Policy Brief

Livestock, Employment, and Economic Development in Low- and Middle-Income Countries[1]

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Highlights

- Livestock contributes to enhance food security in the low-income countries through its economic contribution to employment generation.

- Structural differences of "livestock sectors", across countries with different levels of economic development, are documented:

  o *Countries with high agricultural labor productivity, where sheep and poultry production are dominating in these countries.*

  o *countries with high population growth and high consumption of poultry meat and highest importation of cattle meat. These are mainly Low-Middle- and Upper-middle income countries.*

  o *Countries with low labor productivity and low agricultural added value. Cattle production is the highest, in average, compared to other livestock types. Levels of meat production is the lowest across groups (mostly low-income).*

  o *low-Middle income countries with the highest level of chicken meat production across groups and low trade openness. Sheep production in these countries is the lowest across countries. (mostly low-middle income).*

- Results provide pathways for better targeting of livestock investments and policy tailored to the economic conditions of given countries.

Rationale and Objectives

While aspects of the contribution of livestock within agriculture are well studied, its overall economic and social impact on national economies, all sectors included, is less obvious in the literature. Studies on food security and livestock development for poverty reduction in Latin America, Asia and Sub Saharan Africa revealed that although the agricultural sector makes a relatively small contribution to the Gross Domestic Product (GDP), large proportions of national economically active labor forces are employed in the livestock sub-sector (Chongela, 2015; The World Bank, 2010). Other examples of livestock contributions to national economies in other countries can be found in the literature (Asresie et al., 2015 for the case of Ethiopia; Rehman et al., 2017 for the case of Pakistan; Dutilly et al., 2020 for the case of Zambia, etc.). More structured studies, globally documenting the economic role and contribution of the livestock sector in the economies of developing countries, remain needed to better appreciate the importance of this sector and further prioritize livestock development and related food security investments based on their expected economic impact.

Additional arguments for in depth analytical studies about the livestock sector are related to the fact that this subsector has achieved the greatest growth in production over the last three decades, and it is expected that it will continue to grow faster than all other agricultural subsectors in the next decencies (Delgado et al., 2001; Rosegrant et al., 2013). *However, the growth tendency and the scope of possible growth investments in the livestock sector, will depend on the current structural characteristics of this sector in the different developing countries. Current structure of this sector is in turn depending on different economic,*

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[1] This policy draft is withdrawn from the results of a forthcoming paper (under review) referenced as: Frija Aymen, Dolapo Enahoro, Ameur Wafa, Ouerghemmi Hassen. (Forthcoming). Contributions of livestock to agricultural development and employment growth in a set of low- and middle-income countries. [Submitted – Under review at "Global Food Security" Journal]

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institutional, environmental and agroecological conditions including, agroclimatic conditions, type of available biomass in dominant agroecology of the country, accumulated knowledge (including traditional knowledge), consumer preferences, efficiency of technology transfer, etc.

This brief provides highlights of "typical livestock structural characteristics" which can be found under different contexts of economic development. For doing so, we conducted a typology analysis of 43 low- and middle-income countries based on their livestock and macroeconomic characteristics and aggregates. This enables context-specific analyses of the importance of livestock within each of the emerging patterns of "linkages between livestock and development" and helps to better understand whether different structural characteristics of livestock sectors (including livestock production and importation by type) exist for (and influence) different levels of economic development.

Are there different livestock sectoral patterns for different levels of economic development?

Figure 1 shows that countries with high contribution of agriculture to the national GDP are overall characterized by lower importance of livestock in the agricultural sector. While this relationship needs to be statistically validated, additional understanding of the relative importance and structural (production, trade, and consumption) characteristics of livestock sectors in the different stages of economic development will be useful for guiding programs and policies for bringing about structural adjustments of these sectors in lower income countries. Such knowledge could in addition facilitate the identifying of viable pathways to enhancing the role played by livestock in the overall economy, particularly in relation to contribution of the sector to food security, value-addition, and employment.
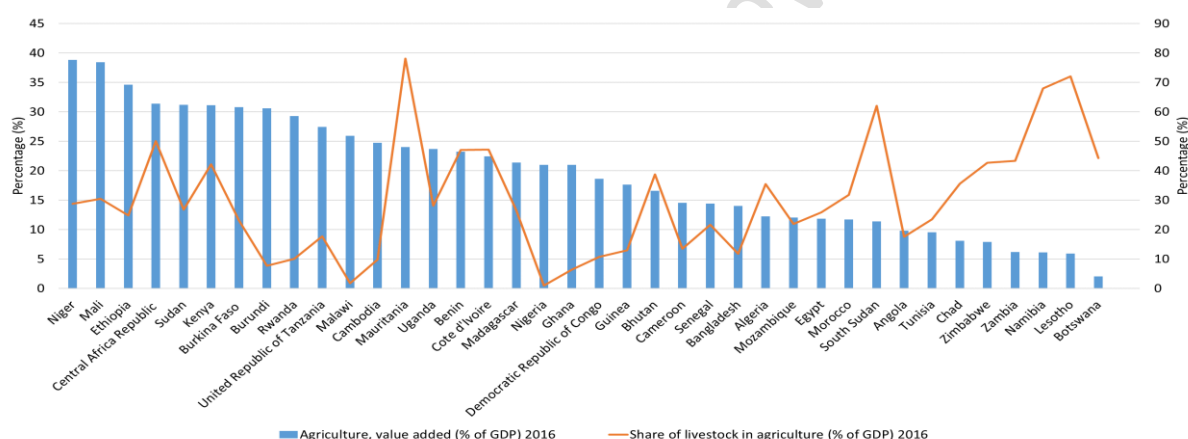

Figure 1. Agricultural contribution to GDP and livestock shares in agricultural GDP for a set of selected countries in Africa and Asia

Combining "livestock-oriented variables" reflecting the structure of livestock production sector, in addition to livestock importations and other macroeconomic variables such as agricultural, industrial, and service sectors contribution to overall GDPs, performance indicators of financial sectors, trade openness, and other income and employment indicators led us to understand descriptively the variability of these studied indicators as well as identifying patterns of "typical structures of livestock sector" under different "economic development contexts" or levels. This has been done using the typology analysis as highlighted in the next section.

Typology analysis of countries based on macroeconomic and livestock variables

Principal Component Analysis (PCA) followed by a K-Mean typology analysis (Frija et al., 2016) were used over a dataset of 15 variables (Table 1). The PCA methodology allows, in our case, for depicting sets of components (factors) that summarize correlations of different variables (among the macroeconomic and livestock ones considered) and for revealing clearer

patterns of homogenous structural livestock and economic characteristics among countries.

Variables in table 1 were collected for a set of 43 countries listed in table 2. The choice of these countries was based on their level of economic development, thus only considering low, lower-middle, and upper-middle income countries. A focus was made on SSA and SA, in addition to six MENA countries (Table 2).

Table 1. Descriptive statistics of selected variables used to classify livestock system in the selected countries (2015 data). Source: Authors' calculations for the selected countries using the World Banks' World Development Indicators (WDI)

Macroeconomic and livestock aggregate variables	Average	Standard deviation
Meat cattle production (metric tons)	163,470.07	186,837.73
Meat sheep production (metric tons)	43,200.88	77,894.83
Meat chicken production (metric tons)	276,900.57	534,981.92
Meat cattle: Import value (Thousand US$)	65,983.26	192,897.11
Meat Sheep: Import value (Thousand US$)	2,522.02	5,824.72
Meat Poultry: Import value (Thousand US$)	43,210.40	106,718.57
GDP per person employed (constant 2011 PPP $)	15,414.01	15,714.22
Agricultural value added per worker (constant 2010 US$)	2,514.41	3,657.01
Employment in agriculture (% of total employment)	48.44	19.45
Employment in services (% of total employment)	36.23	12.87
National poverty rate (Thousand head)	4,887.30	4,782.70
Mean of GDP annual growth (%)	4.94	2.14
Import of goods and services (Million USD)	35,141.40	48,528.60
Trade openness (Indicator)	0.64	0.26
Mean of population growth (%)	2.15	0.94

Table 2. List of countries involved in the analysis

Low-Income Countries			Lower-Middle Income			Upper-Middle Income		
Ref (ISO)	Zone	Countries	Ref (ISO)	Zone	Countries	Ref (ISO)	Zone	Countries
BDI	SSA	Burundi	AGO	SSA	Angola	BWA	SSA	Botswana
BEN	SSA	Benin	BGD	SA	Bangladesh	DZA	MENA	Algeria
BFA	SSA	Burkina Faso	BTN	SA	Bhutan	NAM	SSA	Namibia
CAF	SSA	Central Africa Republic	CIV	SSA	Cote d'Ivoire			
COD	SSA	Republic of Congo	CMR	SSA	Cameroon			
ETH	SSA	Ethiopia	EGY	MENA	Egypt			
GIN	SSA	Guinea	GHA	SSA	Ghana			
GNB	SSA	Guinea-Bissau	KEN	SSA	Kenya			
MDG	SSA	Madagascar	KHM	EAP	Cambodia			
MLI	SSA	Mali	LSO	SSA	Lesotho			
MOZ	SSA	Mozambique	MAR	MENA	Morocco	**Abbreviations**: EAP: East Asia & Pacific; SSA: Sub-Sahara Africa; SA: South Asia; MENA: Middle East and North Africa.		
MWI	SSA	Malawi	MRT	SSA	Mauritania			
NER	SSA	Niger	NGA	SSA	Nigeria			
RWA	SSA	Rwanda	SDN	SSA	Sudan			
TCD	SSA	Chad	SEN	SSA	Senegal			
TZA	SSA	United Republic of Tanzania	SSD	SSA	South Sudan			
UGA	SSA	Uganda	TUN	MENA	Tunisia			
			ZMB	SSA	Zambia			
			ZWE	SSA	Zimbabwe			

This typology analysis was further complemented by a panel regression of labor force in the 43 countries over a set of livestock and macroeconomic variables (see equation 1). To further estimate the relationship between employment growth and livestock GDP, the system GMM estimator proposed by Blundell and Bond (1998) was used. The equation used in this model is as follow:

Labor force i,t = ʋ +ß1 Labor forcet-1 + ß2Crop (GDP)t-1 + ß3Livestock (GDP) t-1 + ß4trade openness t-1 + ß5service added value t-1 + ß6Industry added value t-1 + ß7Domestic credit provided by financial sector t-1 + ß8Domestic credit to private sector t-1+ ß9population growth t-1 + ß10GDP t-1+µi,t-1 Eq.1

Labor force is the dependent variable (Yi, t), explained by a set of explanatory variables (Xi, t-1), and a lagged labor force variable (of year t-1) (Tongurai and Vithessonthi, 2018). Labor force is expressed in "Number of persons"; Crop and livestock GDPs are expressed in "1000 Int. $"; trade openness is an index coefficient; service, industry, domestic credit provided by financial and private sectors are all expressed in "% of GDP"; population growth is expressed in "annual percentage"; and finally, overall GDP is expressed in "current US$".

Results: Country profiles based on their macroeconomic and livestock aggregates

Four country groups/types of countries were identified based on their livestock and economic development patterns (Table 3).

Table 3. Identification and description of clusters and their respective country lists

Name of the country group	Relevant components	Number of observations (%)	Countries	Type
Cluster1: Countries with high agricultural labor productivity	Component 1	5 (11.90%)	**Algeria, Botswana, Namibia, Tunisia Iran**	LI (0 %) LMI (20 %) UMI (80 %) *MENA (60 %) SSA (40 %)*
Cluster2: countries with high population growth and high consumption of poultry meat	Components 3 and 5	3 (7.14%)	**Angola, Egypt, Iraq**	LMI (66.7 %) UMI (33.3 %) *MENA (66.7 %) SSA (33.3 %)*
Cluster3: Countries with low production of red meat and high contribution of employment in agriculture	Component 1	18 (42.85%)	**Benin, Cameroon, Central Africa Republic, Democratic Republic of Congo, Guinea, Guinea-Bissau, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Rwanda, Uganda, Zambia, Bhutan, Nepal**	LI (72.2 %) LMI (27.8 %) SA (11.1 %) SSA (88.9 %)
Cluster4: low-income countries with low red meat production and low trade openness	Component 2 and 4	16 (38.1%)	**Burkina Faso, Cote d'Ivoire, Ghana, Kenya, Morocco, Nigeria, Sudan, United Republic of, Tanzania, Zimbabwe, Bangladesh, Cambodia, Indonesia, Myanmar, Pakistan, Philippines, Sri Lanka**	LI (12.5 %) LMI (81.3 %) UMI (6.2 %) EA & P (25.0 %) MENA (6.3 %) SA (18.8 %) SSA (50 %)

LI: Lower Income countries; LMI: Lower middle income; UMI: Upper middle income

The characteristics of the identified groups are as follows:

▪ A first type refers to "**countries with high agricultural labor productivity**": these countries are characterized with the highest GDP per person employed and the highest agricultural value added per worker. The average contribution of agriculture to national employment for this country type is about 17% which is the lowest across the country types. Within the same type, the average share of population employed in service sector is about 55%, which is the highest across identified country types.

▪ A second type of countries is "**countries with high population growth and high consumption of poultry meat**". This type is specifically

characterized by high levels of cattle and chicken meat importation in addition to the highest population growth rates. Both agriculture and services employ large shares of the population, 31% and 49% respectively, in these countries.

▪ The third type of countries refers to "**countries with low labor productivity and low agricultural added value**". These are countries having the highest levels of agricultural employment (about 64.79% of the total employed population). GDP per person employed, and agricultural GDP per worker are lowest in this group (5700$ and 750$ respectively).

▪ The final type refers to **low-Middle income countries with the highest level of chicken meat production across groups and low trade openness**. Sheep production in these countries is the lowest across the group. This group represents

about 38% of the total sample, mostly low-middle income.

To test whether the two variables "country types" and "geographical zone" are dependent, an "Exact Test of Fisher" (a non-parametric test used when a Chi-square test is not possible) was applied. The Fisher test confirmed that both variables are dependent. The strength of this dependency was concluded by estimating the V-Cramer value which was equal to 0.468 (> 0.4) thus confirming the strength of this relationship. The same was also observed for both variables "country type" and "income class" (OCDE classifications). This means that country types generated above are compatible with other OCDE classification (income types) and geographical zones. This also means that livestock patterns are indeed different across different income-level countries.
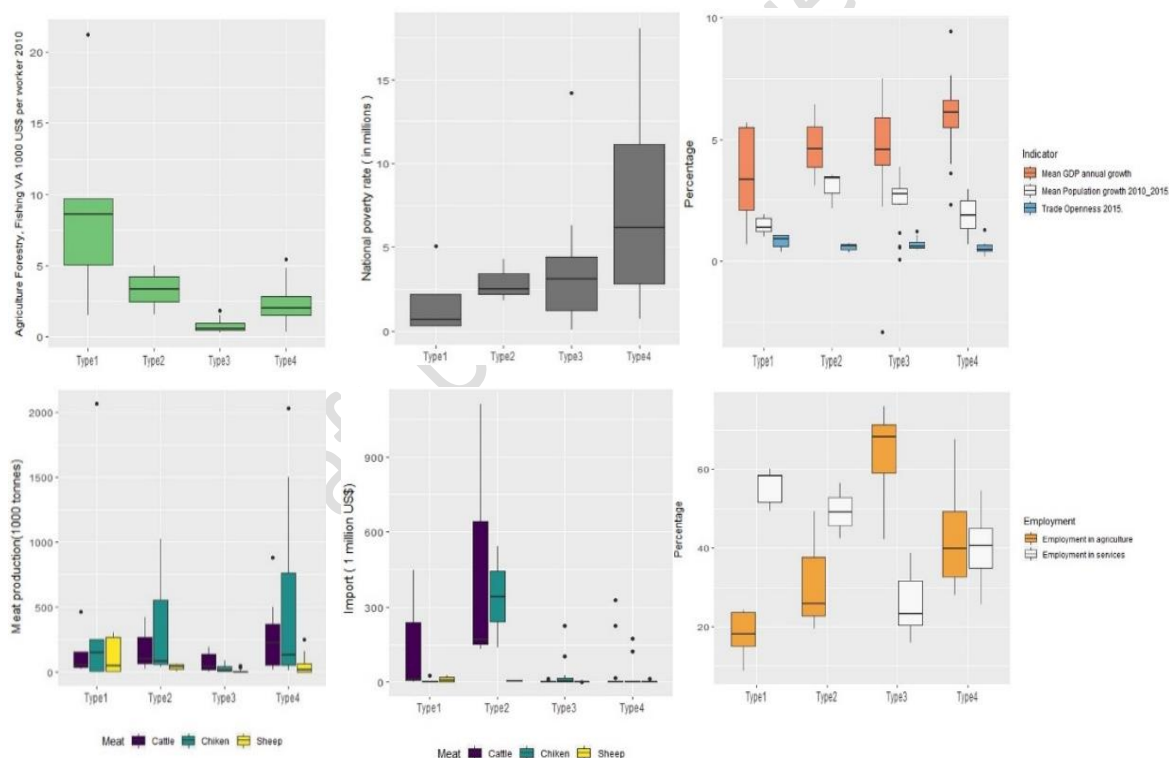

Figure 2. Major macroeconomic and livestock characteristics of the different country types generated

Livestock, employment, and food security

The second hypothesis tested in this study, in relation to the contribution of livestock to the overall employment in the economy, was also validated through the GMM panel regression. In addition to

confirming some of the already documented macroeconomic relationships (impact of trade openness, lagged labor, and population growth on employment), the panel regression results (Frija et al., Forthcoming) further document the social importance of livestock in terms of employment generation in the overall economies of low- and middle-income

countries. This result was also partly discussed in the literature (i.e., Baltenweck et al., 2020) but with persistent lack of quantitative assessment and evidence. Thus, in addition to its direct contribution, livestock can also indirectly contribute to enhance food security in the low-income countries through its economic contribution to employment generation.

Lessons learned and conclusions.

Three main conclusions can be withdrawn from this policy brief:

- There are differences across low- and middle-income countries in terms of their respective structural characteristics of livestock sectors, both in terms of production and consumption;

- Livestock development investments need to be targeted according to countries income classifications as this would result in different economic, and social impacts;

- Livestock GDP was influencing employment growth in these low-income and middle-income countries. Which further highlights the indirect relationship between livestock sectors and food security, channeled through macroeconomic relationships, especially in relation to employment generation in the whole economy, as illustrated in this study.

These results can help donor and policy makers in terms of foresight for:

- Better targeting of livestock investments and policy tailored to the economic conditions in a given country;

- Forecasts of livestock sectors structural transformations which may happen in parallel to the economic transition a country may have.

Acknowledgement

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