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Livestock assets, livestock income and rural households Cross-country evidence from household surveys¹

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Abstract – This paper investigates the livestock asset positions of rural households and the contribution of livestock to their income in 12 developing countries. It draws on the FAO Rural Income Generating Activities (RIGA) database, which allows cross-country comparisons of household surveys. The majority of rural households keep livestock; the rural poor, defined as those living in rural areas and belonging to the bottom expenditure quintile, are more likely to keep livestock than those in higher quintiles; there are minor differences in herd composition between households, and the contribution of livestock to total income is overall small, with no significant differences across households.

Key words: Livestock, livestock holdings, livestock income, household surveys, poverty

JEL Classification: Q12, C32

¹ The analysis in this paper is based on data from the Rural Income Generating Activities (RIGA) database, maintained by FAO's Agricultural Development Economics Division (ESA). Luca Tasciotti and Alberto Zezza were both at ESA when work on this paper was started. The paper is a joint output of the LSMS-ISA Project of the World Bank (<http://www.worldbank.org/lsms-isa>) and the World Bank, International Livestock Research Institute, FAO Livestock Data Innovation in Africa Project (www.africalivestockdata.org).

1. Introduction

Growth of agriculture is critical to sustain poverty reduction as about 75 per cent of the world's 1.2 billion extremely poor (< US\$ 1 a day) are estimated to live in rural areas and derive a non-negligible part of their income from agriculture and / or agriculture related activities (Ravallion et al., 2007; World Bank, 2008). The pace of poverty reduction does not only depend on the overall rate of agricultural growth, but also on the ability of poor households to participate in that growth, that is on the quality or inclusiveness of the growth process (Christiansen et al., 2006; Datt and Ravallion, 1998). Given that about three quarters of the extreme poor are estimated to keep livestock as part of their livelihood portfolios (LID, 1999; FAO, 2009), safeguarding and increasing the returns from their livestock assets is expected to help them in their endeavour to escape poverty (Brown, 2003; Catley, 2008; Delgado, 2003; ILRI, 2003; ILRI, 2007; Pica-Ciamarra, 2009; SDC, 2007).

Analyses of the livestock-poverty linkages are however limited, constraining the formulation of policies and investment plans intended to have a positive impact on the livelihoods of the livestock-dependent poor. On the one hand, macro studies show that increases in livestock productivity contribute to GDP growth and generate significant consumption and production linkages, but are too crude to detail investment plans and policies (Pica et al., 2008; Roland-Holst et al., 2010; Tsigas and Ehui, 2006). On the other hand, micro analyses, which focus on few households, one subsector within livestock, or on the livestock sector in isolation from other sources of livelihoods, are rarely appropriate to draw general inferences for pro-poor livestock sector policies and programmes (Barrett and Luseno, 2004; Imai, 2003; Kazianga and Udry, 2006).

This paper draws on the Rural Income Generating Activities (RIGA) database of FAO to investigate the livestock asset positions of rural households and the contribution of livestock to their income in a cross-section of developing countries.

The RIGA database is a compilation of selected Living Standards Measurement Studies and similar multi-purpose household surveys made available by the World Bank and other national and international institutions to derive comparable measures of income and basic household characteristics, with a particular focus on agriculture² (Davis et al., 2010; Winters *et al.*, 2009). The high degree of comparability ensured by the RIGA database facilitates the identification of common traits and patterns, regularities and differences that emerge from household level analysis.³

The surveys used in this paper include Bangladesh (survey year: 2000), Ecuador (1995), Ghana (1998), Guatemala (2000), Madagascar (2001), Malawi (2004), Nicaragua (2001), Nigeria (2004), Nepal (2003), Pakistan (2001), Panama (2003) and Vietnam (1998). While clearly not representative of developing countries in their entirety, the list does represent a significant range of countries and regions and can provide insights into the role of livestock activities in the livelihood strategies of rural households in the developing world, despite countries with significant pastoral livestock populations not being included.

The paper is structured as follows. Section 2 examines the likelihood of households in different expenditure quintiles to keep farm animals. Sections 3 and 4 investigate herd size and composition of livestock-keeping households in different quintiles, while section 5 quantifies the contribution of livestock to household income. Section 6 draws some conclusions.

2. Which households keep livestock?

There is ample evidence that rural households keep livestock across various levels of income. In India, the landless, marginal and poor poultry farmers keep an average

² The RIGA data and their full documentation are available at www.fao.org/es/ESA/riga/.

³ This paper presents additional analyses with respect to the 2009 FAO State of Food and Agriculture 'Livestock in the Balance' (FAO, 2009), which also makes use of the RIGA database.

flock of 7-8 non-descript hardy but low-yielding poultry birds, mainly as a source of eggs for home consumption and to meet one-off expenditures, whereas wealthier farmers can keep flocks with over 20,000 broilers for profit motives (GoI, 2006; Mehta and Nambiar, 2007). In Mexico, the poorest rural households rear piglets to maturity and then sell them to meet immediate cash needs, for example to purchase cereals; at the same time, Mexico's pork industry includes modern, vertically integrated hog farms that are competitive in the NAFTA market (Batres-Marquez et al., 2007; Dorward et al., 2001). Boran cattle, which are adapted to harsh climatic conditions, are reared for meat by ranchers in Kenya but are also kept by poor pastoral peoples in southern Ethiopia and the neighbouring areas of Kenya and Somalia, primarily as a source of milk for self-consumption (ILRI, 2006).

Households with different levels of income have incentives to keep livestock because of the wide spectrum of benefits these provide, such as cash income, food, manure, draft power and hauling services, savings and insurance, and social status and social capital (Bebe et al., 2003; Moll, 2005; Upton, 2004). At the bottom of the pyramid there are the poor farmers who, in the absence of formal insurance markets, tend to diversify (including into livestock) to achieve a balance between potential returns and the risks associated with climatic variability and market and institutional imperfections (Alderman and Paxson, 2002). In India, for instance, crop diversification is highest on small farms and lowest on the largest farms, both in irrigated and rain-fed areas (FAO, 2002); in Vietnam, small-scale farmers are more likely to have multiple sources of income, including farm and non-farm sources, whereas larger-scale farmers with good market access tend to specialise on one or few sources of income (Minot et al., 2006). At the top of the pyramid there are the (relatively) well-off farmers, some of whom specialise into high-value agricultural

products, including livestock, as an income-enhancing strategy (Abdulai and CroleRees, 2001; Barrett et al., 2005; Kristjanson et al., 2007). In Bangladesh, for instance, within the livestock sector, the ‘entrepreneurial poor’ and the ‘employers of the poor’ are likely to be specialised dairy farmers (CARE, 2008); Roland Holst et al. (2007) show that the livestock (income) dependant in Vietnam and Peru include the relatively better-off rural households but not many of those in the lowest income quintile, who are too poor to invest in livestock farming.

It is thus difficult to generalise whether poorer or richer households are more likely to keep livestock. Whether livestock-keeping is more important for the better-off or the poor is therefore an empirical question that needs to be assessed country by country. Table 1 and 2 show the proportion of households keeping livestock by expenditure quintile in rural and urban areas of the sample countries, ordered by increasing value of GDP per capita at purchasing power parity.

Table 1. Proportion of rural households keeping livestock by expenditure quintile

	Per cent of rural households					All
	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile	
Malawi	56.7	62.2	67.0	67.2	61.2	62.8
Madagascar	73.7	81.0	79.3	76.5	73.2	76.7
Bangladesh	55.2	57.6	64.6	64.4	66.5	61.7
Nepal	88.9	90.7	88.5	87.8	86.1	88.4
Ghana	64.6	55.3	51.4	43.5	36.0	50.1
Vietnam	85.3	87.1	83.2	81.7	73.4	82.1
Nigeria	58.3	53.9	46.7	39.0	33.9	46.4
Pakistan	40.9	45.5	47.3	49.3	51.7	46.9
Nicaragua	58.4	60.7	60.7	54.1	42.3	55.3
Guatemala	74.5	76.6	71.3	69.7	58.9	70.2
Ecuador	88.3	86.5	88.0	86.1	73.2	84.5
Panama	75.5	64.7	63.5	57.2	43.2	60.8

Table 2. Proportion of urban households keeping livestock by expenditure quintile

	Per cent of urban households					All
	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile	
Malawi	21.0	17.7	12.4	7.2	10.0	13.7
Madagascar	34.6	37.6	37.6	32.7	21.8	32.9
Bangladesh	19.6	17.9	15.0	10.6	4.4	13.5
Nepal	41.4	44.0	32.5	19.4	15.6	30.6
Ghana	26.1	14.7	8.5	4.2	2.3	11.2
Vietnam	36.5	31.7	21.6	9.6	3.8	20.6
Nigeria	20.4	12.2	8.9	7.5	4.3	10.7
Pakistan	7.6	5.2	4.8	4.3	3.6	5.1
Nicaragua	10.5	9.4	4.4	2.6	2.9	5.9
Guatemala	41.4	26.7	19.3	15.0	8.3	22.2
Ecuador	39.0	32.4	31.6	23.4	14.9	28.4
Panama	11.4	8.5	8.7	6.8	4.4	7.9

Livestock are kept across all expenditure quintiles, which is suggestive of the multiple roles of farm animals in the household economy. On average, around 68 per cent of rural households in the two lowest expenditure quintiles keep some farm animal vis-à-vis 65 and 58 per cent of those in the top two quintiles; in urban areas these proportions lie between 22 and 26 per cent for the less well-to-do, and between 8 and 12 per cent for the well-off. Overall, in 9 out of the 12 sample countries, rural households in the bottom two expenditure quintiles are more likely to keep livestock compared to those in the top two quintiles, though the difference is not always statistically significant. In urban areas, poor households are definitely more likely to keep livestock than richer ones. Note that in Guatemala, Madagascar, Nepal, Nicaragua and Vietnam rural households in the second quintile are more likely to keep livestock than those in the bottom quintile. This is consistent with findings by IFAD (2001) for Botswana and by Roland-Holst et al. (2007) for Senegal and Vietnam, who argue that the very poor may lack even the resources to invest in small animals, and their livelihood depends almost fully on providing casual labour.

3. Livestock holdings

Conditional on keeping livestock, one would expect poor households to keep smaller herds / flocks than better-off households. Ellis and Freeman (2004) find that mean livestock herd / flock size grows along income quartiles in Kenya, Malawi, Tanzania and Uganda; USAID (2007) observes a positive correlation between mean income and cattle herd size in Botswana; the 59th National Sample Survey (NSS) Report of the Government of India, Livestock Ownership Across Operational Holding Classes, shows a positive correlation between farm size and ownership of large ruminants, small ruminants and poultry (GoI, 2006); the World Bank (2004) reports a positive association between livestock herd size and household well-being in Nicaragua.

Table 3 displays the herd / flock size, expressed in tropical livestock units (TLU), of rural livestock-keeping households by expenditure quintile. TLU (250 kg live weight) standardises live animals by species mean live weight with the following conversion factors: cattle: 0.55 to 0.60 depending on the country; buffalo: 0.50; sheep and goats: 0.10; pigs: 0.20 to 0.25; and poultry: 0.01.

Table 3. TLU kept by rural livestock-dependent households by expenditure quintile

	Average TLU					All
	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile	
Malawi	0.36	0.40	0.50	0.58	0.64	0.50
Madagascar	1.48	1.74	2.04	2.43	2.51	2.03
Bangladesh	0.62	0.74	0.86	1.02	1.01	0.85
Nepal	1.96	1.98	1.82	2.04	1.99	1.95
Ghana	1.94	1.15	1.27	0.94	1.14	1.34
Vietnam	1.31	1.40	1.36	1.38	1.16	1.32
Nigeria	2.12	1.74	1.33	1.31	0.74	1.53
Pakistan	n/a	n/a	n/a	n/a	n/a	n/a
Nicaragua	1.14	2.52	3.29	5.41	8.48	3.86
Guatemala	0.73	0.76	0.91	0.82	3.86	1.31
Ecuador	2.48	3.11	2.89	3.50	5.00	3.33
Panama	0.97	1.45	2.79	3.51	9.97	3.20

Table 3 shows that a strong positive association between the TLU owned and household wealth only exists in the four Latin American countries and, to some extent, in Bangladesh, Madagascar and Malawi. An inverse relationship between expenditure level and herd / flock size appears to exist in rural areas of Ghana and Nigeria, while no clear relationship is found in Nepal and Vietnam. The coefficient of variation around the mean 'herd size' increases across the expenditure quintiles – it is the lowest for the poorest households (0.5 TLU) and highest for households belonging to the top quintile (1.0 TLU) – suggesting greater heterogeneity among the better-off livestock-keeping households.

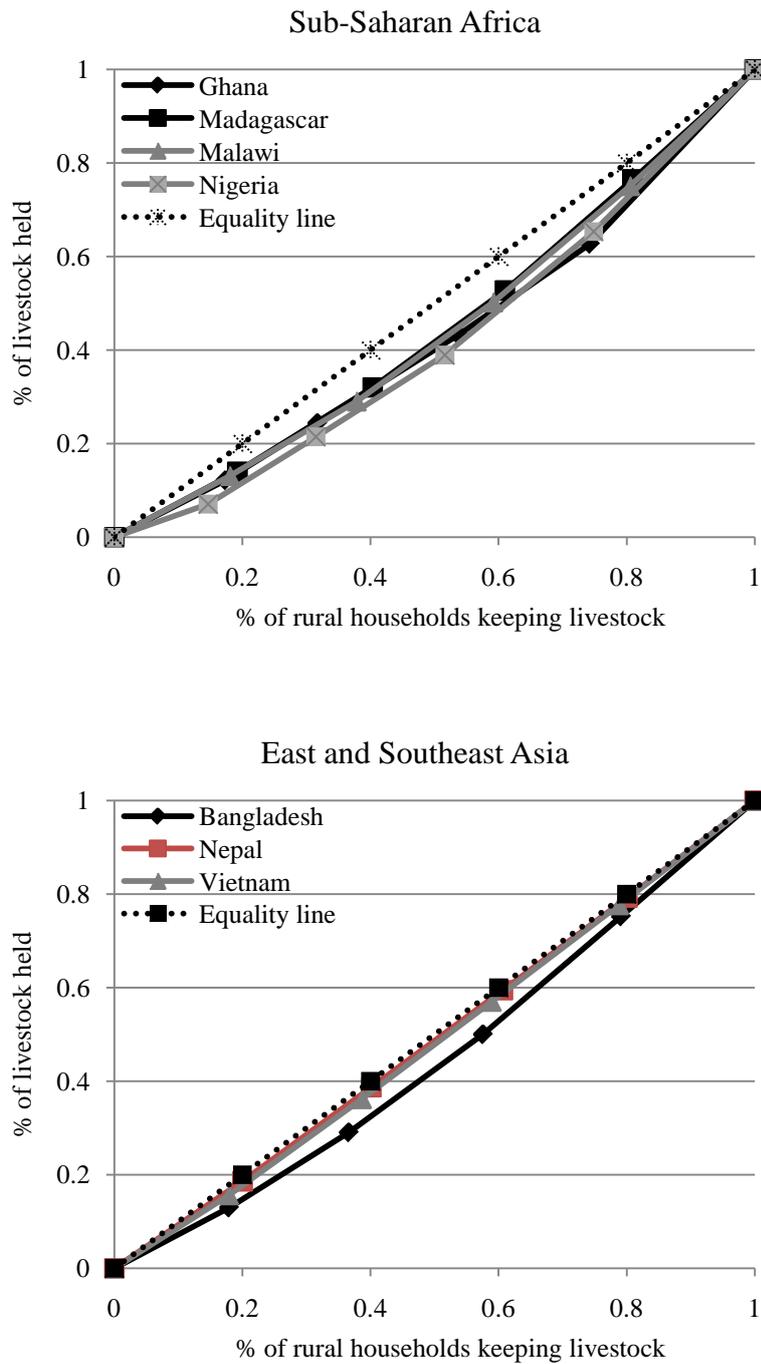
Table 3 also shows that the average herd size (calculated across livestock-keeping households only) is relatively small for households in all expenditure quintiles, with the exception of Latin American countries. It needs to be kept in mind that these results are illustrative of mixed crop-livestock production systems as households in pastoral areas tend to keep larger herds (Bebe et al., 2003; Lybbert et al., 2004; Maltoglou and Rapsomanikis, 2005; Maltoglou and Taniguchi, 2004; Nanyeenya et al., 2008). The fact that even households in the top two quintiles only keep an average of 2.0 to 3.3 TLU – that is between three to four cattle, which are in most circumstances insufficient as the only source of livelihood for a typical household – indicates that specialisation in livestock as the main income generating household enterprise is not a widely adopted strategy. In India, for instance, poultry farms with less than 20,000 birds (approximately 200 TLU) are deemed too small to singularly generate enough income to sustain a family, although commercial units with birds in the hundreds can be financially viable and can significantly contribute to household income (Mehta *et al.* 2002; PRADAN, 2008). In pastoral areas of East Africa a minimum herd size of two cattle or more per family member is estimated to be

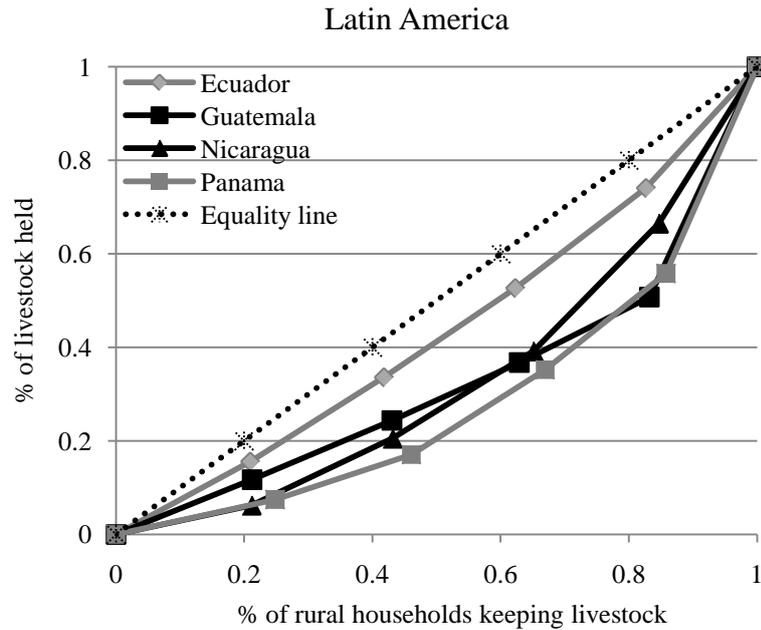
necessary for households to make a living above the poverty threshold if they rely exclusively on livestock farming (Lybbert et al., 2004). In the Andean highlands, according to the International Alpaca Association, 2,000 heads is the minimum herd size needed for alpaca rearing to be commercially viable (ECLAC, 2004). Nevertheless, even if for most households livestock are not the main source of income, they may still be important complements to other sources of income (for example, draught animals for crops) and / or provide income at critical times of the year.

The inconclusive relationship between household wealth and herd size and the relatively minor differences – with the exception of Latin America – in average herd size across expenditure quintiles imply that livestock are relatively equally distributed among the rural population. Figure 1 presents Lorenz curves of livestock ownership for the sample countries.⁴

⁴ Lorenz curves map the cumulative distribution of rural livestock keeping households ordered by average herd size onto the corresponding cumulative proportion of livestock kept. If livestock stock were equally distributed, with every household keeping the same number of TLU, the Lorenz curve would be a 45-degree line; in case of complete inequality, with the largest holder holding all livestock, the Lorenz curve would run along the x-axis with a right angle at (1,0) to terminate at (1,1).

Figure 1. Lorenz curves of livestock holdings to rural households keeping livestock





The Lorenz curves indicate that livestock are fairly equally distributed among the livestock-keeping population, as the curves deviate from the line of absolute equality only in Latin America, where households belonging to the two top quintiles keep over 60 per cent of the livestock. These findings corroborate reports that in developing countries livestock are fairly equitably distributed (Delgado et al., 2008; McKinley, 1995; Mellor, 2003; Zezza et al., 2011) – often more than land, essentially because even landless households can keep some animals.

4. Herd composition

Poor households rarely specialise in one particular crop or livestock species, preferring to diversify to take advantage of the different, often complementary roles each species can play, as well as to spread risks, including that of animal diseases. However, the ability of the poor to acquire livestock is constrained by the capital and maintenance costs of the different species, which are typically highest for large ruminants (IFAD, 2001; Kitalyi et al., 2005). For instance, in February 2009, in Mbarara market, Uganda, cows were sold at about US\$ 190 per head, pigs at between US\$ 35 (sow) and US\$ 43 (boar), goats at between US\$ 21 (female) and US\$ 24

(male), and chickens at between US\$ 2 and US\$ 3 (Foodnet, 2009). Maintenance costs are also higher for large ruminants, which, per day, need fodder equal to about 10 per cent of their body weight, that is 30 to 40 kg for an adult cow; indigenous poultry birds, conversely, can survive on 30 – 50 grams of feed per day, which can be obtained by scavenging and feeding on kitchen / crop residues.

In most situations one would thus expect a hierarchy of livestock keeping: the poorest keeping mainly poultry, the slightly less poor also keeping small ruminants and / or pigs, and only the more affluent, in relative terms, keeping large ruminants (cattle and buffaloes). This sequence is often referred to as the 'livestock ladder', which allegedly represents livestock ownership by rural households in many circumstances (ILRI, 2003; Udo et al., 2007). In Dedza and Zomba districts of Malawi and in the Morogoro region of Tanzania relatively few households own cattle or goats, whereas chicken ownership is widespread (Ellis et al., 2003; Ellis and Mdoe 2003). The Maasai in Kenya and the Afar in Ethiopia tend to keep small rather than large ruminants as a large proportion of their herd (Peacock, 2005). In Lao PDR about 95 per cent of poultry birds are kept by smallholders, with more birds per household kept in the less developed northern and southern regions (Wilson, 2007). In Bolivia, the animals most commonly reared by smallholders are poultry, guinea pigs, and sheep and goats (van't Hooft, 2004). However, because a variety of conditions – beyond capital and maintenance costs – affect herd / flock composition, the evidence is not always conclusive. In the mountain region of Nepal, where about 60 per cent of the population lives below the poverty line, almost 95 per cent of households keep large ruminants suitable to local climatic conditions, but only about 50 per cent keep small ruminants and poultry (Maltosoglou and Taniguchi, 2004). In India, where government livestock policies have been long biased towards large ruminants, most

rural households, with the exception of the landless, are reported to keep some dairy cows or buffaloes (GoI, 2006). In the district of Kapchorwa in Eastern Uganda, both poor and richer farmers were found to keep some cattle, but for different purposes, that is milk production and draught power respectively (Lu et al., 2002).

Although the ‘livestock ladder’ is an appealing concept, it appears that household wealth is a poor predictor for herd composition. Table 4, 5 and 6 show the proportion of livestock dependent households that keep large ruminants, small ruminants and poultry birds by expenditure quintile.

Table 4. Proportion of livestock-dependent rural households keeping large ruminants

	Per cent of livestock-dependent rural households					All
	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile	
Malawi	5.7	6.1	6.9	9.2	10.0	7.6
Madagascar	41.2	43.4	42.7	44.4	46.0	43.5
Bangladesh	54.3	55.8	59.3	67.3	60.8	59.7
Nepal	88.7	91.0	91.0	91.1	90.2	90.4
Ghana	29.3	13.9	9.4	6.3	5.5	14.4
Vietnam	56.1	48.4	43.0	35.1	22.6	41.6
Nigeria	34.2	24.0	17.4	11.8	4.6	20.4
Pakistan	90.5	94.2	92.6	94.4	96.3	93.7
Nicaragua	19.5	37.5	39.9	54.1	62.0	62.0
Guatemala	11.9	12.7	15.7	14.6	25.1	15.6
Ecuador	36.3	35.5	32.6	37.6	41.4	36.5
Panama	17.6	15.2	21.5	23.1	36.0	21.6

Table 5. Proportion of livestock-dependent rural households keeping small ruminants

	Per cent of livestock-dependent rural households					All
	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile	
Malawi	36.5	35.0	38.7	41.2	39.3	38.1
Madagascar	11.3	4.0	3.8	4.0	2.3	5.1
Bangladesh	31.5	32.9	26.4	25.6	21.3	27.6
Nepal	54.8	59.6	56.5	60.9	53.1	57.0
Ghana	76.6	66.1	66.1	64.4	56.1	65.8
Vietnam	0.8	0.8	0.4	0.4	0.2	0.5
Nigeria	90.2	85.9	81.8	76.9	73.5	81.7
Pakistan	n/a	n/a	n/a	n/a	n/a	n/a
Nicaragua	n/a	n/a	n/a	n/a	n/a	n/a
Guatemala	15.2	9.3	7.7	5.5	3.8	8.3
Ecuador	27.5	20.6	20.4	12.4	11.1	18.4
Panama	0.9	0.2	1.3	0.0	1.0	0.7

Table 6. Proportion of livestock-dependent rural households keeping poultry

	Per cent of rural households					All
	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile	
Malawi	87.4	89.5	89.3	87.6	89.2	88.6
Madagascar	87.7	89.0	95.2	93.8	92.9	91.7
Bangladesh	84.4	86.2	87.3	86.6	90.4	87.0
Nepal	50.2	53.9	52.2	55.0	55.2	53.3
Ghana	82.7	83.3	78.5	76.4	78.3	79.8
Vietnam	87.6	88.6	87.0	87.0	85.7	87.2
Nigeria	77.9	79.3	84.9	89.6	90.9	84.5
Pakistan	n/a	n/a	n/a	n/a	n/a	n/a
Nicaragua	91.7	93.9	94.2	96.1	95.6	94.3
Guatemala	91.7	91.6	92.7	88.8	91.1	91.2
Ecuador	91.1	90.9	90.9	88.1	86.3	89.5
Panama	98.1	97.7	98.4	98.2	91.7	96.8

The graphs do not reveal a clear pattern of livestock species ownership with respect to wealth groups. Poultry are relatively evenly kept across all expenditure quintiles while small ruminants are more likely to be kept by the relatively poorer households in 6 of the 8 countries for which data are sufficient / available to draw some conclusions. With respect to large ruminants, no clear pattern of ownership emerges across the 12 countries: in 8 countries households in the top expenditure

quintiles are most likely to keep large ruminants; the evidence is inconclusive for Nepal; in Ghana, Nigeria and Vietnam the poor are more likely to keep large ruminants.⁵ The RIGA data show similar patterns of livestock ownership when comparing the herd composition of the extremely poor (< \$ 1 a day) with that of the remainder of households (≥ \$ 1 a day), overall suggesting that the ‘livestock ladder’ differs depending on the country and in terms of large and small ruminant holdings rather than in terms of ownership of poultry birds.

5. Livestock income

Livestock contribute to household livelihoods through a variety of direct and indirect pathways. Firstly, livestock provide cash income or income in kind through the sale of animals and / or the sale and consumption of milk, meat, eggs and other animal products. Second, livestock are a form of savings (capital growth through herd growth) and insurance, as the sale of animals provides immediate cash to deal with significant or unexpected expenditures (for example, school or medical fees). Third, livestock provide manure, draft power and transport services, which can be used on the household farm or exchanged on the market (for example, rental of bull for ploughing). Fourth, being a source of wealth, livestock not only contribute to social status but may possibly facilitate access to financial services, both in formal and informal markets. Finally, because some livestock can be kept close to the homestead and require few labour inputs, such as a small flock of poultry birds, these can be tended by women while managing other time-consuming activities (for example, cooking or child care), thereby falling under their control and providing some degree of empowerment. Given these diverse outputs, which comprise both monetised and

⁵ This is, at least to some extent, a result of the geography of poverty in these three countries. In Vietnam poverty is highest in the northern mountain regions where people can actually graze cattle. Similarly in Nigeria and Ghana poverty is highest in the Sahelian north, again an area where cattle can be kept.

non-monetised goods and services, it is difficult to quantify the overall contribution of livestock to household livelihoods, and only few have tried (Alary et al., 2011; Moll, 2005; Moll et al., 2007).

Even quantification of the contribution of livestock to household income, which is the simplest proxy for its livelihood status, is not straightforward. One would need information on: (i) the quantity and value of products – such, as milk, meat and eggs as well as manure (used as fertilizer or fuel) as well as the animals themselves – consumed and / or marketed; (ii) the quantity and value of services provided, such as bullock ploughing and transport; (iii) the amount and cost of inputs used such as feed, water, family and hired labour, veterinary services, replacement stock, and so forth; and (iv) changes in value of the livestock inventory over the reference period, which result from changes in herd size due to births, deaths, purchases, sales, and gifts as well as from appreciation / depreciation of individual animals (for instance, if an animal is still in the household's possession at the end of the reference period, then changes in the value of that animal, for example due to weight gain in the case of animals kept for fattening, need to be quantified and enter the livestock-income equation). In most cases, because of the paucity of data, livestock income is however calculated as the total value of production (either sold or both sold and self-consumed) net of the value of some inputs for which data are available, such as purchased feed, hired labour and veterinary services/medicines.

Irrespective of the way income from livestock is estimated, there is some evidence that poor and landless households derive a higher share of their income from livestock than the relatively better off. Adams (1993) finds that in Pakistan livestock contribute about 20 per cent to total income for households in the first three income quintiles, and 15 and 10 per cent for households in the fourth and top quintile. Ellis et al. (2003)

find that, in Zomba district of Malawi, livestock contribute less than 5.3 per cent to the income of households in the top income quartile, whereas they contribute 7.1 and 7.5 per cent to the income of households in the first two quartiles. Akter et al. (2007) show that in the Indian State of Andhra Pradesh, livestock contribute over 25 per cent to the income of the poorest quintiles and only 7 per cent to the income of the richest ones. Delgado et al. (1999) report of a number of studies in seven countries in Africa, Asia and Latin America, which find that the contribution of livestock to income is larger for the poorest households than for those with higher incomes, larger farm size and more balanced dietary adequacy. Ifft (2005) refers to a Philippine household survey which indicates that the poorest fifth of the sample population relied on livestock for 23 per cent of their income, while the richest fifth only relied on livestock for 10 per cent of their income. However, there are also studies, albeit fewer, which conclude that livestock contribute more to the income of the better-off households than to that of the poor (Wouterse and Taylor, 2008, for Burkina Faso) or which find no clear pattern (Adams, 2002, for Egypt).

Table 6 shows the contribution of net livestock income to total household net income in the sample countries. Livestock income is defined as the value of sales and barter of livestock, plus the value of sales, barter and self-consumption of livestock products (such as milk, meat, eggs, honey, and so forth) minus the expenditures related to livestock production which, depending on the country, may include feed, labour and veterinary services. With respect to the majority of studies in the literature, the livestock income variable is calculated only for livestock-keeping households, which ensures that results are not influenced by the pattern of livestock ownership among the population.

Table 6. Proportion of net income from livestock by expenditure quintile – livestock-dependent rural households

	Per cent of rural households					All
	1 st quintile	2 nd quintile	3 rd quintile	4 th quintile	5 th quintile	
Malawi	13.6	13.6	14.0	14.3	16.6	14.4
Madagascar	19.9	18.0	14.8	13.5	18.7	17.0
Bangladesh	4.1	3.9	4.6	4.8	3.3	4.1
Nepal	17.0	15.4	17.3	16.6	20.4	17.3
Ghana	8.5	7.3	8.5	9.0	10.3	8.6
Vietnam	17.0	16.2	17.2	17.7	13.2	16.3
Nigeria	11.8	10.1	10.4	11.7	13.9	11.5
Pakistan	14.1	17.3	17.3	19.2	19.1	17.5
Nicaragua	15.4	18.5	21.8	21.3	23.6	20.1
Guatemala	3.7	3.7	4.8	4.5	2.4	3.9
Ecuador	16.1	13.9	10.8	10.7	7.2	11.8
Panama	6.2	3.1	3.9	3.9	2.2	4.1

Households that keep livestock obtain between 2 and 24 per cent of their income from this activity, with the simple average across the 12 sample countries being 12 per cent. There is no consistent association between expenditure level and income from livestock: in half of the countries the association appears to be positive (Ghana, Malawi, Nigeria, Nepal, Pakistan, Nicaragua) whilst in the other half it appears to be negative or unclear (Madagascar, Bangladesh, Vietnam, Ecuador, Guatemala, Panama). In addition, the difference between the contribution of livestock to the income of households belonging to different quintiles is not statistically significant in any of the sample countries. These results need to be taken together with those in table 1, which show a similar variety of patterns of participation in livestock activities by expenditure quintiles across countries. Overall, country specific features of the livestock systems and their interaction with other rural livelihood options, in combination with country specific patterns in the distribution of assets and resources, are the main determinants of the patterns of livestock ownership and their role in the household economy.

6. Conclusions

This paper investigated the livestock asset position of households in different expenditure brackets and the contribution of livestock to household income in a sample of developing countries in sub-Saharan Africa, East and Southeast Asia and Latin America. It built on the RIGA database assembled by FAO, which allows sound cross-country analyses.

An explorative analysis of household surveys in 12 developing countries highlights that livestock are a common asset amongst rural households across all expenditure quintiles. In particular, an average of 68 per cent of rural households in the two lowest expenditure quintiles keep some farm animals, with the proportion decreasing to 58 per cent for better-off households in the top quintile. The majority of households, therefore, have some motives to keep livestock, either as a risk-coping or income-enhancing strategy or simply because they lack the means or have few opportunities to diversify into non-livestock income-enhancing activities. Livestock (TLU) are fairly equitably distributed among the livestock-keeping population, with the exception of the Latin American countries, with herd size composition marginally correlated to household wealth.

Poorer households are more likely to keep small ruminants than richer ones, who are more likely to keep large ruminants. However, the likelihood of keeping either small or large ruminants varies widely, with proportions ranging from 1 to 96 per cent, and the pattern of ownership is not consistent across the sample countries. Poultry ownership is evenly distributed across all expenditure quintiles in all countries, with over 80 per cent of all households keeping poultry birds in all sample countries with the exception of Nepal (53%). Thus, in general, policies and investments targeting small ruminants and poultry are more likely to directly benefit a

larger share of poor livestock-keeping households than comparable interventions targeting large ruminants.

In the aggregate, the direct contribution of livestock to the income of rural livestock-keeping households is limited, with an average of 12 per cent across the sample countries and proportions ranging from 2 to 24 per cent. These figures, however, do not take into consideration the contribution of livestock to other dimensions of household welfare. For instance Alary et al. (2011) show that, in Niger, 60 per cent of households rely on sale of animals to cope with food shortages or unexpected medical expenditures; Vella et al. (1995) find that ownership of a cow is a significant predictor of height for age status in children in south-western Uganda, even after controlling for other indicators of economic status (for example, occupation, land owned, years of education).

The fact that an overwhelming majority of the rural population keep livestock suggests that increases in productivity or profitability of livestock will directly contribute to their livelihoods. While increased efficiency in the use of livestock assets would be beneficial to all livestock dependent households, it will provide a springboard in particular for those population sub-groups that rely relatively more heavily on livestock for their livelihoods (particularly in the context of rapidly growing demand for livestock products, which grows considerably faster than for staples). Furthermore, increasing the returns to livestock could help some households overcome threshold barriers to entry in other more remunerative activities, such as petty trade, or facilitate complementary use of assets between activities, such as increasing crop productivity through applying manure from livestock.

The above conclusions are limited to the direct impact of increased livestock productivity or profitability on household income and do not take into account the

multiplier effects of livestock sector growth. Omore et al. (2004) find that in Kenya between 0.3 to 2.0 direct and indirect jobs are created for every 100 litres of milk traded, depending the enterprise type; FAO (forthcoming) estimates that in sub-Saharan Africa livestock sector multipliers – as measured by the incremental effect of US\$1 additional spending on aggregate national household incomes – average US\$2.9 in primary livestock production and US\$5.9 in processing. These household multipliers are larger than those for alternative sectors and the benefits of livestock sector growth are usually relatively equally distributed because of a web of indirect linkages across distribution, processing and marketing activities, many of which are again undertaken by low-income households.

Further analyses and investigations are needed based both on the RIGA dataset and using other data which are more representative of the livestock-keeping population to enhance our understanding of the livestock-poverty linkages. Priority should be given to measure not only the overall contribution of livestock to household livelihoods, including livestock income and other non-monetary services provided by animals, but also to quantify the indirect benefits of livestock sector growth to both livestock-keeping and non-livestock-keeping households, both through consumption and production multiplier effects.

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