4. Livestock sector development, economic growth and poverty reduction

Chapter 2 presented an overview of the distribution of poverty across the six main regions of the developing world; trends in the livestock sector's contribution to agricultural value added in these regions; and projections suggesting strong emergent demand for ASFs, particularly in low-income countries, due to growing populations and rising per capita incomes. Meeting this growing demand through expansion of the rural livestock sector could help launch a self-sustaining process of economic growth and more balanced development. Chapter 3 analysed livestock's role in the rural economy, linking increased incomes from poor households' livestock-related economic activities to increased food and non-food expenditures. As ASFs have relatively high income elasticities of demand, livestock are particularly attractive as a means for rural households to participate in urban-based and overall economic growth. This chapter pursues this link between livestock sector development and economic growth by reviewing the concept of pro-poor growth and how the rural and agriculture sector in general, and the livestock sector in particular can be a catalyst for pro-poor growth in developing countries.

The chapter first surveys the theoretical and empirical literature linking economic growth and poverty reduction. This is followed by a more detailed examination of the role of agriculture in general and livestock in particular, tracing their linkages from low-income rural populations to the rest of the economy via agrifood supply chains. The chapter finishes by presenting empirical estimates of the multiplier effects of agrifood and livestock demand and productivity growth. These results reveal how promotion of the agrifood and livestock sectors can be a potent catalyst for growth and poverty reduction.

ECONOMIC GROWTH AND POVERTY REDUCTION

Much recent economic literature has focused on the relationships between economic growth and poverty reduction in developing countries, and most economists and policy-makers would agree that economic growth reduces poverty. The strongest assertion on this relationship was made by Dollar and Kraay (2002), whose controversial study suggested that the average incomes of the poorest quintile of a country, on average, rise or fall at the same rate as the overall average income. This conclusion arises from the strong empirical regularity of this phenomenon (the elasticity of the mean income of the lowest quintile to the national average income being 1) in a large sample of 92 countries over the past four decades. The same study also examined a number of policy-related factors thought to have direct effects on the incomes of the poor through their effect on income distribution (e.g., years of primary education, social spending, agricultural productivity, and formal democratic institutions), but found little evidence of such effects. The

controversies generated by the study revolved around the questions of whether or not economic growth was a sufficient condition for poverty reduction; income (re)distribution was important; and changes in income distribution would naturally follow the inverted U-shaped behaviour suggested by the Kuznets Hypothesis[15] as economic growth in developing countries progressed.

Since the 1980s, more advanced and detailed econometric studies have been made possible by the proliferation of Living Standard Measurement Survey datasets for developing countries, allowing the observation and monitoring of changes in household incomes, poverty indices and income distribution. Adams (2004), for example, analysed two sets of relationships: that between economic growth (increasing per capita income) and poverty reduction (measured by the headcount index of $1.08/person/day); and that between economic growth and income distribution (changes in the Gini coefficient), using the 2001 World Bank Global Poverty Monitoring database of 60 developing countries and 126 data intervals spanning the 1980s and 1990s. The first analysis confirmed that, on average, there is a significant inverse relationship between economic growth and poverty incidence. However, estimation of the second relationship did not confirm the Kuznets Hypothesis of an inverted U-curve behaviour of income inequality. With respect to the first result, the significance of the "on average" qualification can be seen from the summary of findings on growth and poverty reduction in the sample used, shown in Figure 4.1.

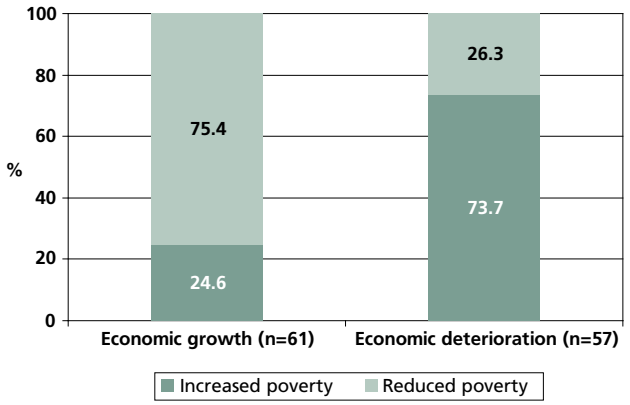
In general, poverty declined with economic growth (in 75 percent of cases) and rose with economic deterioration (in 74 percent). However, in 15 of the 61 instances (25 percent) where economic growth occurred, the features of that growth were such that poverty incidence was not reduced, i.e., economic growth was not a sufficient condition for poverty reduction. Conversely, poverty fell in 15 out of 57 observed time periods, despite overall economic deterioration.

Ravallion (2007) investigated the relationships among economic growth, changes in income distribution and poverty reduction further, using data from the World Bank's PovcalNet and World Development Indicators, representing 80 countries and 290 observations between two successive household surveys for each country, and spanning the period from about 1980 to the early 2000s. Over this period, the investigation found little or no correlation between changes in the distribution of income and rates of economic growth. As growth occurred, the proportion of cases in which inequality fell was about the same as the proportion of cases in which it rose. In general, across countries, it appeared that growth tended on average to be roughly distribution-neutral. However, the author cautions against drawing hasty policy conclusions from this finding, which merely revealed that *on average*, during the process of growth over the observed period, there was very little effective redistribution in favour of either the poor or the non-poor. This should not be interpreted as suggesting that distribution outcomes are unimportant for the poor, or that policy-makers in developing countries should focus on economic growth alone.

In most cases, the distribution-neutral feature of growth over the last two decades

[15] This hypothesis refers to the claim from pioneering work by Simon Kuznets, who – using cross-section data of different countries – concluded that as the economy grows, income distribution initially tends to worsen (the Gini coefficient increases) but, beyond an intermediate level of income, it improves with further economic growth.

FIGURE 4.1
Economic growth and poverty reduction in developing countries, 1980s to 1990s (n=118)



Source: Adams, 2004.

provides insight into the findings of many empirical studies that poverty indices tend to fall with growth. As variation in initial inequality among countries is accounted for, the different rates of poverty reduction for the same rate of growth can be more clearly understood. While inequality does not generally disturb the inverse relationship between growth and absolute poverty measures, it affects the strength with which a given rate of growth reduces poverty. Intuitively, growth without effective redistribution policies tends to be distribution-neutral, and the greater the inequality at the outset, the less the poor will gain from the growth, largely because they initially own a smaller share of the initial "pie". Ravallion (2007) posits the following conceptual relationship between growth and poverty reduction:

(1) Rate of change in poverty ($\dot{r}$) = *Growth elasticity of poverty* (ε) x *Growth rate* ($\hat{g}$)

where *growth elasticity of poverty* (ε) is the proportionate change in the measure of poverty arising from a given rate of economic growth, and in general has a negative sign.

Ravallion further asserts that the rate of poverty reduction is directly proportional to the "distribution-corrected rate of growth". He then refines the basic model (equation 1) to try to capture the impact of income inequality on the responsiveness of poverty rates to aggregate income growth. A simple empirical model that fits well with the relevant developing country data is given by:

$$(2)\ \dot{r} = [k\ x\ (1\text{-}Gini)^{\theta}]\ x\ \hat{g}$$

where $k < 0$ is a constant of proportionality, *Gini* is a standard index of (initial) income inequality, and $\theta \geq 1$ is a parameter that captures the strength of inequality's influence on the relationship between growth and poverty. As the Gini ratio increases towards unity (rising inequality), the entire term in brackets (the growth elasticity of poverty), ε, becomes

smaller (approaching zero), thereby attenuating the effect of growth on poverty reduction.

Calculating the growth elasticities of poverty across 90 developing countries, and relating these to their initial Gini ratios, Ravallion (2007) obtained quite clear results for changes in the poverty headcount index (using the $1/day poverty line) achieved in different situations. The correlation coefficient was 0.26, significant at the 1 percent level. The line of best fit traces a path where growth elasticity reaches its highest average absolute value (ε = -4) at low levels of inequality (Gini ≤ 0.20), and passes through zero at a Gini index of 0.60. Proceeding further, Ravallion estimated values for the two parameters of the empirical model (equation 2) and obtained k = -6.07, and θ = 2. Table 4.1 shows the impact that the initial inequality and poverty conditions have on the poverty headcount index's responsiveness to growth. Demonstrating how the initial level of inequality influences the poverty reduction's responsiveness to growth, he focused on two country cases, starting with the same poverty headcount of 40 percent and growing at the same rate of 2 percent per annum. The only difference between the two cases was their initial degree of inequality.

Differences in the initial level of inequality result in quite disparate outcomes. In the low-inequality country, poverty reduction is three times more responsive to the same rate of growth (ε = -2.97) than it is in the high-inequality country (ε = -0.97). At an average annual growth rate of 2 percent, poverty falls by nearly 6 percent per year in the low-inequality country and by less than 2 percent in the high-inequality country. At these rates of poverty reduction, it would take 35 years to halve the poverty headcount to 20 percent in the high-inequality country and only 11 years in the low-inequality country. Thus, in low-inequality countries, even modest rates of growth would result in relatively rapid poverty reduction.

This work reveals that while growth may contribute to poverty reduction, initial conditions of inequality strongly influence the pace of improvements in living standards of the poor. For this reason, a purely macroeconomic focus is likely to miss many opportunities that might arise from closer attention to the detailed determinants of livelihoods and income inequality. Simply put, aggregate growth is too blunt a policy instrument for effective poverty reduction. Instead, growth needs to be targeted and coupled with improvements in the distribution of incomes, so that the poor benefit disproportionally from the growth.

Table 4.1
RESPONSIVENESS OF THE POVERTY HEADCOUNT INDEX TO GROWTH, BY INITIAL INEQUALITY AND POVERTY CONDITIONS

Initial state	Gini ratio	Annual growth rate *(%)*	Initial poverty headcount *(%)*	Total growth elasticity	Annual rate of poverty reduction *(%)*	Time to halve headcount index *(years)*
Low inequality	0.3	2	40	-2.97	-5.95	11
High inequality	0.6	2	40	-0.97	-1.94	35

Source: Adapted from Ravallion, 2007.

Credit: ©FAO/Giulio Napolitano

AGRICULTURE, RURAL DEVELOPMENT AND PRO-POOR GROWTH

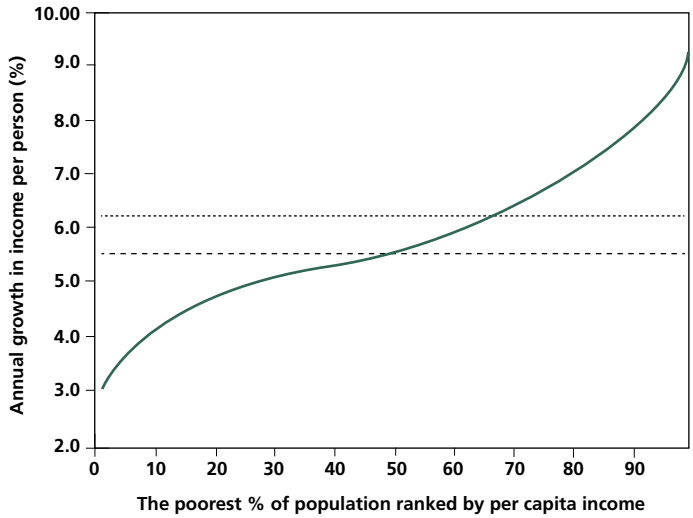
Given the need for focused development policies that propagate the benefits of economic growth more widely, it is necessary to take the circumstances of the poor into greater account, particularly those of the rural poor majorities in developing countries. For some authors, any growth that leads to poverty reduction is pro-poor. For others, growth is pro-poor only if it results in a disproportionate increase in incomes for the poor, i.e., it leads to declining inequality. Klasen (2007) goes beyond theoretical conceptualizations and argues that from a policy perspective, it is useful to define *pro-poor growth* as growth that maximizes income gains for the poor and thus accelerates progress towards meeting MDG 1. Although high overall economic growth can also bring about high income growth for the poor, such income growth will be even higher if the overall economic growth is accompanied by a reduction in inequality, allowing the poor a greater share in growth.

Ravallion and Chen (2003) construct *growth incidence curves* (GICs)[16] across income strata in various developing countries, using the example of China in the 1990s. Here, although rapid overall economic growth was accompanied by increasing real incomes for the poor, the incomes of higher-income groups rose at a much faster rate, widening the income disparities. The resulting GIC for China is shown in Figure 4.2. While the economy was growing at about 6.2 percent per year, the mean income of the poorest 20 percent was increasing at only about 4 percent, while that of the richest 10 percent grew more rapidly than the average growth rate.

This inequitable (inequality-increasing) growth in China from 1990 to 1999 did not represent a natural phase of inequality rising with growth, in accordance with the Kuznets Hypothesis. For the sub-period 1993 to 1996, China experienced income growth averaging 8.2 percent per annum, while income inequality decreased. The income growth of the poorest

[16] The GIC gives the rate of income growth in each percentile of the income distribution, ranked by income per person.

FIGURE 4.2
Growth incidence curve for China, 1990 to 1999



Source: Ravallion and Chen, 2003.

decile averaged 10 percent per annum, which was higher than the overall mean, indicating a pro-poor distributional shift. This distributional shift can be traced to a sharp reduction in the taxation of farmers in the mid-1990s. In China since 1980, periods of more rapid growth saw declining inequality, the fastest growth periods for agriculture did not coincide with periods of slower growth in the primary and tertiary sectors, and the provinces with more rapid rural income growth experienced steeper reductions in inequality (Ravallion, 2007).

A recurring theme in the literature of pro-poor growth is the significance of expansion in the agriculture and rural sector for achieving not only increased aggregate growth but also a growth process that is more inclusive of the poor. As mentioned earlier, even with the slowly changing profile of rural and urban poverty in the world, in 2002 – using the $1/day poverty line – the rural share of the poor remained 75.8 percent of the total, and the rural poverty headcount index (29.3 percent) was more than double its urban counterpart (12.8 percent) (Chen and Ravallion, 2007).

The majority of the rural poor in developing countries rely primarily on agriculture for their livelihoods; although the degree of this reliance varies among and within countries, agriculture remains the most important economic activity for the poor in both developing and emerging agrarian economies (World Bank, 2008). For economic growth to result in significant poverty reduction it must reach the poor, either by changing their economic activities or by linking existing activities to the growth process. Table 4.2 presents selected socio-demographic characteristics of developing countries, categorized into three groups according to the dominant structure of their economies: i) agrarian; ii) emerging; or iii) urbanized.

Table 4.2
SELECTED SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THREE CATEGORIES OF DEVELOPING COUNTRIES (PERCENTAGES)

Indicator	Agrarian economy	Emerging economy	Urbanized economy
Share of agricultural value added in GDP	29	13	6
Share of rural population	68	63	26
Share of agricultural workers in the labour force	65	57	18
Total poverty rate	49	22	8
Rural poverty rate	51	28	13
Urban poverty rate	45	11	6
Share of rural poor in total poor	70	80	46
Total population (millions)	615	3 510	965

Source: World Bank, 2008.

Focusing on only the share of agricultural value added in national GDP masks the magnitude of the potential contribution of agriculture-led growth to poverty reduction. While the share of agriculture in GDP tends to decline as economic development proceeds, this does not imply that faster economic growth and poverty reduction will be achieved by stimulating growth in the industrial and service sectors at the expense of agriculture. Several country studies in Asia and Africa have shown that GDP growth generated by growth in agriculture has stronger poverty reduction impacts than the same growth in non-agricultural activities, particularly in lower-income countries that are starting the process of economic growth and development. In India, for example, studies by the World Bank, based on analysis of a virtually unique set of data on poverty numbers across states and over time, show clearly that agricultural and rural growth reduce poverty drastically, while industrial and urban growth reduce it slightly or not at all (Ravallion and Datt, 1999). Examining longitudinal data from four middle-income Asian economies (Thailand, Indonesia, Malaysia and the Philippines), Warr (2002) found that while agricultural development reduced the incidence of poverty, industrial growth had the opposite effect. This observation also applied to Bangladesh (Woden, 1999) and was confirmed for Indonesia (Thorbecke and Jung, 1996). Cross-country analyses by Timmer (1997) and Bourguignon and Morrison (1998) yielded similar findings.

The underlying source of differential impacts between agricultural growth and non-agriculture-led growth is the large multiplier effect that growth in agriculture generates through its pervasive linkages to the rest of the economy, which are much stronger than those in most industrial and service sectors. On average, the inclusion of growth linkages nearly doubles the national income growth following an initial investment in agriculture, and agricultural investments are also found to generate the largest impact on the poor. For example, a comparison of eight African economies shows that agriculture-led growth strategies typically increase the incomes of the poor more than manufacturing-led growth does (Haggblade, Hazell and Reardon, 2005).

Such multiplier effects come from horizontal (consumption-oriented) and vertical (production or supply chain) linkages. The consumption linkages occur when agricultural

Table 4.3
AGRICULTURAL GROWTH LINKAGES IN ASIA, AFRICA AND LATIN AMERICA

Region	Initial agricultural income increment	Magnitude of additional income growth			Share of source of linkages *(%)*	
		Total	Rural non-farm	Other agriculture	Consumption (horizontal)	Production (vertical)
Asia	1.00	0.64	0.58	0.06	81	19
Africa	1.00	0.47	0.30	0.17	87	13
Latin America	1.00	0.26	0.21	0.05	42	58

Source: Haggblade, Hazell and Reardon, 2005.

households, which gain income from the initial growth in farm output, spend that additional income on mainly local goods and services. As illustrated in Chapter 2 (Table 2.12), in the less developed regions of sub-Saharan Africa, South Asia, and East and Southeast Asia, of an additional $1 of income (or expenditure), between 40 and 47 percent is spent on food (staples, ASFs, fish, fruits and vegetables, and other food items), with the rest going to (largely domestic) non-food goods and services. Economic activities respond to this increase in demand.

The production linkages that arise from the agriculture sector are amplified by downstream value creation, as distribution, processing and marketing activities refine the agricultural products and pass them on to consumers. By generating employment and income from additional economic activity, growth of the livestock sector stimulates forward and backward linkages, comprising demand for agricultural inputs and services. For Asia, Africa and Latin America, Haggblade, Hazell and Reardon (2005) generated estimates of the direct and indirect effects of agricultural growth on other sectors of the economy and on the economy as a whole, assigning the source of these impacts to consumption and production linkages respectively (Table 4.3).

The differences in the total additional income impacts of the initial agricultural income increment indicate how strongly other sectors of the economy are linked to agriculture. In Table 4.3, the linkages are strongest in Asia, and rather weak in Latin America. In Asia, $1 of initial agricultural income growth stimulates another $0.64 of income growth through its multiplier effects. In Africa, the equivalent figure is $0.47, and in Latin America it is a comparatively low $0.26, reflecting the high urbanization of most Latin American countries, with agriculture contributing a relatively small 6 percent of total GDP, while high inequalities exist in the agriculture sector. In all regions, the positive income impacts occur mainly in the rural non-farm sector, as opposed to in other agricultural activities, implying that rural services and other non-farm enterprises respond positively to the initial increase in agricultural income. This is because farm consumption in developing countries is primarily from own production, and cash expenditures are concentrated on local non-food goods and services. In both Asia and Africa, consumption expenditure linkages overwhelmingly dominate, but in Latin America, production linkages are slightly stronger.

The size of the poverty reduction impacts of agriculture-led growth in a developing economy is influenced by: i) the size of agriculture relative to the overall economy; ii) the

strength of the linkages between agriculture and the rest of the economy; iii) the use intensity of the factor with which poor households are primarily endowed – labour – in the growth sector; and iv) the consumption patterns of poor and non-poor households.

In agrarian economies, the agriculture sector's contribution to GDP is fairly large, at about 30 percent, as shown in Table 4.2. Thus, irrespective of the multiplier effects, the direct poverty reduction impacts of agricultural development are already significant. Conditions ii) and iii) in the previous paragraph are closely linked. If agricultural output growth is fuelled solely by intermediate inputs that make little use of domestic resources and/or are produced by capital-intensive industries, the effects on other sectors and households are likely to be small. Haggblade, Hazell and Reardon (2005) attribute the relatively small consumption multipliers in Latin America to the estate-led character of agriculture in that region. Condition iv) is also important, because if additional household incomes are spent on consumption goods and services that are supplied locally, or at least domestically, then growth in non-farm activities will be stimulated.

THE ROLE OF LIVESTOCK IN GENERATING AGRICULTURAL AND OVERALL ECONOMIC GROWTH

The livestock sector makes diverse contributions to rural livelihoods and to agriculture as a whole. Growth of livestock sector activity thereby stimulates growth of the overall economy, through direct income impacts on households engaged in livestock production and via a web of indirect horizontal and vertical multiplier linkages along expenditure and supply chains.

The strength of the income growth and poverty reduction impacts that are attributable to livestock sector development, on the agriculture sector and on the overall economy, depends on the factors listed in the previous section, but pertain more narrowly to livestock as a subsector of agrifood activities and the economy as a whole. Thus, in analogy to the list in the previous section, the size of the income and poverty reduction impacts of livestock sector growth depend on: i) the size of the livestock sector relative to agriculture and to the overall economy; ii) the strength and extent of the linkages between the livestock sector and the rest of the economy; iii) the use intensity of the factor that poor households are primarily endowed with (labour) in the livestock and linked growth sectors; and iv) the consumption patterns for meat, animal products and other allied food and non-food goods.

As seen in Chapter 2 (Table 2.8), in 2007 the average share of the livestock sector in agricultural GDP was about 35 percent, varying among country groupings from a low of 23 percent in low-income countries to highs in middle-income developing regions, such as 43 percent in Latin America and the Caribbean and 45 percent in Eastern Europe and Central Asia. While the stylized pattern is that the share of agricultural GDP in the overall economy tends to decline as countries move from lower- to middle-income status, the share of the livestock sector in agricultural GDP tends to increase. This pattern is consistent with the emergence and modernization of the agriculture sector. As countries move up the development ladder, although the relative importance of agriculture in the total economy may decline, the sectors with higher value added and producing goods with higher income elasticities, such as livestock, fruits and vegetables, expand as the formerly dominant staple goods contract in relative terms. Focusing on low-income countries, where poverty incidence and depth are highest, the importance of the livestock sector

as a catalyst for poverty reduction lies in its superior growth potential within agriculture and the rural economy.

The second factor that influences the size of the income and growth multiplier effects from the livestock sector relates to the strength of linkages between the livestock sector and the rest of the economy. Using the sample countries from the FAO-RIGA dataset, Chapter 3 suggested that purely subsistence households are rare, and that the vast majority of rural households engage in market activities, even though they also produce food (mainly staples) for home consumption. In seven of the 12 sample countries, farm households sold between 30 and 68 percent of their livestock produce, and the poorest households (bottom quintile) sold about the same proportion as their wealthier counterparts. This confirms the tight linkage between rural livestock producers and the local economy, to which they supply primary product to the first-level exchange point in the whole supply chain.

Chapter 2 showed that the impressive growth in demand for livestock products in developing countries is skewed towards more rapid demand growth in urban centres (than in rural areas) as urbanization progresses. Thus, from the first market exchange link for livestock products, in rural areas, the raw material will undergo product transformation and transport at various stages of processing and value addition along the supply chain, until it reaches the final consumers in urban centres. Along this chain, the consumption and production income multipliers will operate to propagate output, employment and income benefits across the economy. Livestock product processing tends to be very labour-intensive and mechanization is difficult and costly, leading to substantial employment opportunities. In Bangladesh, for example, where milk is processed into an array of high-value sweets, it has been estimated that some ten jobs are created for every 100 litres of milk marketed (Omore *et al.*, 2004). Similarly, manual poultry processing currently provides direct employment to nearly 5 000 workers in the main poultry market of Delhi (Gangwar, Saran and Kumar, 2010).

The third factor determining the size of the income multipliers of growth in the livestock sector is the use intensity of the factor that is the rural poor household's primary endowment: labour. Chapter 2 showed that globally, the highest densities of poor livestock keepers are found in mixed crop-livestock systems in South Asia and sub-Saharan Africa. In general, these are integrated smallholder systems where crop by-products and residues are the primary feed for livestock, and livestock are used as draught power in farm operations, livestock manure is used as fertilizer for crops, or both. Chapter 3 provided evidence that among rural households raising livestock, the transformation of crop by-products and residues into usable animal feed, and the use of farm animals as draught power in farming operations are undertaken mainly by household members using manual labour. When the farm is not self-sufficient in inputs, replacement stock and fodder are purchased from neighbouring households, while other locally sourced inputs are produced under labour-intensive technologies. In such systems, both the individual and the community value-added components and producer rates of return are relatively high.

In contrast, in the intensive landless livestock production systems used by corporate enterprises and commercial farming households in peri-urban areas, the main intermediate inputs to livestock production – growing stock, feed and other additives – are supplied by other commercial farms and formula feed suppliers. In these systems, there is very little value addition at the household level.

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The fourth factor influencing the size of the income multiplier effect is the consumption pattern for meat and milk, and its impact on the use of other food and non-food goods by poor and non-poor households. Chapter 2 showed that in the lower-income developing country regions of sub-Saharan Africa, South Asia, and East Asia and the Pacific, more than half (53 to 61 percent) of total expenditure is devoted to food. In contrast, households in high-income countries spend only about 13 percent of disposable income on food.

In these same lower-income regions, about 30 percent of the food budget is spent on staples (bread and cereals). However, income elasticities of demand for food overall are low (typically less than unity), while those for non-food items are relatively high (greater than unity). Given these elasticities and budget shares, as income increases, less than half of each additional $1 of new expenditure would be devoted to the purchase of food items. Within the food group, livestock and dairy products have higher income elasticities of demand than cereals and bread, and as total expenditure on food rises, the share of cereals and bread falls while about 20 to 25 percent of each additional $1 of food expenditure goes on meat and dairy products. Among the middle-income regions of Eastern Europe and Central Asia, Latin America and the Caribbean, and the Near East and North Africa, the proportion of additional expenditure devoted to meat and dairy products is even higher, at 30 to 35 percent of food expenditures.

The expenditure patterns in developing countries suggest that a large proportion of the additional income generated by growth in the rural livestock sector will continue to be spent on food products, among which livestock and dairy products will become increasingly important relative to staples in the household food budget. However, as higher levels of income are attained, the non-food component will also grow, in both absolute and relative (share of expenditure) terms. Within the food basket, the increasing importance of livestock generally and dairy products in particular represents a strong consumption linkage that reinforces the emerging agrifood demand that can be met by rural households.

Using a panel dataset assembled from the World Bank's World Development Indicators Database and FAO's Internal Statistical Database spanning the period from 1961 to 2003,

Pica, Pica-Ciamarra and Otte (2008) found a statistically significant causal relationship between livestock sector development and economic growth in 36 of the 66 countries analysed (almost 55 percent). Most of these countries were agrarian or emerging economies. Livestock sector development appeared to be an important driver of per capita GDP growth in 33 of the 36 countries in which a statistically significant relationship was found. In nine of them a bi-directional causality was also found. Increases in livestock sector productivity appeared to be driven by per capita GDP growth in only three countries.

To give a more precise idea of the income growth potential of livestock promotion, Table 4.4 presents impact estimates from two sources. The second and third columns present estimates of household income multipliers for livestock production and livestock product processing, across regions. These results are static estimates of expenditure chain effects derived from Social Accounting Matrices in the Global Trade Analysis Project (GTAP) database and are weighted by country GDP.

In general, the household income multipliers for both livestock and livestock products are higher in developing countries than in high-income countries. This demonstrates two robust characteristics of most developing countries: i) greater contributions of the livestock sector to household income; and ii) higher expenditure shares for agrifood products in lower-income countries.

Overall, the magnitudes of the multipliers of livestock production and of livestock product processing are quite similar, as both act on the demand side of the agrifood economy. Differences among regions and countries can be quite large, however, with the multipliers of livestock product processing being markedly higher than those of livestock production in the Near East and North Africa, and sub-Saharan Africa. The similar resource endowments and economic structures within regions, especially for traditional sector activities, are the primary cause of this. Comparing regions, the livestock and processing multipliers are largest for South Asia and sub-Saharan Africa – the regions with the highest poverty incidences – indicating substantial livelihood potential from livestock sector development. Nevertheless, even in the other regions, which tend to have higher per capita income and lower poverty rates, the livestock sector multipliers are substantial.

Building on analysis of detailed data from Senegal, Roland-Holst and Otte (2006) concluded that although lower-income rural households receive smaller absolute gains from the livestock value chain than higher-income groups, the relative benefits to lower-income households are greater. This strengthens the case for livestock as a pro-poor policy instrument, as the marginal effect of improving livestock supply conditions will disproportionately benefit the country's rural poor majority. Multiplier decomposition analysis revealed that the small absolute gain in livestock livelihoods for the poorest comes almost entirely from direct production income. Rural quintiles 1 and 2 obtain more than three-quarters of their livestock-related income directly from animal (product) sales, thus leaving the food value chain at the earliest stages. Higher-income rural households have less direct participation in livestock production.

Higher-income households receive the largest absolute multiplier benefit, which is almost entirely indirect, from food processing and retailing. These more complex downstream linkages to food value creation explain the higher aggregate income gains for this group and have important implications for the net results of subsector policies. As higher-income

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groups generally have more indirect linkages to the livestock sector, they may capture a large percentage of gains, even from policies targeted elsewhere (Roland-Holst and Otte, 2006).

The last two columns of Table 4.4 present the estimated impact on real GNI of targeted livestock sector development strategies, derived by using a dynamic computer-generated environment model to simulate the effects of 5 percent annual productivity growth in livestock production (third column) and in both livestock production and associated food processing (fourth column). The primary determinants of these impacts are similar to those of the multiplier results, i.e., livestock and ASFs as shares of domestic GDP and aggregate household expenditure respectively. The productivity experiments show the extents of developing countries' unrealized potential in the livestock sector. As documented in the original report (Roland-Holst and Otte, 2010), assuming 5 percent annual productivity growth over the next decade is not unreasonable, particularly for lower-income countries operating far below their sector output potential. Livestock sector development can clearly be a very potent catalyst for livelihood enhancement in West and East Africa, and South Asia, and concerted efforts in the agricultural and food processing sector will often yield synergies resulting in more than additive growth dividends.

Within an intersectoral framework, the sizes of household livestock sector multipliers presented in Table 4.4, although large, are only relevant if they are compared with the multipliers for other sectors of the economy. If the multipliers for other economic activities are larger than those of the livestock sector, there is little justification for promoting growth in the livestock sector because growth in other sectors will have stronger impacts on household incomes. Table 4.5 presents the ratios of the household multiplier of livestock production to the household multipliers of other (sub)sectors, such as crops, fruits and vegetables, manufacturing or services, across regions and economic groupings (country values are weighted by population). A ratio greater than unity indicates that the livestock sector multiplier is larger than that of the comparison sector. The computed estimates for the ratios of fruits and vegetables in two regions have been adjusted to exclude two countries that are obvious outliers: Malaysia in East Asia and the Pacific, and Nigeria in sub-Saharan Africa. The inclusion of these countries significantly inflates the weighted regional values and the overall value for developing countries.

Table 4.4
HOUSEHOLD MULTIPLIERS* AND IMPACTS OF INCREASED PRODUCTIVITY (5 PERCENT ANNUAL GROWTH OVER TEN YEARS) IN LIVESTOCK PRODUCTION AND PROCESSING ON TOTAL GNI, BY REGION

	Household multipliers		Aggregate GNI growth 2010–2020 (%)	
Region/country	Primary livestock production	Livestock product processing	Productivity growth in primary production	Productivity growth in production and processing
EAP	2.7	2.4	4.6	9.0
China	2.2	2.1	4.3	8.1
EECA	2.0	4.4	2.7	4.8
LAC	3.2	3.2	3.8	6.9
NENA	2.3	4.9	7.1	14.6
South Asia	4.7	4.3	6.9	14.3
India	4.7	4.4	6.2	13.4
SSA	2.9	5.4	8.3	18.9
West Africa	3.3	5.2	17.9	44.7
East Africa	4.3	6.8	17.6	43.3
Southern Africa	2.7	5.4	2.4	4.5
All regions	2.9	3.2	3.3	6.5
High-income countries	3.1	3.3	0.0	0.3

* Incremental effects of additional $1 spending on aggregate national household incomes.
Source: Authors' estimates from the GTAP database 2010.

Table 4.5
RATIOS OF HOUSEHOLD MULTIPLIER OF LIVESTOCK PRODUCTION TO HOUSEHOLD MULTIPLIERS OF OTHER SECTORS, BY REGION

Region/country	Crops	Fruits and vegetables	Manufacturing	Services
EAP	1.5	1.1	1.1	1.0
China	1.4	1.6	1.2	1.2
EECA	1.8	0.8	1.1	0.8
LAC	1.6	1.1	1.4	1.1
NENA	1.3	1.1	1.3	0.9
South Asia	1.3	1.1	1.6	1.5
India	1.3	1.1	1.6	1.6
SSA	1.8	1.4	1.5	1.1
All regions	1.5	1.2	1.4	1.3
High-income countries	1.4	0.9	1.4	0.9

Source: Authors' estimates from the GTAP database 2010.

Table 4.5 reveals that across all developing country regions and for all comparisons, the ratio is always close to or above unity, indicating that at the very least, the livestock sector is as strong as the other sectors in promoting household income growth. Across all developing country regions, the income multiplier for livestock production is about 50 percent higher than that of crops, and only marginally higher than that of fruits and vegetables. Compared with growth in manufacturing and services, livestock sector growth has 1.4 and 1.3 times the household multiplier effect, respectively. Within regions, there is substantial variation in the extent to which the livestock income multiplier exceeds those of comparison sectors, indicating variation in the degree to which these sectors are integrated into the rest of the national economy.

Diao and Nin Pratt's (2007) work on Ethiopia provides a country example of the comparative impacts that growth in various subsectors of agriculture has on growth of the national economy and on poverty reduction. As an agrarian economy, Ethiopia is characterized by a very high poverty incidence, a dominant proportion of the population (85 percent) living in rural areas, and agriculture as the main livelihood activity. Taking 2003 as a base year, poverty incidence at the national level was 44.4 percent. The study established that a business-as-usual scenario, in which agriculture sector growth is low, would bring sluggish growth in the whole economy and rising poverty incidence.

To identify the types of investment that have the largest impact on agricultural growth, and consequently result in more pervasive economic growth and poverty reduction, the authors used a disaggregated economy-wide model that allows analysis of growth and poverty reduction linkages involving the major subsectors in the agricultural economy. The four main agricultural subsectors – staple crops, livestock, traditional exportables (coffee), and non-traditional exportables (fruits, cotton, horticultural products, and others) – were evaluated to assess their contributions to economic growth and poverty reduction, by exogenously increasing the productivity growth rate of one sector while maintaining growth of the others at baseline levels. To allow comparisons among different subsectors, the exogenously determined rate of growth in each, independent of the others, should lead to a reasonable and comparable rate of growth in agricultural GDP up to 2015, in line with the MDG 1 target of halving the incidence of poverty by that year.

The staple crops subsector dominates the structure of agriculture in Ethiopia, representing 65 percent of value added, followed by the livestock subsector, which contributes about a quarter (26 percent). Combined, these two subsectors account for 91 percent of agricultural value added, while the other two each account for less than 5 percent. Obviously, if the productivity growth in all subsectors were identical, the larger ones would produce larger effects on agricultural GDP and overall economic growth and poverty reduction. On the other hand, smaller subsectors have greater capacity to grow rapidly, and the investment required to induce productivity growth would be smaller. Viewing the same relationships from another perspective, to achieve the agreed feasible target of 3.4 to 3.5 percent annual growth in agricultural GDP up to 2015, smaller subsectors need higher rates of productivity growth to achieve similar overall impacts, while productivity can grow more slowly in larger subsectors. In the simulations, the respective individual productivity growth rates above the baseline were determined to be 1.5 percent per annum for the staple crops subsector, 3.4 percent for livestock, 13 percent for each of the non-traditional crops, and 7 percent for coffee. The

Table 4.6
GROWTH AND POVERTY REDUCTION OUTCOMES OF DIFFERENT AGRICULTURE SECTOR GROWTH SCENARIOS

Indicator	Base year[a]	Staple crops only[b]	Livestock only[c]	Non-traditional exportables only[d]	Coffee only[e]
Agricultural GDP growth rate (%)	2.5	3.5	3.5	3.4	3.4
GDP growth rate (%)	3.1	3.9	3.9	3.6	.6
Poverty rate by 2015 (baseline = 44.4)	45.7	36.7	39.7	40.2	42.0
Change in poverty reduction over baseline by 2015	+1.3	-7.7	-4.7	-4.2	-2.4

[a] 2003.
[b] An additional 1.5 percent above baseline annual productivity growth rate in 2004 to 2010.
[c] An additional 3.4 percent above baseline annual productivity growth rate in 2004 to 2010.
[d] An additional 13 percent above baseline annual productivity growth rate in 2004 to 2010.
[e] An additional 7.0 percent above baseline annual productivity growth rate in 2004 to 2010.
Source: Diao and Nin Pratt, 2007.

respective impacts on overall economic growth and poverty reduction depend on not only the size of the subsector but also the extent and strength of linkages between the subsector and other subsectors in the economy.

Table 4.6 presents the findings of Diao and Nin Pratt (2007) on the impacts on economic growth and poverty reduction of growth in each of the subsectors.

The model results show that stagnant growth in the agriculture sector under the business-as-usual scenario would lead to rather slow growth of the entire economy, which in turn would result in a worsening of the incidence of poverty by 2015.

Comparing sources of growth, an additional productivity increase of 1.5 percent per year in the staple crops sector, although resulting in roughly the same agricultural GDP growth as growth in the other subsectors, generates the largest decline in poverty incidence. This stems from the structure of the staple crops economy in which small farmers engaged in the activity benefit directly from increased productivity. On the consumption side, staple crops are the most important source of food for both rural and urban poor households, and the poor spend about 70 percent of their total income on staple food crops.

In contrast, achieving economic growth through high productivity growth in the coffee subsector generates the lowest reduction in poverty. This reveals the weak consumption and production linkages between that subsector and the rest of the economy. The livestock sector is second to the staple crops subsector in terms of impact on poverty reduction, with a potential for reducing poverty incidence by 4.7 percentage points from the baseline. However, to take full advantage of the close linkages between the staple crops and livestock subsectors and the rural economy, combining productivity increases in both sectors would result in a large drop in rural poverty from 45.8 percent in 2003 to just 33 percent by 2015. Similar results were generated in comparable simulation studies for Uganda (Benin *et al*., 2008) and the Southern African region (Nin Pratt and Diao, 2006).

These examples demonstrate that even in a staple crop-dominated agriculture sector, the livestock subsector could work as a partner engine for growth and poverty reduction. As the agricultural economy develops, and average per capita incomes increase, staple crops will recede in relative importance within consumption patterns of the domestic economy. The stimulation of agricultural productivity growth should no longer be confined to staple crops and basic food security, but should expand to support a more diversified, higher-value-added agricultural economy (Timmer, 2005). With a larger livestock subsector, agriculture sector growth will make an even more pronounced contribution. As long as smallholders and the rural population are able to participate productively in the expanding industry – whether as direct producers, processors or participants/workers along supply chains for the main domestic markets – growth in the sector will also contribute to poverty reduction.

DISCUSSION AND CONCLUSIONS

There is general agreement that economic growth in developing countries is necessary for reducing poverty, however the importance of agricultural and rural growth in comparison with industrial and urban growth is often undervalued. Agriculture's declining share in GDP is universally noted, while its potential contribution to employment growth is often overlooked, because it is to a large extent indirect (Mellor, 2003).

While growth is necessary, it is not sufficient for achieving uniform poverty reduction across the diverse economies of the developing world. With different initial conditions and different policy packages, a given rate of growth can lead to either a rapid or a slow reduction in poverty. In a growing economy, a high degree of income inequality among households seriously constrains economic growth's ability to reduce poverty. For growth and development to be pro-poor, they must be inclusive by stimulating the economic activities and income opportunities of households living close to the poverty line. In developing countries, such households are mainly among rural populations and are engaged in agriculture and rural non-farm activities.

As a developing economy grows, the industrial and service sectors increase their shares of value added in GDP, while agriculture's share shrinks. It is tempting to conclude that stimulating the industrial and service sectors at the expense of agriculture is the way to accelerate poverty reduction. However, the evidence shows that except for in a few small island states, such a strategy will be of limited success unless large numbers of the rural poor migrate to urban areas. While such demographic transitions are under way in some places, and have occurred in Organisation for Economic Co-operation and Development (OECD) economies, they generally take generations and often lead to the unintended substitution of large-scale urban poverty for rural poverty.

On the other hand, stimulating growth in agriculture, and turning it into a dynamic sector through productivity improvements, has direct impacts on the income of today's rural poor farmers and non-farm enterprises alike, through intensive local consumption and production linkages. However, to reduce poverty significantly, agricultural growth needs to outpace population growth, and small farmers need to be at the centre of the growth process. Increasing the agricultural productivity of small farms would eventually lead to increased labour productivity, reflected in higher rural real wages. Productivity improve-

ments in agriculture would also spill over to poor consumers, through increased supply and lower prices of basic food items, effectively increasing real incomes.

In agrarian economies, growth led by the livestock sector has very strong poverty reduction potential, and is second only to growth in the dominant staple crops sector in its power to reduce poverty over time. In such economies, a strategy of stimulating growth in both livestock and staple crops has greater poverty reduction potential than a strategy that focuses on stimulating productivity growth in only one of these sectors. As developing economies proceed from an agrarian to a more diversified economic structure, high-value commodities, of which livestock is the largest, become the prime drivers of high agricultural growth rates. Demand for and production of high-value agricultural commodities can grow at 6 to 8 percent a year, whereas it is difficult to sustain growth rates of more than 2.5 to 3.5 percent for cereals (Mellor, 2003). High-value commodities tend to be perishable, which creates a strong need for improved rural infrastructure, particularly roads.

However, as developing countries go through the transition to more diversified economies, the formal sector expands, intersectoral linkages become more market-oriented and economic activities become more nationally, regionally and globally integrated. Under these conditions, growth in the livestock sector must keep pace by improving efficiency, product quality and capacity to compete in a liberalized environment without the artificial props of subsidies and protective policy interventions. The policy issues involved in livestock sector growth are thus more complex than those for cereals, and involve support from an expanding agribusiness and finance sector, but the synergies from balanced growth are potentially huge.

SUMMARY AND KEY POINTS

- Economic growth is necessary for poverty reduction, but the magnitude and speed by which growth can reduce poverty over time are strengthened and accelerated when income distribution is less inequitable, and when the poor can participate in the economic activities that experience expansion.
- For more rapid poverty reduction in developing countries, it is not enough simply to focus on rapid aggregate economic growth; attention must also be given to removing the types of inequalities that limit the poor's access to and capacity to exploit the opportunities for economic advancement.
- For growth to be pro-poor, it must achieve income gains for the poor in an inclusive growth process, promoting demand and market participation for activities that use the poor's resources (mainly labour) intensively.
- To accelerate the poverty reduction potential of economic growth in low-income agrarian developing countries, economic activities need to be stimulated where the majority of the poor are located – in rural communities – and in the economic sector in which most of the poor pursue their livelihoods: agriculture.
- The strong poverty reduction impacts of agriculture-led growth arise not only from agriculture's significance in the overall economy but also from strong consumption and production linkages between agriculture and other sectors of the economy. Agriculture's pervasive expenditure and supply chains generate output, employment and income multipliers from the agriculture sector to rural non-farm economic activities and the overall economy.

- In low-income agrarian economies, livestock form an integral part of predominantly smallholder diversified crop-livestock farming systems. Superseded only by larger-scale staple crops, the livestock sector is the second most important contributor to the agricultural economy. Despite its smaller output than that of staple crops, productivity and income growth in the livestock sector have strong income multiplier and poverty reduction impacts. These result from the demand side via direct and indirect income gains among rural households, and from the supply side via linkage to the staple crops sector as a generator of by-products for livestock feed.
- A combined strategy for livestock and staple crop productivity growth, exploiting the close linkage between these two sectors, would have the strongest income multipliers and poverty reduction benefits.
- As developing countries proceed from agrarian subsistence to more diversified market economies, growth in demand for livestock products and other high-value crops becomes stronger, and the livestock sector increases its share in agricultural value added, together with its potential for direct and indirect income and poverty reduction impacts. Marketing agrifood products with high income demand elasticities, such as livestock and their products, provides a way for the rural poor to participate indirectly but very actively in urban growth, propagating the benefits of this growth without social dislocation and other adjustment costs.