pursued industrialization policies implied a strong pro-urban bias leaving the returns to investment in the rural areas with much higher rates of return (see Fan et al. 2005). In a very influential work, that is partially responsible for turning the anti-agricultural tide Krueger et al. (1991) (with main results summarized in Krueger et al. (1988)) show that on average (over 16 developing countries for the period 1975-1984) the exchange rate overvaluation and import tariffs on industrial goods were the equivalent to at least an 11% export tax on each country’s agricultural export.

Another important lesson that can be obtained from a general equilibrium development analysis is an interpretation of poverty traps, i.e. those countries that are unable to generate enough savings to lead them into the development path. These countries are characterized by overstretching/overharvesting their natural resources, a manifestation of this overstretching being an excess of labor resources employed in resource using sectors. The general equilibrium view suggests two ways to exit a poverty trap: On one hand, there is implicitly low productivity in the industrial sector, and investing in non-agricultural productivity can help increase the demand for labor in the industrial sector and reduce the pressure on the resource. However, another possibility is to increase agricultural productivity to make the operation sustainable. Today most of the rural poor live in fragile tropical ecosystems, and where labor is not a major economic constraint. Most of the human and financial resources, public and private, that are devoted to agricultural R&D, are employed in research that is relevant for capital intensive and temperate climate agriculture; i.e. which are the needs of developed countries' agriculture<sup>16</sup>. The corollary is that although agriculture may play a key role in development, as we have argued above, this role may not be played if the agroecological conditions places limits to the expansion of the sector<sup>17</sup>.

#### **V.- Agriculture's Pro-Poor Role**

Not all growth experiences are equal. There is a growing focus on the importance of a “pro-poor growth” defined as growth (an increase in average income / purchasing power) that is also accompanied by an improvement in the distribution of income. To help in the understanding of a formal definition of the concept, let us imagine a rural world with only 100 inhabitants. One person owns the only farm, and earns 101 monetary units, while the rest are 99 laborers that earn 1 currency unit each. If the poverty line is 2, then the headcount poverty rate in this rural economy is 99%. Let us consider 2 growth possibilities: (i) the owner earns 151.5 and the workers earn 1.5 each; and (ii) the owner earns 201 while the laborers still earn 1 each. Initially, the average income is 2, so on average nobody is poor. In both growth possibilities, income grows exactly by a striking 50%, however in both cases poverty remains at 99%. In the first case, all incomes grow exactly by 50%, so there is no change in the distribution of income, and all inequality measures commonly used (which are sensitive to the distribution and not to the level of income) remain constant. On the second case, while

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<sup>16</sup> Pingali (2006).

<sup>17</sup> A cautionary tale may be given by the experience of Pakistan in the 1990's that had a slumping agricultural sector specifically because of overstretched resources, see Malik (2005).

growth is the same, the distribution of wealth deteriorates, and income inequality measures rise.

The above example serves to highlight some important facts about growth. First, when the initial distribution is extremely unequal, growth is not enough to reduce poverty, even if there is “trickle down” of the benefits of growth, as in case (i). Given that many examples of growth that resemble cases (i) and (ii) have been documented, with limited or no reduction of poverty, is that researchers have turned their attention to “pro-poor growth”. In our example assume case (iii): all incomes grow by 1. In case (iii), growth is also exactly 50%, but the distribution of income has improved, and more importantly poverty has been reduced to 0%. Case (iii) is an example of pro-poor growth.

Different formulas have been proposed to formally define pro-poor growth. Both Ravallion and Chen (2003) and Kakwani et al. (2004) propose formulas to measure “pro-poor growth” that involve scaling up or down the observed growth rate by a factor that is greater (less) than one if inequality has been reduced (increased).

There is ample theoretical support and empirical evidence that suggests that agriculture is pro-poor, and that growth based on the expansion of the sector is pro-poor growth. We can identify four main channels by which agricultural growth helps poverty alleviation:

- *Directly increasing the income/own consumption of small farmers:* Small holders are usually not only inadequately endowed with land, but usually also lack other assets, like physical and human capital, and thus are usually poor. Expansion of the agricultural sector may benefit also the small-holder sector and pull some of them out of poverty. Small farms are, with respect to capital and land utilization, labor intensive (own family labor), and are therefore likely to benefit from technological progress that is labor intensive. When land distribution is equitable, it will be the case that expansion of agriculture will benefit the small-holder sector; when the land distribution is inequitable there could be agricultural growth fully based on large farm output expansion, in which case the small holder sector would not necessarily benefit.
- *Indirectly by reducing food prices:* Most measures of poverty are based, directly or indirectly, on the cost of access to food. When the price of food is reduced, there is a two-way accounting improvement in the welfare of the poor. In the first place their real income increases, and more so than the wealthier, because food is the main

component of their consumption basket. At the same time, the poverty line which is usually used to measure poverty is decreased, which acts to alleviate poverty. In a completely open economy without any additional transaction costs, the price of food should not be affected by agricultural growth in the same country. However, not all food is tradable, many perishable vegetables are for all purposes non-tradables. In addition, the bulk of cereal staple foods produced and consumed by the poor in rural areas are traded in local markets which, due to high transactions costs, are disconnected from larger (including international) markets.

- *Indirectly by increasing the income generated by the non-farm rural economy:* The rural non-farm economy in most regions is either: mostly composed of goods and services that directly serve agriculture, or indirectly depend on the demand of those tied to agriculture. The more disconnected the rural economy is from urban markets, the more dependent is the rural non-farm sector on the income generated by what is usually the main engine of the rural economy: agriculture. Hence, agricultural growth can increase the demand for the goods and service of the rural non-farm sector and help pull out of poverty households tied to this sector.
- *Indirectly by raising employment and wages of the unskilled:* Agriculture is usually intensive in unskilled labor. Thus, agricultural growth through an increase in unskilled labor demand will increase unskilled employment and/or the wages of the unskilled, most of which are poor. There is here a general equilibrium effect, because raising the unskilled wages in agriculture pushes upward the unskilled wages in urban areas also. This latter general equilibrium effect will be higher the more integrated rural and urban labor markets are.

Given these channels through which agriculture reduces poverty, it should come as no surprise that the overwhelming empirical evidence shows that agricultural growth is not only pro-poor, but more pro-poor than growth in other sectors of the economy. The key in this fundamental result lies in that all four channels described benefit the poorest households of the economy more than the rest. In a seminal study Ravallion and Datt (1996) used a long time series data from India, to explain poverty with output from the different sectors of the economy. They found a large elasticity of poverty with respect to primary output (-1.2), with the sector being more effective at poverty alleviation than industry. Kakwani (1993) used the additive property of the most popular poverty indicators, the FGT (Foster, Greer, Thorbecke) class, and decomposed the effect of sectoral growth in poverty. Using the information of a

1985 Côte d'Ivoire household survey she shows that the elasticity of poverty with respect to agricultural output is much larger (-1.8) than other sectors such as services (-0.1) and industry (-0.1). Thorbecke and Jung (1996) used the additive property of the FGT poverty measures and a Social Accounting Matrix (SAM) to decompose the contribution of each sector to poverty alleviation. The authors apply this methodology to Indonesia, and find that the primary sector has a larger contribution to poverty alleviation than the industrial sector, and slightly larger than the services sector. Khan (1999) applies the same methodology with data from South Africa and reports similar evidence, agriculture is the sector with the largest contribution to poverty alleviation.

The fact that agricultural growth is more pro-poor than that in other sectors seems to be substantiated in poor countries like India and Côte d'Ivoire; as well as in middle income countries like South Africa. It is reasonable to expect that at different stages of development different channels dominate the pro-poor role of agriculture. The four channels described above are ordered in their likely importance from earlier stages of development, a ranking that can be corroborated by the scattered evidence. In very poor countries, most agricultural output comes from small holders, and therefore, this is likely the most important pro-poor channel of agriculture, for example, for poor Sub-Saharan nations. This intuition is consistent with the results of de Janvry and Sadoulet (2002), who show that following a (simulated) technological improvement, the direct effect of technical progress on poor farmers is the main poverty reducing factor in Sub Saharan Africa, larger than price and employment effects. In Asia employment effects dominate, while in Latin America indirect effects on the rest of the economy are more important in the poverty reducing effect of agricultural technological progress. The food price effect is also likely to be more important in poorer regions, because they are likely to have a food basket highly dominated by 1 staple crop, like in some poor Asian nations. Timmer (2004) shows that in the case of Indonesia 80% of the variability of the poverty to growth elasticity can be explained just by changes in the real price of rice. Note that when the price of rice falls, it adversely affects poverty by reducing income of poor farmers; however, when the price fall is caused by gains in productivity this is not necessarily the case.

As rural economies develop, the non farm economy becomes more sophisticated and diversified and, as we show below, more important within the rural economy. Therefore, this indirect effect of agriculture promoting the rural non-farm economy becomes more important.

On the other hand, with development also, the rural non farm economy becomes more tied to the rest of the economy, diminishing this indirect effect. Thus we also expect in very poor economically isolated rural economies, the non-farm sector to depend heavily on agricultural productivity, income and demand. This is consistent with the very high demand multiplier from agriculture found by Haggblade et al. (1989) in poor Sub-Saharan rural economies; but also consistent with the high indirect poverty elasticity of agriculture found by de Janvry and Sadoulet (2002) for Latin America in general.

Finally, as agriculture makes its transformation into commercial farming, the direct effect of the sector on small and poor farmers becomes much smaller, but commercial farmers are employers of unskilled labor; and concomitantly with the commercial farm transformation and their interaction with world markets, generally rural economies become interlinked with the rest of the economy, in particular with urban markets. These are the preconditions for agriculture to have an important effect on the employment and wages of unskilled workers. Anríquez and López (2007) show that in Chile, where the lion share of agricultural output comes from medium and large commercial farms, agriculture is still more pro-poor than other sectors of the economy, and that this poverty to agricultural growth elasticity is mostly explained (90%) by the effect of agriculture on unskilled labor markets.

## **VI.- Agriculture and Rural Development**

To what extent do rural development and agricultural development coincide? In other words, in which case is a sectoral (agricultural) driver to rural growth indispensable? To answer this question we need to have an idea of the importance of agriculture within the rural world. There is no direct measurement to uncover the importance of agriculture within the rural economy, but we will show alternative roads which indirectly point to that measure.

Agriculture is an important component of most rural economies especially in the developing countries. It was shown above that the size of agriculture within the local economy is sometimes used to define rurality. Therefore, any successful rural development strategy will contain an agricultural development component; but they are not the same thing. While agricultural development aims at improving the welfare of populations through sustained improvements in the productivity of the agricultural sector, rural development aims at the improvement of welfare of rural populations through the sustained growth of the rural

economy, which includes agriculture, but may not be its only component and not necessarily the most dynamic.

Ideally, if we wanted to know the importance of agriculture within a rural area, we would look at the GDP or output figure for that region, and measure the share of agricultural output within the total value added of the region. Unfortunately only few countries have aggregate output figures available by region (state or province), and even at this regional level, output is aggregated for both rural and urban areas.

We show above that the importance of agriculture within the national economy declines with development, but this does not necessarily mean that the relative importance of agriculture in the rural economy also falls with development (given that rurality also falls with development). Poorer countries, with lower per capita income, and with higher incidence of poverty, not only are more rural, but in their economies agriculture has a higher relative weight. Thus, the poorer the economy, the more important agriculture is for its rural and overall development.

Another road to measure the value of agriculture in the rural economy is to examine the share of income from agriculture to total rural income. This can be done, thanks to household surveys that measure income, most of them implemented in developing countries since the 1950's to understand poverty. Unfortunately, the way researchers have measured rural agricultural income *vis-à-vis* non-agricultural income (also known as rural non-farm income) has varied too much. Examples of these conceptual inconsistencies are: to add remittances (which in countries like Pakistan and in Central America can amount to more than 5% and even 10% of household incomes) to rural non-farm income, when remittances are not *rural* (sometimes not even national) income. Other inconsistencies arise with income from wages of agricultural labor. Some authors add wages accrued in farms outside their own to non-farm income, when it is clear that this is agricultural income. Further problems arise when wage income due to the absence of information can not be assigned to any particular sector, in these cases all of wage income can be added to either the farm or non-farm sector<sup>18</sup>. Some authors even add food sales to non farm income. Then there are gray areas, like the way in which to

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<sup>18</sup> In the dataset we present below we tried to deal with this inconsistency. When the data disaggregation permitted it, we assigned a share of wage labor income, equivalent to the share of agricultural income in household income excluding wage labor income, to the measure of agricultural income we used.

value own agricultural consumption; or income from fishing and forestry that could be added to either farm or non-farm income. These conceptual differences and inconsistencies highlight the need for comparable measures of agricultural and non-agricultural rural income to make further meaningful cross-country comparisons and studies<sup>19</sup>.

However, for our purpose of uncovering any links between rural agricultural income and development, these measures, alas inconsistent, will be helpful. For this study we have collected share of agriculture in rural income for 120 country-year combinations. Three country-year combinations are repeated with different figures, but we keep all the information as we are in no condition to discriminate the inaccurate information. The main sources are: FAO (1998), and Lanjouw and Feder (2001), who made comparable recollections of rural non-farm income shares, and our own collection from more than 30 monographs, mostly from rural household survey studies. This database contains information from four continents and it spans the period 1950 to 2002. Table 6 summarizes the average share of agricultural income in total rural income by continent.

**Table 6. Share of Income from Agriculture in Total Rural Household Income by Continent.**

	<b>Share of Agricultural Income (%)</b>	<b>Observations</b>	<b>Coefficient of Variability</b>
<b>Complete Sample</b>			
Africa	63	32	0.22
Asia	68	66	0.23
Europe	50	1	0.00
Latin America	53	21	0.27
Total	64	120	0.25
<b>Only Observations from 1990 onwards</b>			
Africa	63	12	0.21
Asia	62	14	0.17
Europe	50	1	0.00
Latin America	56	18	0.20
Total	60	45	0.20

This dataset by no mean should be considered a representative sample, because this sample, except for Japan, contains only developing nations (and one transition economy, Poland). Furthermore, some countries have better information and are over-represented; this is the case

<sup>19</sup> An attempt at internationally comparable income shares is currently being undertaken by the RIGA project, see [www.fao.org/es/esa/riga/](http://www.fao.org/es/esa/riga/).

for example of India and Pakistan in Asia, and Mexico in Latin America. However, Table 6 should give us some idea of differences by continent. Perhaps a more meaningful sample is obtained by including only the more recent observations, from 1990 onwards, where we can see that both in Africa and in Asia, agriculture accounts for more the 3/5 of total rural income, while in Latin America, agriculture accounts for 56% of rural income.

Table 7 explores the existence of an empirical regularity between level of development and the relative size of agriculture in the rural economy. The Table shows that, as per capita GDP increases, the share of agricultural income in total rural income tends to fall, although at middle income level (medium for the sample) the share seems to be relatively stable. Per capita GDP may be a good indicator of overall development for a country, but not necessarily an equally good indicator of rural development. We propose as a better indicator of rural development an alternative measure of income: agricultural GDP per rural inhabitant. Obviously both income measures are highly correlated (correlation coefficient of 0.93 in our sample), but the proposed income indicator has the correct denominator (rural population) and its numerator is very likely highly correlated with the ideal one (i.e. rural GDP). The lower panel of the table shows that when the share of agricultural income in total rural income is ordered by agricultural GDP per rural inhabitant categories, there is clearly a diminishing trend for the share as income increases.

**Table 7. Share of Income from Agriculture in Total Rural Household Income by Income Categories.**

	Mean Income	Share of Agricultural Income (%)	Observations	Coefficient of Variability
<b>PPP Per Capita GDP in US\$ (2000)</b>				
Les than 250	200	72	29	0.23
Between 250 and 450	328	66	26	0.16
Between 450 and 800	635	62	13	0.20
Between 800 and 2,000	1210	62	21	0.22
More than 2,000	7939	49	22	0.28
Total	2006	63	111	0.25
<b>Agricultural GDP per Rural Person in US\$ (2000)</b>				
Les than 100	81	71	20	0.23
Between 100 and 200	134	66	46	0.20
Between 200 and 300	251	64	16	0.21
Between 300 and 500	364	56	6	0.09
More than 500	1556	51	23	0.33
Total	448	63	111	0.25

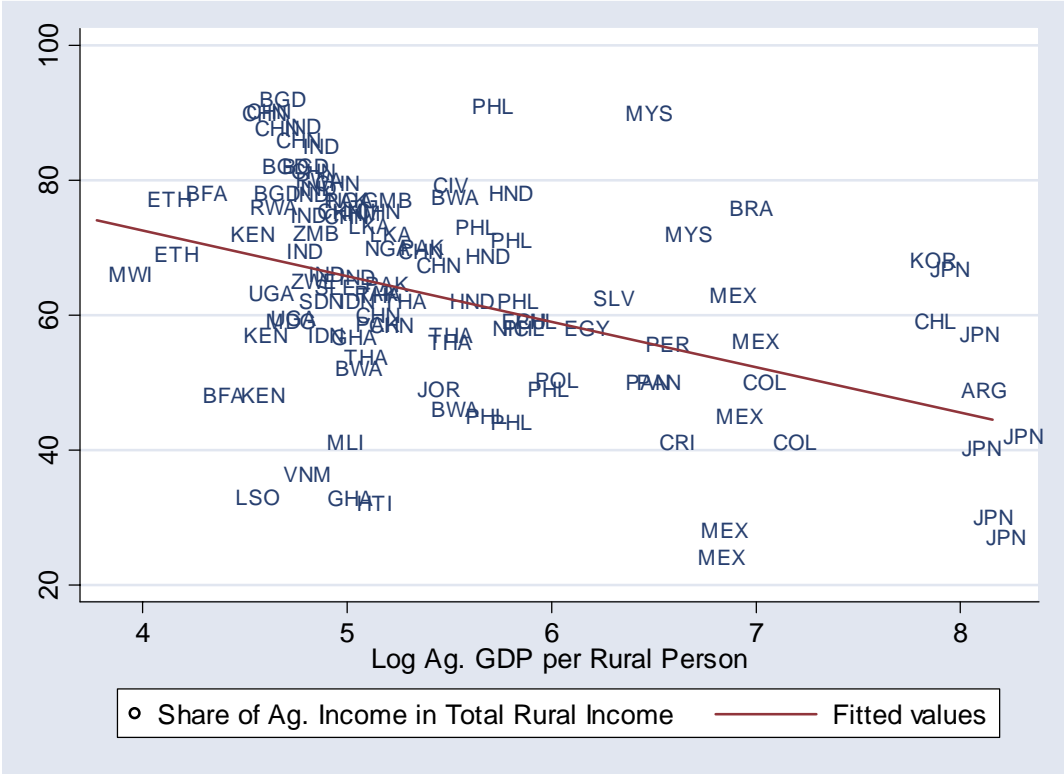
Table 8 reports the results of a basic regression analysis relating agricultural income share with income levels (both GDP per capita and agricultural GDP per rural inhabitant). The second regression, which uses our preferred indicator of rural development is plotted in Figure 4. The results confirm that more developed rural economies have a lower share of agricultural income in total rural income<sup>20</sup>. This relationship is statistically significant, and the estimated elasticity indicates that a 1% growth in rural per capita agricultural income reduces the share of agriculture in total rural income by about 0.12%. Also, the differences in income (development stage) explain one fifth of the variability of the share of agricultural income in total rural income, which is a good fit considering the possible inconsistencies in the measurement of agricultural income; and that geographic, agroecological and climatological differences probably explain a lot of the observed variability. Figure 4 also exposes the weakness of our database, as it shows countries like Mexico with different observations at relatively equivalent income levels with shares that vary widely.

**Table 8. Share of Agricultural Income in Total Rural Income**

Explanatory Variable			Explanatory Variable		
Constant	133.7	(12.26)	Constant	99.6	(7.13)
Log PPP GDP per Capita	-9.31	(1.57)	Log Ag. GDP per Rural Person	-6.76	(1.29)
Std. error of regression = 13.12 Adj. R <sup>2</sup> = 0.27 Observations = 91 Implicit Elasticity = -0.17 (0.03)			Std. error of regression = 14.05 Adj. R <sup>2</sup> = 0.19 Observations = 111 Implicit Elasticity = -0.12 (0.02)		

<sup>20</sup> This general result is corroborated with a smaller, but consistent sample by Davis et al. (2007).

**Figure 4. Share of Agricultural Income in Total Income and Agricultural GDP per Rural Inhabitant**



The negative relationship between rural development and the share of agricultural income can also be confirmed by examining time series data for particular countries. In Japan for example the share of agricultural income in rural income dropped from 82% in 1950 to 30% in 1980; a similar drop can be observed in India, 92% to 62% in the period 1958-1994; and in China from 90% to 67% in the period 1980-1997. In Bangladesh the share of agricultural income in rural income actually went up in the period 1963-1982 from 82% to 92%, but real income also dropped in this Asian country during this same period (agricultural GDP per rural person fell from 103 to 91 US\$).

Thus, the cross country as well as the time series data indicate that a feature of *rural development* is that the share of agriculture in rural income falls with development. Nonetheless, as Table 6 indicates, agriculture is the main source of income for rural households, responsible for more than three fifths of total rural incomes.

## VII.- Spatial Constraints to the Promotion of the Non-Farm Economy

As we have established that a feature of rural development is a relative increase of the non-farm economy, it is important to characterize the sector. In general, in the rural space we find activities that require proximity to the point of extraction or production: primary activities like agriculture, fishing, forestry and mining; industry that may benefit from proximity to the sources of raw material like food (including fisheries products) and other processing (fuels, timber, and metals); and services that need proximity to the resource like eco- and agro-tourism. In less developed countries scant evidence indicates that most non-farm activities (i.e. non primary) are closely linked to agriculture and cluster regionally in small and medium-sized towns (Haggblade et. al (2002)). Davis et al. (2007) find similar evidence, as they show that proximity to infrastructure is robustly correlated with higher non-farm income in a cross section of developing countries.

The realization that non-farm activities enjoy economies of agglomeration and tends to cluster throughout the rural space has motivated the promotion of rural development strategies that promote the non-farm sector but with regional focuses. One early such strategy was the clusters promotion, which focused on the development of regions specialized in one industry or non-farm sector (i.e. wine industry or steel industry cluster)<sup>21</sup>. More recently, the territorial approach to rural development has proposed a more integral approach by seeking the promotion of both agricultural and non-agricultural activities jointly at a regional level (de Janvry and Sadoulet (2007)). Both strategies presume the existence of rural-scale agglomerations that make viable the promotion of a particular non-farm sector (see also Winters (2004)).

A successful territorial approach strategy requires the existence of the agglomerations and/or infrastructure which will facilitate the reaping of benefits from economies of agglomerations and scale. In Figure 5 we present the spatial distribution of different countries in Sub-Saharan Africa, using the previously described GRUMP-CIESIN database. In panel A we see the spatial distribution of population in South Africa. In this country there is a smooth gradient of population densities, implying that people live in areas of different densities, from large cities like Johannesburg and Cape Town to sparsely populated rural areas. In the rural space we have the presence of large medium and small towns. Therefore in South Africa development

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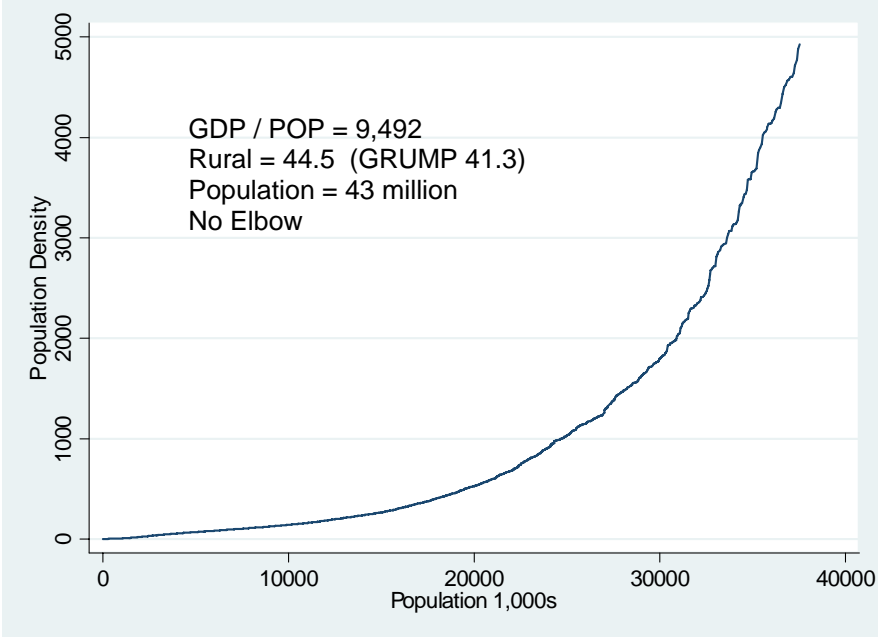
<sup>21</sup> See Perroux (1950) for early theories, and Porter (2000) for a current treatment of the theory of clusters.

projects that anchor in large rural towns have the potential to transmit to smaller town and to less populated areas.

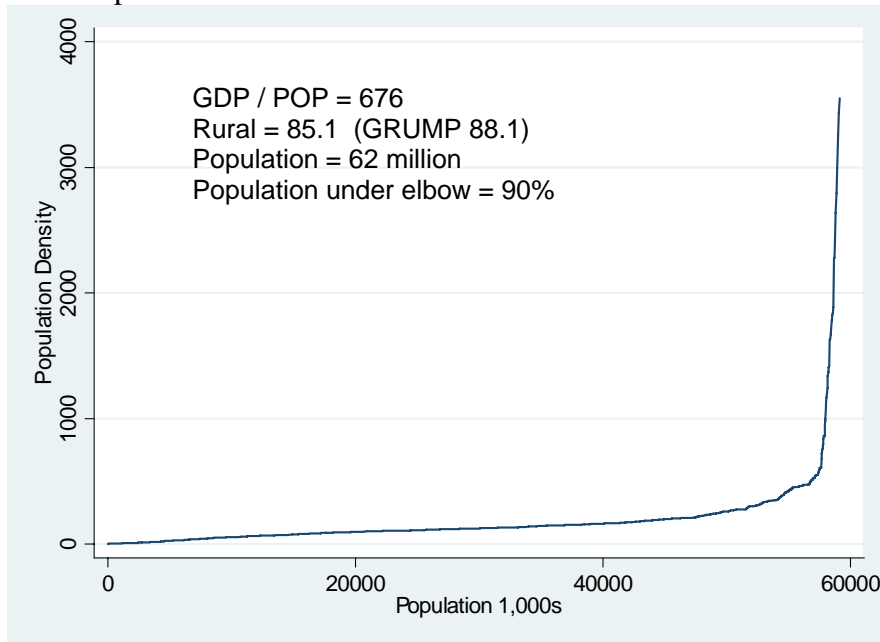
However, in panels B and C we show the reality of an East and a West African country, which is the opposite to what we observe in South Africa. Both in Ethiopia and Côte d'Ivoire there is no smooth gradient. Population densities grow smoothly only up to what we call an “elbow”, or point of non-differentiability. This break signals a duality: people live either on very high density areas like Abidjan in Côte d'Ivoire or in a scarcely populated rural space. In fact, in Ethiopia, roughly 60% of the population lives in areas with densities under 150 persons/km<sup>2</sup>, in Côte d'Ivoire roughly 3 out of 4 Ivoirians live in such low density areas.

**Figure 5. Population Distribution**

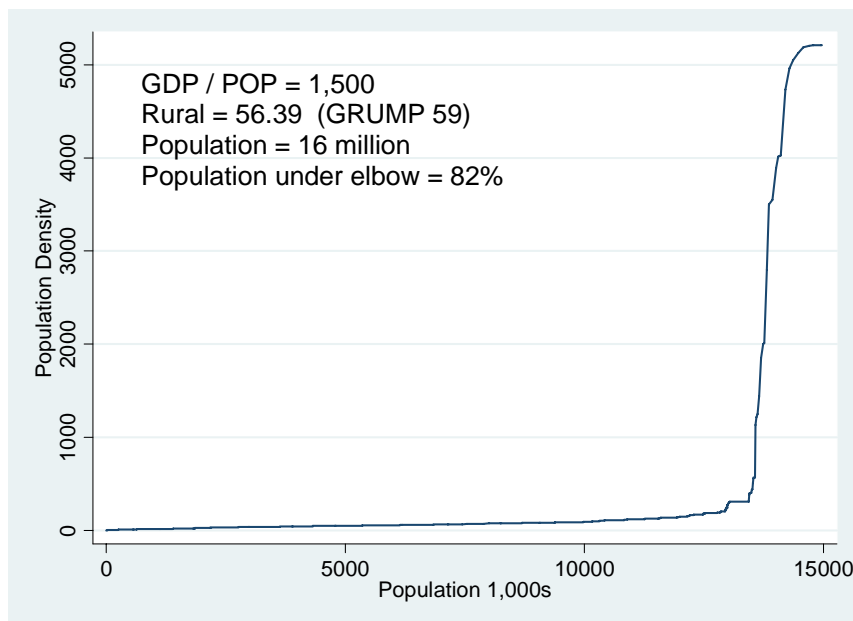
A. South Africa



## B. Ethiopia



## C. Côte d'Ivoire



In this latter spatial context it is hard to argue in favor of a territorial strategy. Not only are densities very low, but they are *de facto* compounded by a very poor standing communications infrastructure. In these contexts a sectoral, agricultural based rural development strategy is still the necessary first step.

### **VIII.- Conclusions and Some Policy Implications.**

The last few years have seen an increased attention of the international development community on agriculture and rural development. If the data for the last 3 years constitute a real trend then we are witnessing a real increase in official development assistance to agriculture and rural development. The emergence of private donors and foundations (such as the Gates foundation) with keen interest in transferring resources to agriculture is a welcome development. Major multilateral donors (such as the World Bank) are looking at agriculture as an engine for poverty reduction for most developing countries and regions and a fundamental component of a growth and poverty reduction strategy for the poorest, agriculture based economies<sup>22</sup>. There seems to be increased interest by domestic and foreign private capital (including multinational agro-industrial firms) in investments in sectors up and downstream of production agriculture. The potential of agriculture as a source of bio-energy promises to attract further attention to the sector.

The present paper provides analytical evidence and arguments in support of the proposition that agriculture and the rural economy are fundamental for obtaining substantive and sustainable gains in the fight against poverty. Even using the existing, highly imperfect measures of “rurality” (which very likely underestimate the economic importance and dimensions of the rural space and the extent of rural poverty) poverty is intrinsically linked to rurality. What the evidence shows is that even when population movements and demographics reduce the share of the rural in total developing country population, poverty will still be a predominantly rural phenomenon. The experience of Latin America ( the most urbanized of the developing regions) is instructive in this regard: even in countries where the number of rural poor are less than the number of urban poor, the poverty rate is nevertheless higher in the rural areas.

The paper also shows that the analytical underpinnings of a development strategy with a strong anti-agricultural bias do not hold in light of new data and evidence. Agriculture has strong links with other sectors in many countries, and a productivity-induced agricultural expansion can “pull” other sectors with it, and increase economic activity and employment opportunities in the rural areas. The paper also shows that, while a regional or spatial approach to the development of the rural economy is a reasonable proposition for countries

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<sup>22</sup> In this context, it is instructive to see that the forthcoming 2008 World Development Report is on “Agriculture and Development”

with good infrastructure and functioning labor and other markets, there is substantial scope for a sectoral (agricultural) entry point for rural and possibly overall development and poverty reduction. This proposition is further corroborated by the results of Davis et al. (2007), who show that despite income diversification by rural households, households in the lowest expenditure categories have a larger share of agricultural in their total income than households in higher income groups.

The balance of entry points for rural development and poverty reduction is bound to change, as food systems change both globally and, especially, in developing countries. However, such a change hides both opportunities and threats. First, the role of agriculture in the structure of the economy will decline in the process of development. However, the data on the agricultural transformation shows that the labor share of agriculture declines much slower than the share of agriculture in national GDP. Unless policies and investments are put in place to foster agricultural productivity, there is a danger that the decline of agriculture will be accompanied by increased rural poverty, some of which will find its way into the urban areas. At the same time, policies and programs which increase the human capital of the rural poor and allow them to enter more remunerative labor markets are powerful tools to ensure a smooth transition of people out of agriculture without increasing poverty.

At the same time a transformation of the agricultural sector itself is underway. Growing per capita incomes have increased, and will increase further the demand for high value food products and for the quality and safety characteristics of foods. Such shifts in demand are reflected in the structure of the food systems even in some of the poorest developing countries towards the spread of the modern food chains and consolidation of the production, distribution and retail segments of food markets. The role of the more traditional “chain” will shrink overtime. Therefore, while increasing productivity for food staples oriented agriculture will still be an important anti-poverty entry point for many poor areas in the world, the high requirements in terms of skills and capital by the “new agriculture” point to the need for increased access to modern technologies (research and extension systems) which promote the higher quality and safety standards demanded by consumers.

Will trends towards (domestic) market integration, and globalization affect the strength of the links between primary agriculture and up-stream and down-stream sectors? On one hand, market integration will sever the links between agriculture and the local economy, but will

open new links to larger markets (regional, national or even global). Opening the agricultural sector to foreign but also domestic competition will challenge the position of smallholders in national markets. The non-farm rural economy will also be subjected to competition pressures from cheaper consumer goods distributed by supermarkets and similar retail outlets as they expand to the rural areas of developing countries. Small scale and artisanal food processing may give way to more organized, capital intensive processing plants, and a similar scenario may be thought for other activities up or down-stream primary agriculture (such as transport or input processing, etc.). The speed and extent to which these changes will occur will vary by context as will the net effects on employment etc. (Reardon et al. (2007), Stamoulis et al. (2004)). In such cases, even if the “inverse” relationship between size and productivity were to hold in primary production (commodity production), especially of staples, larger farmers will more than likely have an advantage in producing what will be increasingly demanded: high value products requiring capital intensive technologies and human and managerial capital.

However, the future of smallholders and rural livelihoods is not without opportunities: access to larger markets and higher value alternatives will also be available for those who innovate and are able to take up opportunities presented by the changing system. Public policy will have a significant role to play in this context. In addition to providing the “traditional” public goods it also needs to provide assistance to farmers in dealing with new product requirements, and creating the proper institutional and regulatory framework to enable smallholders to organize so as to exploit available economies of scale and promote competition.

## Appendix I. Additional Linkages Regressions

	<b>Forward Linkages / Agricultural GDP (%)</b>		<b>Backward Linkages / Agricultural GDP (%)</b>	
PPP Per Capita GDP	3.32	(1.235)	4.05	(1.780)
Constant	20.81	(5.726)	22.26	(8.704)
R2	25.4		12.5	
Std. Error of the Regression	18.07		33.99	
Observations	27		27	

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