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Benjamin Davis, Erdgin Mane, Leman Yonca Gurbuzer, Giulia Caivano, Natalia Piedrahita, Nimra Azhar, Marwan Benali, Nidhi Chaudhary and Rodrigo Rivera
Food and Agriculture Organization of the United Nations

Kate Schneider
Paul H. Nitze School of Advanced International Studies, Johns Hopkins University

Ramya Ambikapathi
Department of Global Development, Cornell University

and

Paul Winters
Keough School of Global Affairs, University of Notre Dame

Food and Agriculture Organization of the United Nations
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Abstract

Global and national policy discourse and agendas are moving beyond traditional silos of agriculture, nutrition, health, and climate change to address the challenges facing agrifood systems (AFS). In this paper, we use international labour force statistics to provide the first systematic and documented global estimate quantifying the total number of people employed in AFS. We estimate that 1.23 billion people are employed in AFS and that 3.83 billion people worldwide live in households linked to AFS-based livelihoods. However, international labour force statistics focus on the main labour activity in the last seven days and are likely to undercount the total number of people who are engaged in AFS. Using household survey data from the harmonized multi-country Rural Livelihoods Information System (RuLIS) database, we find that the number of people engaged in AFS is on average 24 percent higher than employment defined only by the main labour activity. This analysis shows the relevance of counting secondary jobs and household farming activities to identify all individuals whose livelihoods depend to some degree on AFS.

Contents

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Abbreviations and acronyms

AFS	agrifood systems
ICLS	International Conference of Labour Statisticians
ILO	International Labour Organization
ISIC	International Standard Industrial Classification of all Economic Activities
RuLIS	Rural Livelihoods Information System

1 Introduction

Agrifood systems (AFS) encompass primary agricultural production of food and non-food products (from crops, livestock, fisheries, forestry and aquaculture), the production of food of non-agricultural origin (e.g. synthetic meat), the food supply chain from producers to consumers, and the final consumption or disposal (waste) of food (FAO, IFAD, UNICEF, WFP and WHO, 2021). Food systems provide sustenance for people and are made up of numerous actors; all humans are tied to food systems for their food, and many for their livelihoods (FAO, 2017; IFAD, 2016; OECD, 2019). Historically, agriculture has been at the centre of economic development as a driving force in the process of agricultural, rural and structural transformation. The agricultural sector remains the predominant employer of adults in low-income countries (LICs), especially through primary agricultural production, where wages and derived incomes from these activities remain low (Christiaensen *et al.*, 2021; Davis *et al.*, 2017; Townsend *et al.*, 2017).

Global and national policy discourse and agendas are moving beyond traditional silos of agriculture, nutrition, health and climate change to address challenges facing food systems (Byerlee and Fanzo, 2019; Fanzo *et al.*, 2021; Webb *et al.*, 2020). There is no greater testament to this shift than the 2021 United Nations Food Systems Summit (Kalibata, 2021). Taking a food system perspective requires looking all along food value chains and at food environments, as well as addressing issues of food security, consumer behaviour, food safety and the impacts of all food system processes on human well-being (e.g. livelihoods, health, equity) and on the environment (Fanzo *et al.*, 2020, 2021). Further, it requires identifying interactions between system components – including trade-offs that might achieve one goal (such as affordability of healthy food) – to the detriment of another, such as environmental sustainability or labour rights (Béné *et al.*, 2019; Blackstone *et al.*, 2021; Davis *et al.*, 2022; Loboguerrero *et al.*, 2019). Finally, this shift in policy attention also recognizes the fundamental role that transforming AFS must play in achieving the urgent social and environmental goals of our time, including meeting the Paris Agreement targets and the Sustainable Development Goals (Anderson, 2020; Herrero *et al.*, 2021; Lartey *et al.*, 2018; Rosenzweig *et al.*, 2020; Webb *et al.*, 2020).

Identifying and quantifying the number of AFS workers is essential for several reasons. First and foremost, as we show in this paper, in lower-income countries the largest number of workers are found in the agrifood system. Moreover, AFS transformation offers the promise of many new jobs, particularly in lower-income countries with large, young populations (Townsend *et al.*, 2017; Tschirley *et al.*, 2015; Yeboah and Jayne, 2018), though deliberate policies are needed to ensure the quantity and quality of these jobs (Christiaensen *et al.*, 2021; IFPRI, 2020). Realizing this potential – in an equitable manner with adequate human rights protections and delivering livelihoods that support well-being – requires tracking changes in the AFS workforce through the transformation process (Christiaensen *et al.*, 2021; IFPRI, 2020; Townsend *et al.*, 2017). A better understanding of the existing workforce could reveal entry points for programmes and policies to, for example, promote upskilling or entrepreneurship in service of planned transformations, and ensure their inclusive reach (Allen, 2010; Anderson, 2019; Battersby, 2017; Christiaensen *et al.*, 2021; Den Boer *et al.*, 2021; IFPRI, 2020). Subsequently, such data would enable monitoring and evaluation to assess whether policies had their intended impact and to quickly raise any unanticipated issues requiring intervention.

Second, statistics on the number of people employed in AFS would help in regulating working conditions, monitoring for violations of human rights, or developing and targeting appropriate policies and programmes (Fanzo *et al.*, 2021; Resnick, 2017). Ample evidence demonstrates a high degree of exploitation in AFS including: human trafficking, dangerous and harmful conditions, precarious job security, low wages, disproportionate burdens on women and other gender imbalances, and coercive use of child labour and other vulnerable populations (Allen, 2010; Blackstone *et al.*, 2021; Clutterbuck, 2013; Davies, 2018; Hunt, 2016; ILO and UNICEF, 2020; Limoncelli, 2017; Luo, 2021; Mileski *et al.*, 2020; Norwood, 2020; Palacios and Yamamoto, 2017).

To date, no formal statistics or other available data readily identify and quantify the people whose livelihood depends on AFS. Recent estimates of primary employment range from approximately 740 million (Fanzo *et al.*, 2021) to 1.2 billion (United Nations, 2020) to 1.3 billion (Thurlow *et al.*, forthcoming) people employed in AFS. These estimates are based on a variety of methods using a combination of International Labour Organization (ILO) statistics, national accounts and household surveys. The methodologies underlying each of these estimates have neither been published nor clearly documented.

Beyond these global estimates, a number of studies have focused on specific regions and subpopulations. Dolislager *et al.* (2021) estimate that 21–23 percent of rural employed youth work in AFS across Africa, Asia and Latin America. In West Africa, Allen *et al.* (2018) estimate that the food economy accounts for 66 percent of total employment. Further, they find that certain areas of food economy work such as processing and food vending/services are disproportionately female, with women comprising over 80 percent of workers in those sectors. In eastern and southern Africa, using household surveys from six countries, Tschirley *et al.*, (2015) estimate 83 percent of jobs are in AFS. Ambler *et al.* (2019) look across four countries in sub-Saharan Africa (Ghana, the Niger, Uganda and the United Republic of Tanzania) and find that AFS work in rural areas remains predominantly agricultural, and that AFS jobs outside agriculture remain both a small share of the total workforce and are concentrated in urban areas. Yeboah and Jayne (2018) arrive at similar conclusions across nine sub-Saharan African countries and over a longer period, concluding that agriculture remains the largest employer though its share of total employment is declining. They find that non-agriculture AFS jobs – in the subset of countries where they could be measured – account for less than 20 percent of the total number of all jobs (9–23 percent of all jobs in full-time equivalent terms).

These regional and country-level studies of AFS employment have been much more extensively documented. They use different combinations of labour force surveys, LSMS-type household surveys,[1] ILO cross-country statistics and national accounts, as well as different methodologies. First, the studies use different classifications of activities within food systems or AFS, owing to the level of subsector detail in the data as well as choices about whether to include non-food agricultural products (e.g. cotton, tobacco) or value-chain segments where food and non-food activities cannot be disaggregated (e.g. retail, transportation). Second, some studies use worker counts while others consider hours worked and use full-time equivalents. Third, many consider – or only have data relating to – a primary job, while some incorporate additional jobs as well. As detailed in these studies, identifying and quantifying AFS workers is not a straightforward task – see in particular Ambler *et al.* (2019) and Resnick (2017).

[1] Living Standards Measurement Study (LSMS) surveys are nationally representative multitopic household surveys typically carried out by national statistical offices with support from the World Bank. See World Bank (2022) for further details.

In this paper, we demonstrate an approach to identifying individuals working in AFS using an operational definition based on the International Standard Industrial Classification of all economic activities (ISIC) (United Nations, 2008).[2, 3] ISIC 2-digit codes are the minimum disaggregation necessary to identify employment in AFS. The ILO has the global mandate to produce employment statistics, and thus is the natural point of departure for this study. Thus, we start with official labour statistics and then use an econometric model to impute missing data to arrive at an estimate of the number of people employed in AFS. This is likely an undercount, however, given that it only accounts for the main job a person held in the seven days prior to survey. We then explore the implications of counting additional jobs and including longer recall periods, using household surveys for the 18 countries where the data are available to do so. We also use the data available in household surveys to understand the nature of individuals engaged in AFS by exploring socioeconomic and demographic characteristics within and across countries. Then, since individuals can have multiple jobs across different economic sectors or within the same sector, we compare how the number of jobs in AFS aligns with the number of workers in the sector, and we observe whether individuals with multiple jobs work in the same sector or across different sectors. Finally, we estimate the number of people globally who rely on livelihoods based at least in part on AFS employment.

In Box 1, we highlight the data challenges we address in this paper as well as those challenges that we are still unable to address.

Our paper adds to the existing literature in three ways. First, our analysis provides a systematic and documented global estimate quantifying the total number of people employed in AFS. Second, it explores the nature of AFS work over more countries and geographic regions than prior efforts. Finally, it offers a systematic set of methods that can be built upon to further refine and account for people's involvement in AFS employment and begin to better understand their livelihoods and welfare outcomes. These methods can be combined and compared with other approaches such as those based on national accounts and time use data, which can be used to estimate labour value added and productivity, complementing our approach in the identification of workers and the quantification of jobs.

[2] Economic activity refers to the main activity of the establishment in which a person worked during the reference period and does not depend on the specific duties or functions of the person's job, but on the characteristics of the economic unit in which this person works.

[3] The ISIC is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. The original version of ISIC was adopted in 1948, and it has been revised four times since then: in 1968 (ISIC Rev.2), in 1990 (ISIC Rev.3) and in 2008 (ISIC Rev.4). An updated version of the ISIC Rev.3 was introduced in 2002 to account for substantial changes in many countries' economic structure (ISIC Rev.3.1) (United Nations, 2008).

Box 1. Why is it difficult to identify and quantify agrifood systems workers?

This paper attempts to address the following challenges in accounting for AFS workers:

- Coverage: Official labour statistics are not available for all countries, all years, or at a useful level of detail to identify AFS workers.
- Multiple jobs: Many people hold multiple jobs, but labour statistics typically only ask about primary and sometimes secondary jobs. Many people are engaged in some farming activities and hold other jobs at the same time outside of agriculture or have other income sources. Some of these people may not be captured in the surveys when a direct question on engagement in household farming is missing and if these activities are not considered their primary job by the respondent.
- Seasonality: Standard labour modules will miss activities that occur outside of the last seven days. Even where longer reference periods and national statistical organization sampling procedures are used, they risk missing activities due to recall bias.
- AFS tasks in transportation and trade: Many jobs in the trade and transport sectors involve AFS tasks but are classified by the nature of the items traded and transported. Further, any worker may interact with a combination of AFS and non-AFS goods, such as truck drivers and other transportation workers who move agrifood products and unrelated goods. In wholesale and retail, some jobs will be mixed (e.g. "big box" stores), dedicated AFS (e.g. grocery value chains), while many will not interact with AFS at all. The workers in these sectors who do AFS tasks will be missed in AFS calculations relying on the ISIC classification exclusively.
- Sampling: Sample surveys, such as labour force surveys, which are typically used to collect, compute and disseminate the number of people employed in different economic activities may not be fully designed to capture the number of employed people at the disaggregated ISIC 2-digit level of detail. As a result, they capture only a small number of observations in certain categories. Although sample surveys are designed to minimize and control for these types of biases, some level of bias may occur. Therefore, in some countries, the national statistics offices collect the number of people employed at the ISIC 2-digit level but only publish the employment statistics by broad economic activities.

Some limitations we cannot address with ISIC 2-digit codes or data adhering to official labour statistics standards:

- Food and non-food crops are combined: ISIC 2-digit codes do not allow for differentiation by agricultural crop grown, so cotton and tobacco farmers, for instance, cannot be isolated from farmers who grow food. Though this is not of concern for AFS estimates, it is relevant for exercises where distinguishing food from non-food agriculture is of interest.
- Periodic revision of ISIC codes: While ISIC codes are periodically revised, historical datasets are not recoded so additional work is needed to merge datasets produced under different classification schemes. Furthermore, ISIC codes are available at multiple levels of detail (described by the number of digits), but the most detailed coding (four digits and more) is not available for most countries.

2 Methodology

2.1 Defining agrifood systems

AFS are the combination of agriculture, forestry and fishing, the manufacture of products derived thereof, and all other aspects of food systems beyond production and manufacturing. The agricultural sector includes all work activities involved in agricultural production – including on-farm activities related to growing crops and raising livestock, fishing, aquaculture, forestry, logging foraging, and hunting. Food systems encompass these activities of food production, but more broadly refer to all of the people, institutions, infrastructure and environment related to the production, processing, distribution, preparation and consumption of food (Fanzo *et al.*, 2020; HLPE, 2017). AFS also include the production and manufacture of non-food agricultural goods – such as forest-derived products (e.g. lumber, paper), fibres and tobacco.

To go beyond the agriculture, forestry and logging, and fishing sectors and account for all the people employed in AFS, we develop an operational definition to classify individuals that are employed in AFS based on ISIC codes at the 2-digit level. This is the minimum level needed to identify AFS workers, although with limitations such as the exclusion of people employed in trade and transport sectors as described in Box 1. Although more detailed ISIC codes would give more precise estimates, the review of existing data sources and household surveys shows that data coverage becomes much more limited with each additional digit level of coding. At the ISIC 2-digit level, we can identify AFS by the following ISIC codes and divisions shown in Table 1.

Table 1. ISIC codes identifying agrifood systems

Categories	ISIC divisions	ISIC codes – Rev.4	ISIC codes – Rev.3
Agriculture, forestry and fishing	Agriculture	01	01
	Forestry and logging	02	02
	Fishing	03	05
Food processing and services	Manufacture of food products	10	15
	Manufacture of beverages	11	
	Food and beverage service activities	56	
	Undifferentiated goods- and services-producing activities of private households for own use	98	96
Manufacture of non-food agricultural products	Manufacture of tobacco products	12	16
	Manufacture of textiles	13	17
	Manufacture of leather and related products	15	19
	Manufacture of wood and of products from wood and cork, except furniture	16	20
	Manufacture of paper and paper products	17	21

Source: Authors' own elaboration.

To allocate labour between AFS and non-AFS employment in the trade and transportation sectors (Table 2), we need to find a proxy measure. Several alternatives have been proposed in the literature referenced above. Thurlow *et al.* (forthcoming) allocate labour in and out of AFS by using the share of AFS

in gross domestic product (GDP) derived from their global model and using national accounts data. Others, such as Tschirley *et al.* (2015) use the average share of food in total household consumption in a given context using household survey data. Instead of making assumptions, Ambler *et al.* (2019) calculate the minimum and maximum possible employment in AFS, using zero and 100 percent AFS in trade and transport. Another potential approach is the methodology under development by FAO, the United States Department of Agriculture and Cornell University under the Global Food Dollar (GFD) initiative, which estimates the distribution of final consumer dollars spent that accrues to farmers and post-farm-gate value chains, using input-output table data. The GFD methodology is based on the System of National Accounts and the United Nations' related System of Environmental-Economic Accounting, and allows for internationally comparable metrics on the food value chains, disaggregated by commodity group (e.g. cereals, meat, dairy products) and industry decomposition. Some indicators are reported in the newly established FAOSTAT domain on food value chains.[4]

To address this issue, we proxy the share of trade and transportation sectors by multiplying overall employment in trade and transportation by the share of AFS in total employment not including trade and transportation – in essence assuming that the share of trade and transportation in AFS mirrors the overall share of AFS in total employment.

Table 2. ISIC codes identifying trade and transportation sectors

ISIC Code	Description
Trade	**Wholesale and retail trade; repair of motor vehicles and motorcycles**
46	Wholesale trade, except of motor vehicles and motorcycles
47	Retail trade, except of motor vehicles and motorcycles
Transportation	**Transportation and storage**
49	Land transport and transport via pipelines
50	Water transport
51	Air transport
52	Warehousing and support activities for transportation
53	Postal and courier activities

Note: For ISIC code 46, we include activities when 4-digit codes are available and relevant to our definition of AFS employment. For example, the 4-digit level codes 4620, 4630, and 4653 relate to the wholesale of agricultural raw material and live animals, wholesale of food, beverages and tobacco, and wholesale of agricultural machinery, equipment and supplies, and are used accordingly when they are available in Section 4.
Source: Authors' own elaboration.

2.2 Defining employment and engagement

Employment

The ILO has an international mandate to define and measure employment around the world. The official ILO definition of employment is all persons of working age who, during a specified brief period (e.g. one week or one day) were: a) in paid employment (at work or with a job but not at work); or b) self-employed

[4] Available at https://www.fao.org/faostat/en/#data/GFDI

(at work or with an enterprise but not at work). The working-age population is defined as the population above the legal working age, which varies from country to country based on national laws and practices. For international comparability, we follow convention in defining the working-age population as all persons aged 15 and older. Official labour statistics classify the employed population only by their main job in the last seven days, defined as the activity in which they spent the largest amount of time. A recent resolution by the International Conference of Labour Statisticians (ICLS) (adopted by the 19th ICLS in 2013) removed the category of own-use production from the definition of employment (International Conference of Labour Statisticians, 2013), meaning that smallholder farmers, herders or fisherfolk whose main activity is producing (or hunting/gathering) food for their own consumption are excluded from those considered employed. Only some countries have already implemented this new measurement of employment, which is clearly documented but nonetheless reduces the comparability of ILOSTAT data across countries and over time.

Employed individuals are categorized by economic activity according to the ISIC classification and where the category is defined by the main activity of the establishment in which they worked during the reference period. In other words, economic activity does not depend on the specific duties or functions of the person's job, but rather on the characteristics of the establishment in which the person works. This feature of labour statistics poses a challenge to accounting for all AFS workers (as described in Box 1).

Engagement

In official employment statistics, individuals holding multiple jobs are only counted in the job where they spent the most time during the last seven days, and therefore are only classified in one category of economic activity. For instance, a teacher who works 30 hours per week at school and who spends 15 hours per week growing and selling vegetables on their land will be captured only in the education sector. Therefore, their contribution to AFS through work in agriculture as a secondary job will not be recognized in the official labour statistics. Further, given the seasonality of agriculture, short reference periods will be more likely to miss agricultural workers when surveys are implemented outside of the peak season for agricultural labour. However, this risk is partially mitigated by the inclusion of those who are temporarily not working, including seasonal workers.

Given these limitations of official statistics to account for all people who labour in AFS, in this paper we utilize a broader concept of "engagement" to identify additional people who hold non-primary jobs in AFS or whose main work is for own consumption and therefore would not be counted as employed in AFS according to official statistics. To do so, we take advantage of additional information available in household survey data, which capture three additional groups of people who work in AFS in roles unaccounted for in the official employment statistics. First, engagement includes all people holding multiple jobs (main, second and third or fourth whenever available) in AFS. Second, it includes people who perform household farming activities – any on-farm work including cropping, livestock or fishing activities carried out for sale and/or for household consumption. Third, it includes both a 7-day and a 12-month recall period (and any other recall period if available), potentially better capturing seasonal or intermittent work. Engagement in AFS then corresponds to the number of people involved throughout the year in the different activities – jobs or household farming activities – in the subsectors detailed in Table 1.

3 Data

We use two main sources of data in this analysis. ILOSTAT, which has broad country-level coverage, serves as the foundation for our estimate of AFS employment. We then use detailed country-level household survey data to better understand the limits of ILOSTAT (detailed above), as well as to link AFS employment to household-level socioeconomic and demographic characteristics. While the household surveys provide much more detailed information, the number of countries covered is far lower and data collected differ across countries, at times limiting comparability.

3.1 ILOSTAT database and FAO econometric model to fill in the data gaps

Countries report official labour statistics to the ILO, which are made publicly available in the ILOSTAT database as an indicator of employment by economic activity, age and gender (ILO, 2022a and 2022b). The dataset spans from 1992 to 2021 and covers 120 countries with at least one data point during the 2000–2020 period, disaggregated by gender. Depending on the survey year, some of the data are classified using the most recent ISIC Rev.4, however older data are classified by ISIC Rev.3.1. We also use the ILO modelled estimates[5] that fill in gaps in reported data (that exist overall or for a given year). These estimates are based on a series of econometric models used to estimate employment indicators when unavailable. However, the modelled estimates are insufficient to account for AFS workers because they are only disaggregated by broad sectors (e.g. agriculture, manufacturing and services) rather than at the detailed ISIC 2-digit level.

Since the ILO modelled estimates cannot be used to identify AFS workers, we impute employment in non-agricultural AFS for missing country–years with an econometric model to fill in the missing countries and complete the time series for a given country. First, we group employment in AFS into two categories: agriculture and all other non-agricultural AFS employment (including both food processing and services and the manufacture of non-food agricultural products). Second, we estimate a regression model to predict non-agricultural AFS employment for country–years where it is missing. The following is a description of the process step by step.

We first construct employment variables using ILOSTAT data as defined in Table 3. Agrifood systems employment (afs) is the sum of employment in agriculture (agr), food processing and service (fsy) and manufacture of non-food agricultural products (frel).

[5] The ILO modelled estimates consist of annual projections based on vector error correction models. These annual projections are the average of two projections estimated by two different models. In the first model, the dependent variables are the change in the unemployment rate, the employment-to-population ratio and the labour force participation rate. The independent variables are the lag of the respective variable, GDP growth and the lagged value of the change in one of the other variables. The second model utilizes the hours worked per employed person, and the hours worked as a ratio of the labour force. More detailed information on the methodology used to produce the ILO modelled estimates is available here.

Table 3. Definition of agrifood systems employment variables

Total AFS employment (afs) is composed of	Definition	ISIC codes
Agriculture (agr)	Agriculture + forestry + fishing	ISIC codes 01–03 revision 4
Food processing and service (fsy)	Manufacture of food products + manufacture of beverages + food and beverage service activities + undifferentiated goods- and services-producing activities of private households for own use	ISIC codes 10, 11, 56, 98 revision 4
Manufacture of non-food agricultural products (frel)	Manufacture of tobacco products + manufacture of textiles + manufacture of leather and related products + manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials + manufacture of paper and paper products	ISIC codes 12, 13, 15–17 revision 4

Source: Authors' own elaboration.

The United Nations correspondence table was used to convert ISIC Rev.3.1 codes to ISIC Rev.4 categories to create the set of employment variables. ILO modelled statistics were then used to generate agricultural employment, other employment, and total employment. If the difference between modelled and Rev.3.1 or Rev.4 data was greater than 50 percent, the modelled estimates were kept. Often, this occurred when there were no data available for categories such as fisheries or forestry, or there was a change in methodology. If the differences between the modelled estimates and Rev.3.1 or Rev.4 were lower than 50 percent, estimates from Rev.3.1 or Rev.4 were kept. However, if the year was after 2016 and the difference was between 20 and 50 percent, the numbers were checked individually to determine which data point to keep. This was done because, starting in 2016, several countries began using the new ICLS resolution to define employment, which excludes people whose work was performed for own-use production, and therefore may not be comparable with estimates from previous years. We then used a linear trend to impute values for the three employment variables for missing years in between years with data. We incorporated additional indicators into the dataset from the World Development indicators and FAOSTAT that were used in the econometric model, further described below.

Finally, we developed a model to predict non-agricultural food system employment for those countries that did not have any recent data. The dependent variable was defined as:

$$y_{it} = \frac{fsy_{it} + frel_{it}}{agr_{it}}$$

Where:

fsy is food processing and service employment in country *i* in year *t.*
frel is manufacture of non-food agricultural products employment in country *i* in year *t.*
agr is agriculture employment in country *i* in year *t.*

We then regress:

$$\ln(y_{it}) = \alpha + \beta_1 share\ ag\ employ_{it} + \beta_2 urban\ pop\ share_{it} + \beta_3 \ln(gdp\ per\ capita_{it}) + \beta_4 share\ ag\ gdp_{it} + \boldsymbol{\gamma_t YEAR_t} + \delta_i + \epsilon_{it}$$

Where:

$$share\ ag\ employ_{it} = \frac{agricultural\ employment_{it}}{total\ employment_{it}}$$

$urban\ pop\ share_{it}$ refers to the share of the population living in urban areas in country *i* in year *t.*

$gdp\ per\ capita_{it}$ refers to country *i*'s GDP per capita in PPP in year *t.*

$share\ ag\ gdp_{it}$ is the share of agriculture value added in total GDP in country *i* in year *t.*

δ_i refers to country fixed effects

$\boldsymbol{Year_t}$ is a vector of years.

We predict $\hat{y}_{it}$, and multiply $\widehat{y_{it}}$ by $agr_{it}$to obtain non-agricultural food systems employment for countries with ILOSTAT modelled data. Table 4 below shows the source of the data for each country–year combination.

Table 4. Global non-agricultural food systems employment by data source

Year	Data source			Total
	ILO	Interpolated values	Modelled	
2000	35	0	130	165
2001	38	2	127	167
2002	37	7	125	169
2003	41	6	123	170
2004	43	7	120	170
2005	50	6	115	171
2006	53	8	113	174
2007	53	11	110	174
2008	56	13	107	176
2009	62	10	105	177
2010	64	12	101	177
2011	68	11	98	177
2012	71	14	92	177
2013	76	11	92	179
2014	78	16	87	181
2015	74	17	90	181
2016	78	14	88	180
2017	80	7	90	177
2018	77	9	90	176
2019	77	7	94	178
2020	64	2	106	172

Note: Data for China come from the Chinese Academy of Agricultural Sciences and the Zhang and Diao (2020) study, which estimates the share of AFS in total employment and includes the trade and transportation sectors. The employment data used by Zhang and Diao (2020) is official data from the China Statistical Yearbook by the National Bureau of Statistics.
Source: Authors' own elaboration.

3.2 Bringing in trade and transportation

We next estimate the share of trade and transport employment in AFS using a multiplier based on the share of AFS employment in the total economy. Specifically, where ILOSTAT data are available at the ISIC 2-digit level, we first subtract the trade and transportation sectors from the total employment in the economy. We then calculate the share of AFS in this modified measure of total employment that excludes the trade and transportation sectors. Last, we multiply total trade and transportation employment by this share of AFS to obtain the amount of trade and transportation employment in AFS.

For countries with only modelled estimates, we impute using the method described in Section 3.1. For China, we use data provided directly by the Chinese Academy of Agricultural Sciences (CAAS), following the methodology defined in Zhang and Diao (2020).[6]

3.3 Household surveys: RuLIS database

The Rural Livelihoods Information System (RuLIS) database compiles processed microdata from publicly available household surveys with the purpose of harmonizing indicators and data on different topics including employment.[7] The RuLIS database currently includes data for 39 countries (72 surveys) with increasing country and time coverage as more microdata become available. These datasets contain information on multiple jobs, engagement in household farming, and cover different (including longer) reference periods (e.g. 7 days and 12 months), hence enabling the estimation of the number of people engaged in AFS as described in Section 2.2. We selected a group of countries where the survey data include main and secondary jobs associated by economic activities,[8] and household farming activities for the recall periods available in the surveys. As a result, the measurement of engagement in AFS could be implemented in 18 countries,[9] using a total of 35 household surveys.[10]

While household surveys can capture multiple jobs and better account for seasonality and intermittent labour, the information collected varies across countries and years.[11] The key elements that vary across surveys include: 1) the number of jobs for which data are collected; 2) whether an indicator of participation in household farming is collected; 3) the reference period over which questions are asked (usually 7 days, 12 months, or both); 4) whether economic activities (used to assign ISIC codes) are asked of non-wage workers or only of wage workers; and 5) which revision of ISIC coding is used and at what level of detail. Although these differences reflect country priorities and allow for rich context-specific detail, the differences mean that a uniform methodology cannot be used across countries. While this is the case, it still allows us to approximate engagement in AFS and to compare with the numbers from the narrower official statistics definition of employment.

[6] All ILO data for China were based on modelled estimates. Since our econometric model appeared to underpredict the number of people employed in AFS, we used data provided by the Chinese Academy of Agricultural Sciences and Zhang and Diao (2020).
[7] RuLIS is available at http://www.fao.org/in-action/rural-livelihoods-dataset-rulis/en/.
[8] In Nigeria 2013 and 2016, as the ISIC codes were not available, International Standard Classification of Occupations (ISCO) codes referring to the occupation are used to classify the people engaged in AFS.
[9] Benin, Bolivia (Plurinational State of), Burkina Faso, Côte d'Ivoire, Georgia, Guatemala, Guinea-Bissau, Malawi, Mali, Mozambique, the Niger, Nigeria, Peru, Senegal, Sierra Leone, Togo, Uganda, the United Republic of Tanzania.
[10] Please see Table 1 in Annex I for the full list of surveys and available variables used to define all engagement.
[11] For further information on the available variables that are used for the computation of engagement in each survey, please refer to Table 2 in Annex I.

4 Results

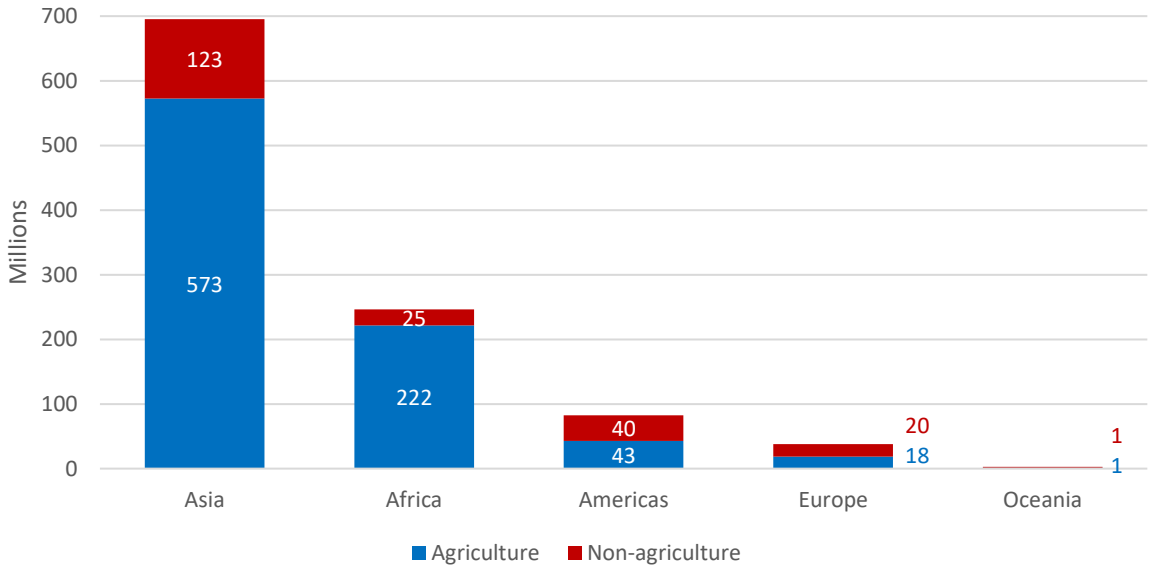
4.1 FAO model: employment in agrifood systems

We provide four sets of results. We estimate total global employment (main job) in AFS for 2019 first without and then with employment in trade and transportation. We also report total employment in AFS for 2020 that captures the initial strongly negative impact of COVID-19 on employment. We focus on the 2019 results given that they more likely represent the long-term trend of employment and AFS. This is also justified by the fact that ILO-estimated trends expect total employment to bounce back in 2021 (ILO, 2022c).

Figure 1 shows our resulting estimate of total global employment (main job) in AFS for 2019 without trade and transportation. We estimate that 857 million people were employed in agriculture[12] and another 208 million people in non-agricultural AFS jobs, for a total of 1.06 billion people employed in AFS in 2019. The largest number of people employed in AFS (695 million) is in Asia, followed by almost 250 million in Africa.

Figure 2 presents employment in AFS as a share of total employment. AFS represents 53 percent of total employment in Africa and 35 percent in Asia, with agriculture making up the largest part of AFS in both regions (48 percent and 29 percent, respectively). In contrast, in the Americas, Europe and Oceania, the shares of employment in agriculture and non-agricultural segments of AFS are roughly similar although the total share in AFS share is higher in the Americas (17.9 percent) than the other regions.

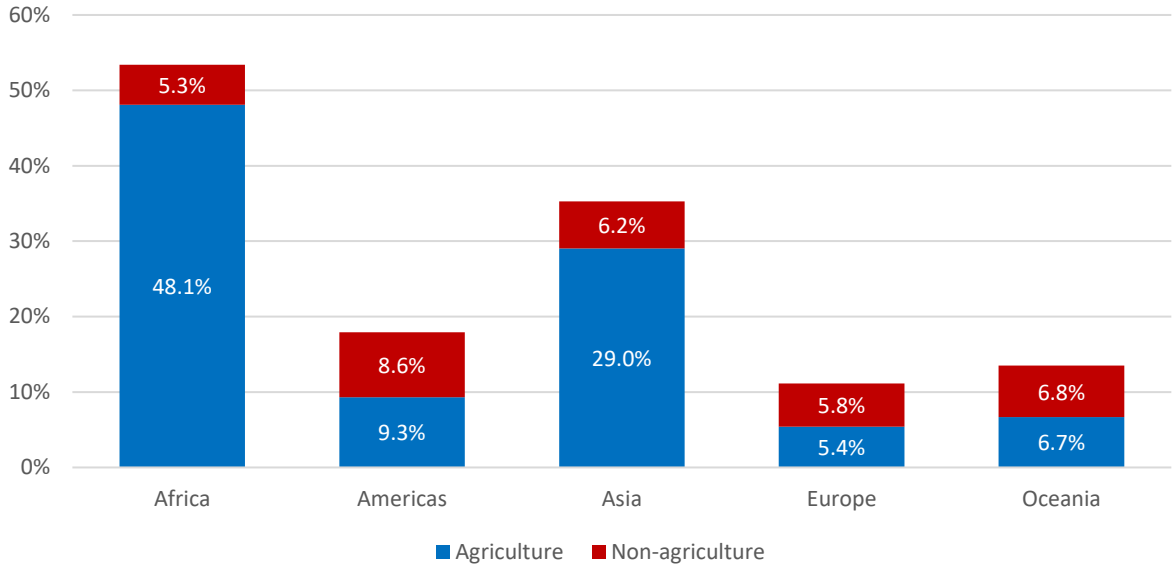
Figure 1. Employment in agrifood systems by region in 2019



Source: Authors' own elaboration.

[12] For comparison, the ILO estimates that 787 823 599 people were employed in agriculture, including forestry and fishing (ILOSTAT data and ILO modelled estimates), slightly lower than our estimate that adds data from China.

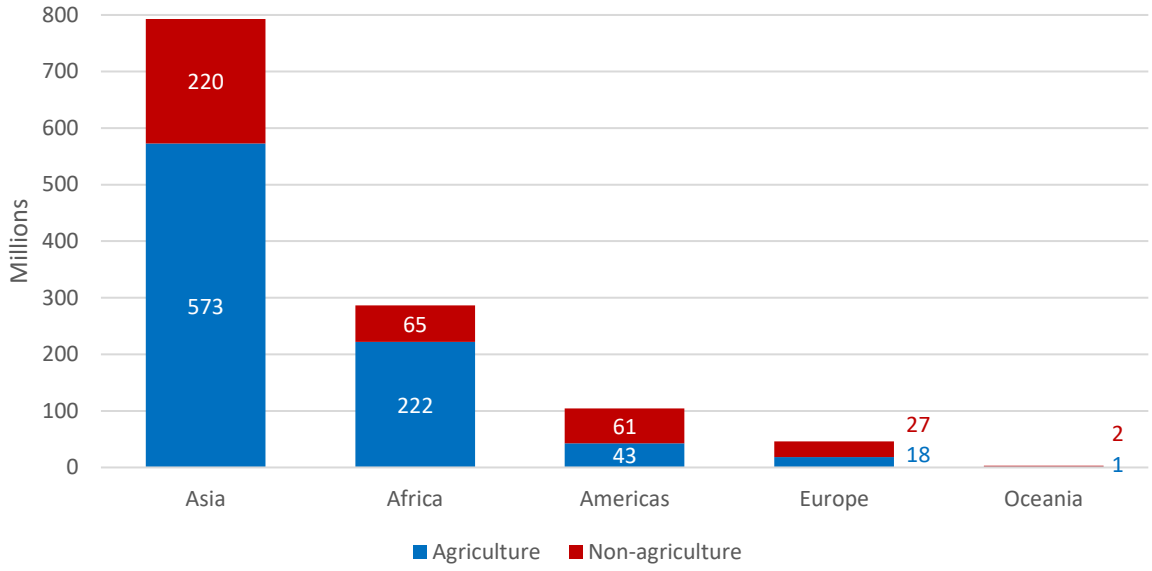
Figure 2. Share of employment in agrifood systems in total employment by region in 2019



Source: Authors' own elaboration.

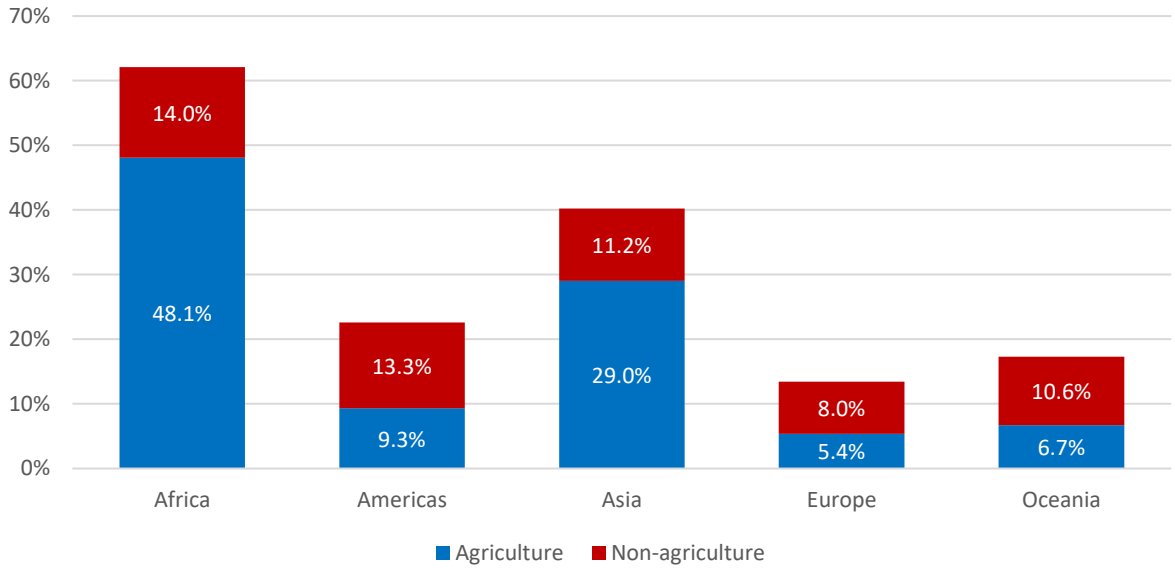
The estimates in Figures 1 and 2 do not consider trade and transport as AFS employment and thus are a lower-bound estimate of total AFS employment. Using the previously described approach, Figure 3 incorporates trade and transport in the AFS employment estimate. While the estimate of employment in agriculture, including forestry and fishery, remains the same, the number employed in non-agricultural AFS jobs increases to 375 million, making total employment in AFS rise to 1.23 billion people. While the importance of non-agricultural AFS jobs in total employment increases across regions, the inclusion of trade and transportation has the biggest impact in Africa, where the share of non-agricultural jobs in AFS goes from 5 percent to 14 percent (Figure 4). Across all regions non-agricultural AFS employment ranges from 8 percent in Europe to 14 percent in Africa. Total AFS employment in Africa stands at 62 percent, compared to 40 percent in Asia and 23 percent in the Americas.

Figure 3. Employment in agrifood systems by region in 2019, including trade and transport



Source: Authors' own elaboration.

Figure 4. Share of employment in agrifood systems in total employment by region in 2019, including trade and transport



Source: Authors' own elaboration.

These results compare favourably to other recent estimations. Thurlow *et al.* (forthcoming) use ILO modelled estimates, national accounts data, and imputation to estimate that 1.3 billion people were employed in AFS globally in 2019. Their estimate of those employed in agriculture (883 million) is similar to ours (877 million), while the additional people in non-agricultural areas of AFS (457 million) is higher. The United Nations (2020) arrived at a similar estimate of direct employment in AFS of 1.28 billion people

in 2020, of whom 716 million are in primary production. Fanzo *et al.* (2021) used a combination of ILO and national statistics for Europe and China and ISIC 2-digit level codes to estimate that 734 million people are employed in food systems, excluding non-food agriculture and manufacturing but including retail to capture food retail, making these numbers a less appropriate comparison for our estimates.

Table 5 shows the impact of COVID-19 on employment. Including trade and transportation, overall global AFS employment fell 6.8 percent, from 1.23 billion to 1.15 billion people. The decrease was greatest in non-agricultural employment (11.5 percent). The reduction was most severe in the Americas in both agricultural employment (16.1 percent) and non-agricultural employment (20.7 percent). The changes are similar using the estimates excluding the trade and transportation sectors.

Table 5. Change in employment in agrifood systems between 2019 and 2020

Without trade and transportation

Region	Agriculture AFS employment			Non-agriculture AFS employment			Total AFS employment		
	2019	2020	Change	2019	2020	Change	2019	2020	Change
Africa	221 741	217 870	-1.8%	24 536	23 237	-5.4%	246 277	241 107	-2.1%
Americas	42 937	36 539	-16.1%	39 603	32 201	-20.6%	82 540	68 740	-18.2%
Asia	572 713	542 792	-5.4%	122 543	107 262	-13.3%	695 256	650 054	-6.7%
Europe	18 429	18 125	-1.7%	19 696	18 565	-5.9%	38 125	36 690	-3.8%
Oceania	1 287	1 293	0.5%	1 310	1 153	-12.8%	2 597	2 446	-6.0%
Total	857 107	816 619	-4.8%	207 688	182 419	-13.0%	1 064 795	999 038	-6.4%

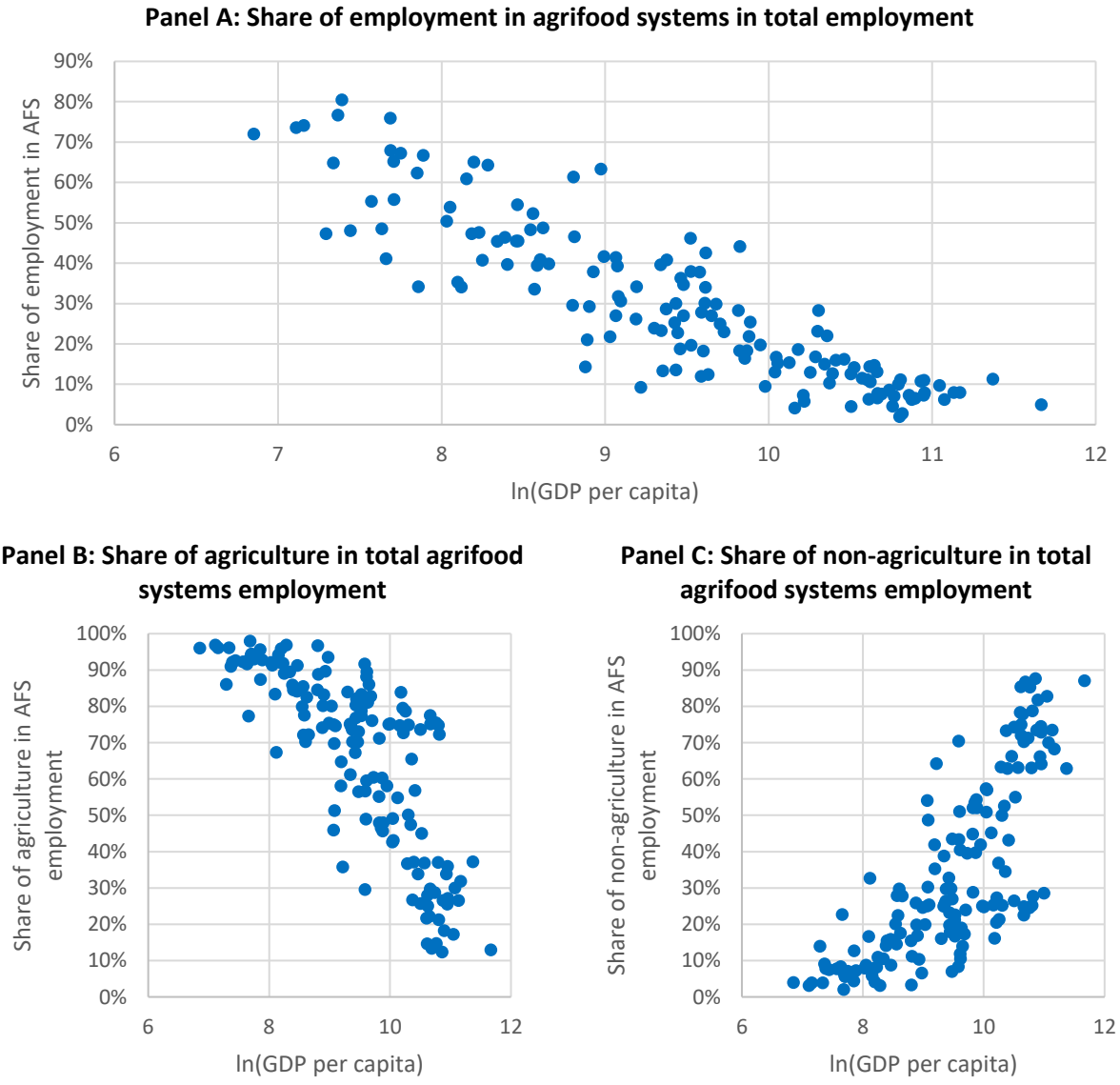
With trade and transportation

Region	Agriculture AFS employment			Non-agriculture AFS employment			Total AFS employment		
	2019	2020	Change	2019	2020	Change	2019	2020	Change
Africa	221 741	217 870	-1.8%	64 552	61 547	-4.8%	286 293	279 417	-2.4%
Americas	42 937	36 539	-16.1%	61 169	49 675	-20.7%	104 106	86 214	-18.8%
Asia	572 713	542 792	-5.4%	219 932	195 191	-11.9%	792 645	737 983	-7.1%
Europe	18 429	18 125	-1.7%	27 481	26 036	-5.4%	45 910	44 161	-3.9%
Oceania	1 287	1 293	0.5%	2 040	1 855	-9.5%	3 327	3 148	-5.5%
Total	857 107	816 619	-4.8%	375 175	334 305	-11.5%	1 232 282	1 150 924	-6.8%

Source: Authors' own elaboration.

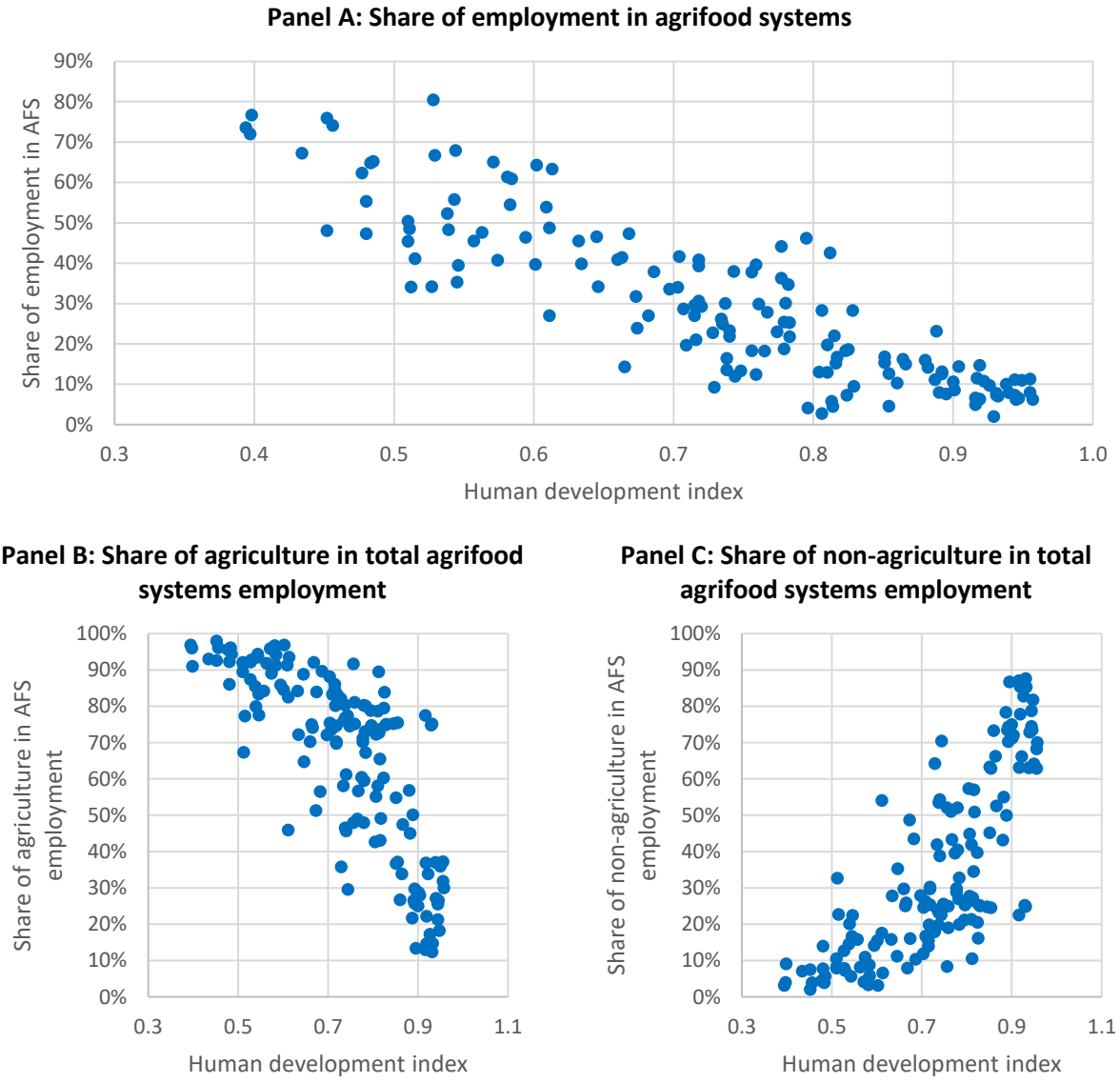
Figure 5 shows that as we move from low-income to high-income countries, using the 2019 estimates without trade and transportation, the share of total employment in AFS decreases (panel A). This is driven primarily by a reduction in employment in agriculture, consistent with processes of structural transformation (panel B). Within AFS employment, countries with higher GDP per capita have a much smaller share of the AFS workforce in agriculture, and a larger share in non-agricultural employment in food processing and services (panels B and C). Figure 6 shows similar trends using the human development index (HDI) instead of GDP per capita.

Figure 5. Share of employment in agrifood systems, agriculture and non-agriculture in agrifood systems vs GDP per capita in 2019



Source: Authors' own elaboration.

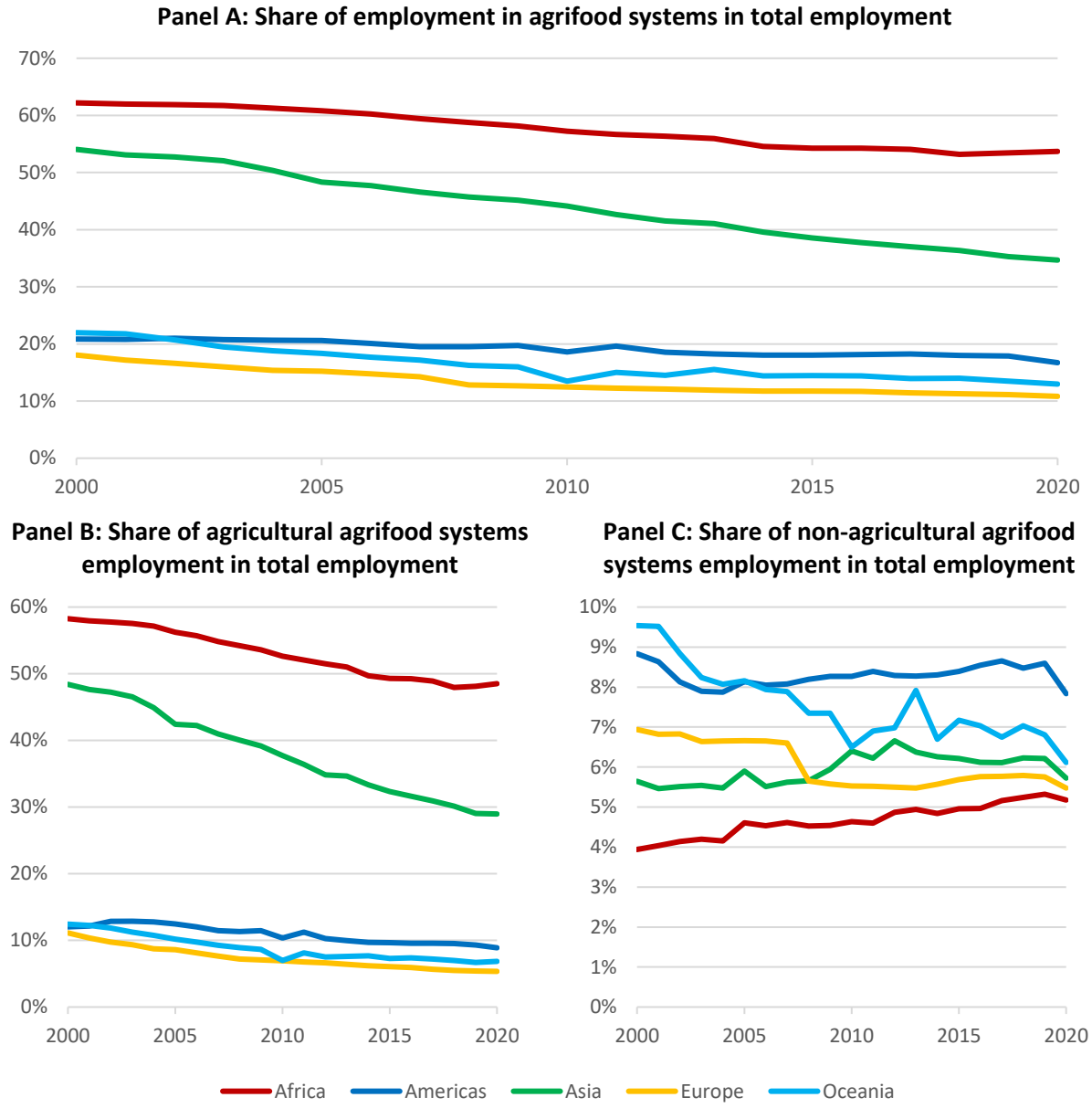
Figure 6. Share of employment in agrifood systems, agriculture and non-agriculture in agrifood systems vs the human development index in 2019



Source: Authors' own elaboration.

Figure 7 (panel A) shows that across regions over time, the share of employment in AFS has been declining, driven by a decrease in the share of people employed in agriculture (panel B). The share of those employed in non-agricultural AFS remains relatively low as a share of total employment (panel C). Relative to all AFS employment, the share of agriculture has been declining, though at a slow pace (Figure 8, panel A), while that of non-agricultural AFS has been increasing over time (Figure 8, panel B).

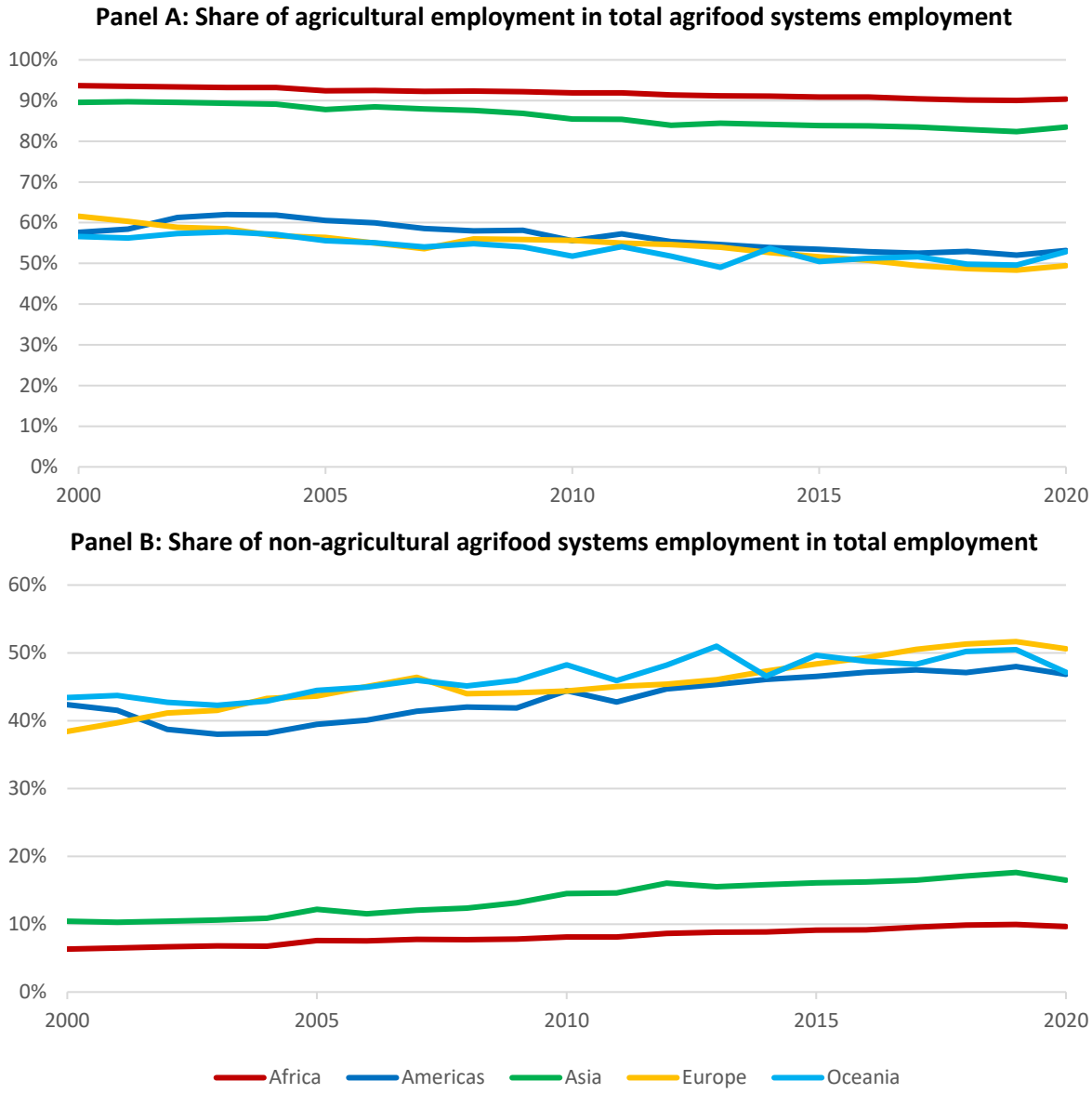
Figure 7. Share of employment in agrifood systems in total employment by region



Note: Values for China were imputed using the 2018 value (which is the only data point available) and the percentage change predicted from the regression model.

Source: Authors' own elaboration.

Figure 8. Share of agricultural and non-agricultural employment in total agrifood systems employment by region



Source: Authors' own elaboration.

4.2 Household surveys: employment and engagement in agrifood systems

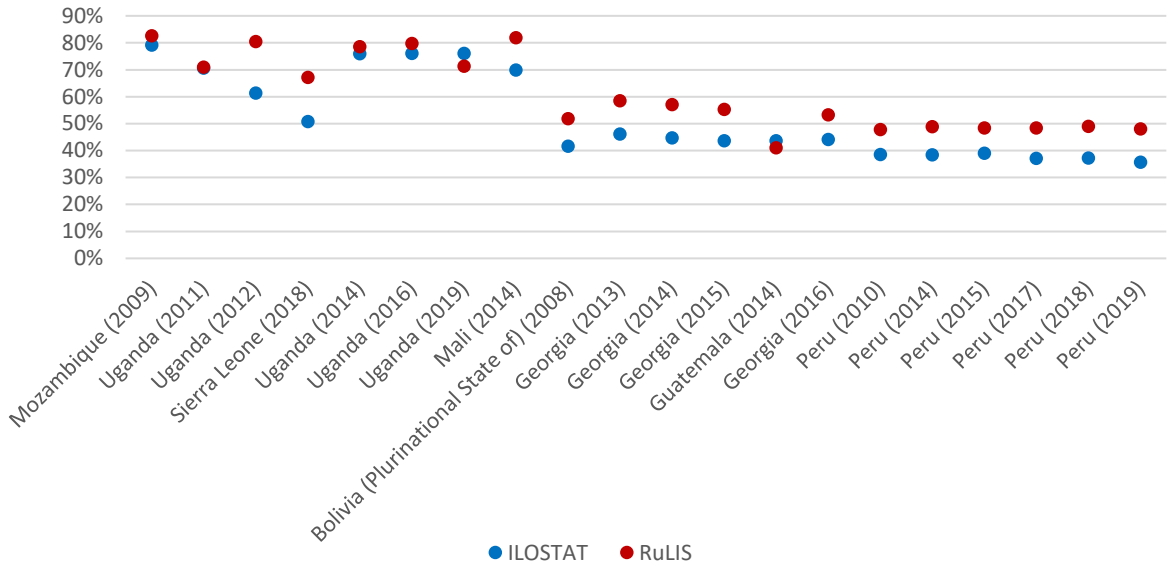
In this section, we validate our AFS employment numbers using the household survey data found in the RuLIS database. We construct employment using the ILOSTAT definition. We then construct engagement in AFS using the RuLIS database and compare with the employment numbers estimated above.

4.2.1 Measuring employment in agrifood systems using household surveys

To assess how a household survey approach to estimating AFS employment compares with official ILOSTAT data used above, we repeat the exercise of quantifying AFS employment using the RuLIS

database.[13] This also provides a baseline comparison of the same indicator (employment) against which engagement can subsequently be compared. Figure 9 shows the share of AFS employment using the two approaches across countries ordered by GDP per capita, increasing from left to right. We find that the RuLIS data result in a higher share of people employed in AFS in most, but not all, countries.

Figure 9. Share of employment in agrifood systems in total employment comparing RuLIS and ILOSTAT



Note: The employment in AFS is calculated as the sum of the three sub-sectors of AFS using ISIC 2-digit level codes. The sources of data are i) ILO Statistics ISIC Rev.4 used for Guatemala (2014), Mali (2014), Peru (2010, 2014, 2015, 2017, 2018, 2019), Sierra Leone (2018), Uganda (2012); ii) ILO Statistics ISIC Rev.3.1 used for Bolivia (Plurinational State of) (2008), Georgia (2013, 2014, 2015, 2016), iii) the FAO model described above used for Mozambique (2009) and Uganda (2011, 2014, 2016, 2019).

Source: Authors' own elaboration.

The difference in employment estimates between RuLIS and ILOSTAT may be explained by three reasons. First, though both databases use household surveys, the source of microdata differs for three countries (i.e. budget surveys vs labour force surveys) with the estimates varying depending on the objectives of the survey used.[14]

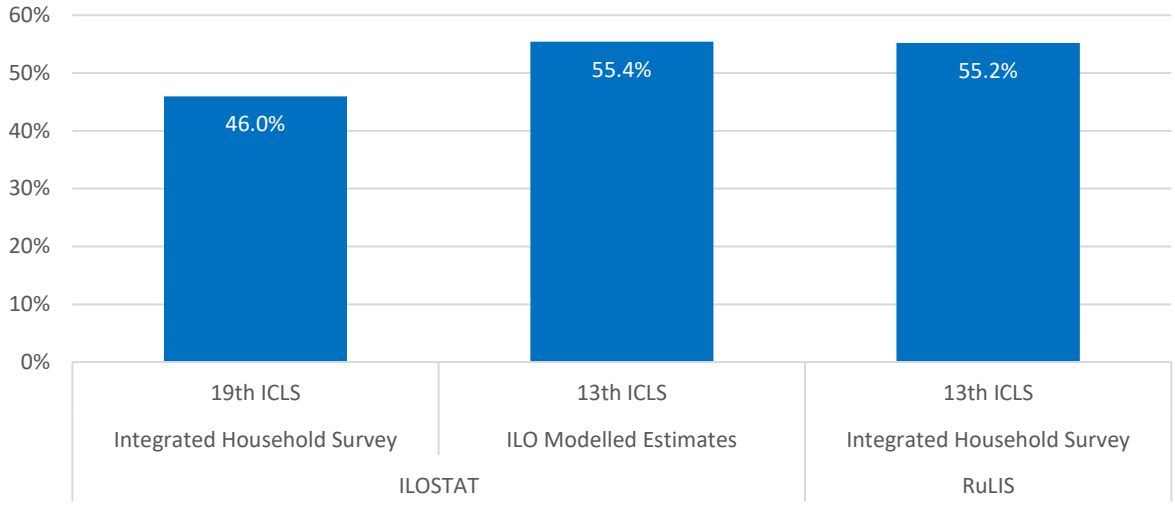
Second, as noted above, the employment figures of some countries included in the ILOSTAT database are computed using the new measurement of employment based on the latest ICLS resolution, excluding people whose work was performed for own-use production. Figure 10 demonstrates how the change in definition between the 13th and 19th ICLS resolutions would change the results in Sierra Leone in 2018. As would be expected in a country still largely dependent on agriculture and with a large share of

[13] Employment in AFS is not calculated for the West African Economic and Monetary Union (WAEMU) surveys because the information on the economic sector of employment for the main job in the previous seven days is not collected. Similarly, the structure of the LSMS surveys for Malawi (2013, 2017,2020), Nigeria (2016) and the United Republic of Tanzania (2015) restricts the reference population to wage workers and/or self-employed people and therefore these surveys are not shown in this comparison.

[14] The surveys used in ILOSTAT and RuLIS are identical for all countries, except Georgia, Mali and Uganda.

smallholder farmers, excluding own-use production from the definition of employment reduces the estimate of the share of agriculture in total employment by 9 percentage points, from 55 to 46 percent.

Figure 10. Share of employment in agriculture, forestry and fishing in Sierra Leone in total employment by data source

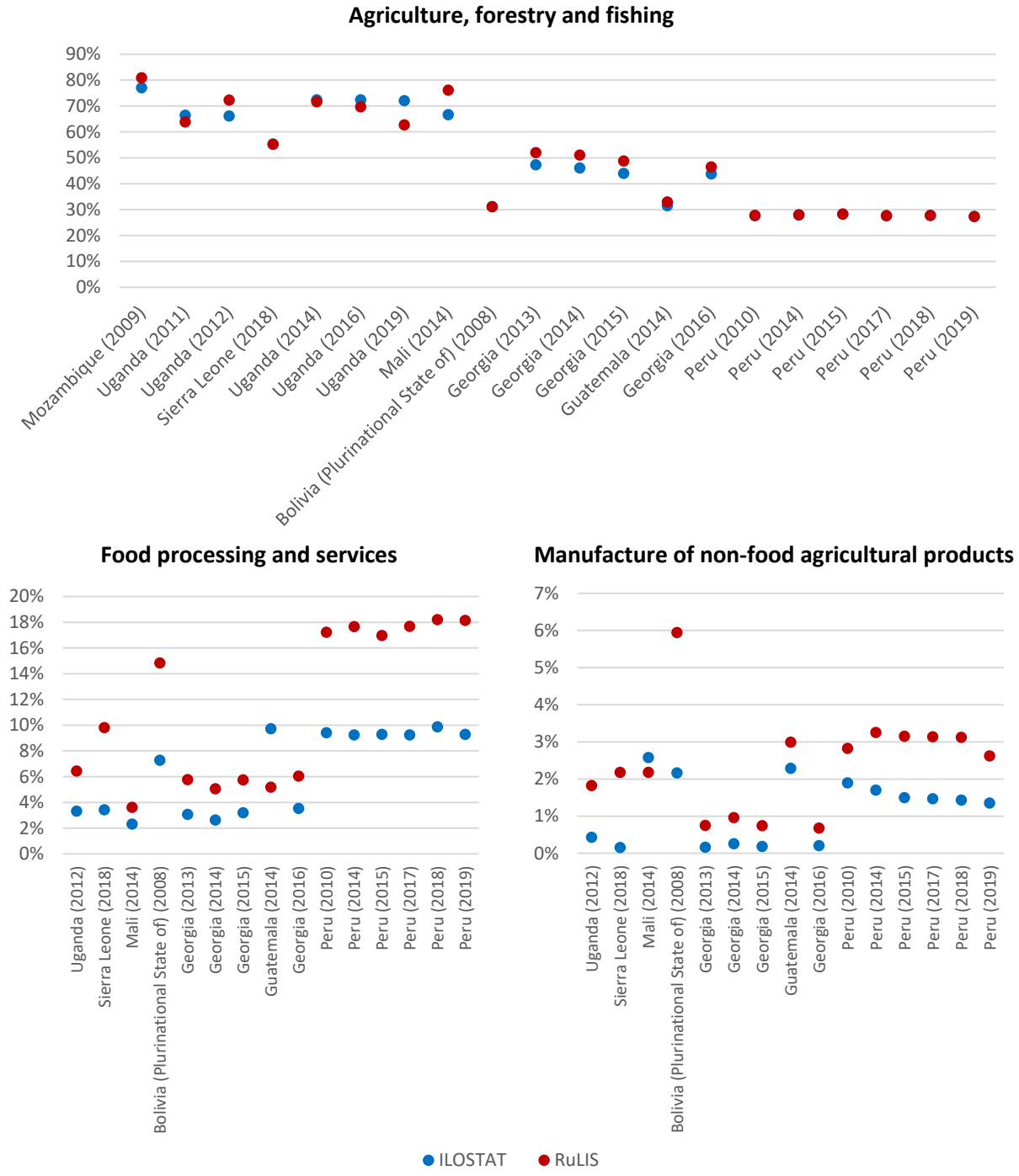


Source: Authors' own elaboration.

Third, differences may arise from the more detailed ISIC coding available in certain household surveys. For example, the share of employment in AFS was estimated at 37 percent in Peru using only 2-digit ISIC codes, but it increased to 48 percent using 4-digit level ISIC codes, with the difference entirely accounted for by non-agriculture jobs (specifically by the inclusion of wholesale of agricultural raw material, live animals, food, beverages, tobacco, agricultural machinery, equipment and supplies included in the AFS definition) because agriculture is fully captured at the 2-digit level.

Figure 11 disaggregates AFS employment by three subsectors. In terms of employment in agriculture, forestry and fishing (panel 1), we observe the same decreasing trend over GDP per capita. RuLIS estimates tend to be higher than ILOSTAT except in Uganda. In the case of food processing and services (panel 2), the ILOSTAT numbers are greater only for Guatemala. Much higher shares for employment are found in Bolivia (Plurinational State of) and Peru (15–20 percent) when using RuLIS. In terms of manufacturing (panel 3), RuLIS shares are greater except for Guatemala and Mali.

Figure 11. Share of employment in subsectors of agrifood systems in total employment using RuLIS and ILOSTAT



Note: For Mozambique (2009) and Uganda (2011, 2014, 2016, 2019), employment figures in food processing, services and manufacture of non-food agricultural products are not available in the ILOSTAT database, and therefore cannot be compared with the RuLIS findings.

Source: Authors' own elaboration.

4.2.2 Measuring engagement using household surveys

Taking advantage of the more detailed information regarding individual labour market activities, household surveys allow us to go beyond the main job captured in the employment statistics. This section aims to estimate the total engagement, building on employment to the main job with additional jobs and household farming throughout the year, which is possible in a few countries with available microdata. Operationally, we identify any individual having at least one job in AFS, applying an “or" condition (i.e. main job or second job or third job, etc. in AFS) to ensure no individuals are double counted in a final number.

Figure 12 provides engagement in AFS as a share of the working-age population (all persons aged 15 and above) for 35 RuLIS surveys with countries ordered by GDP per capita, increasing from left to right. Overall, as with employment figures, the data show that the majority of the population in low-income countries – particularly in Africa – had at least one job or activity in AFS. On average, the share of the working-age population employed in AFS as their primary or secondary job (or who are involved in household farming) was 36 percent in Georgia (2013–2016), 39 percent in Peru (2014–2019),[15] and 84 percent in Malawi (2013–2020). In Malawi, the household survey collects information on the number of jobs held in the previous 12 months, but only for wage workers. However, it also asks about *ganyu* labour carried out both in the previous 7 days and 12 months. *Ganyu* commonly refers to a variety of temporary rural work relations for which the remuneration may be in cash or in kind (such as food), and is often, but not exclusively, calculated as piecework. This form of work is often relatively unskilled and agriculturally based and is the most important source of livelihood for the poorest households after own-farm production (Michaelowa *et al.*, 2010; Whiteside, 2000). For the WAEMU countries, the share of the population with a main or second job in the previous 12 months or household farming activities in the last seven days was, on average, 50 percent in 2019. Senegal is the exception, where the share is below 30 percent.

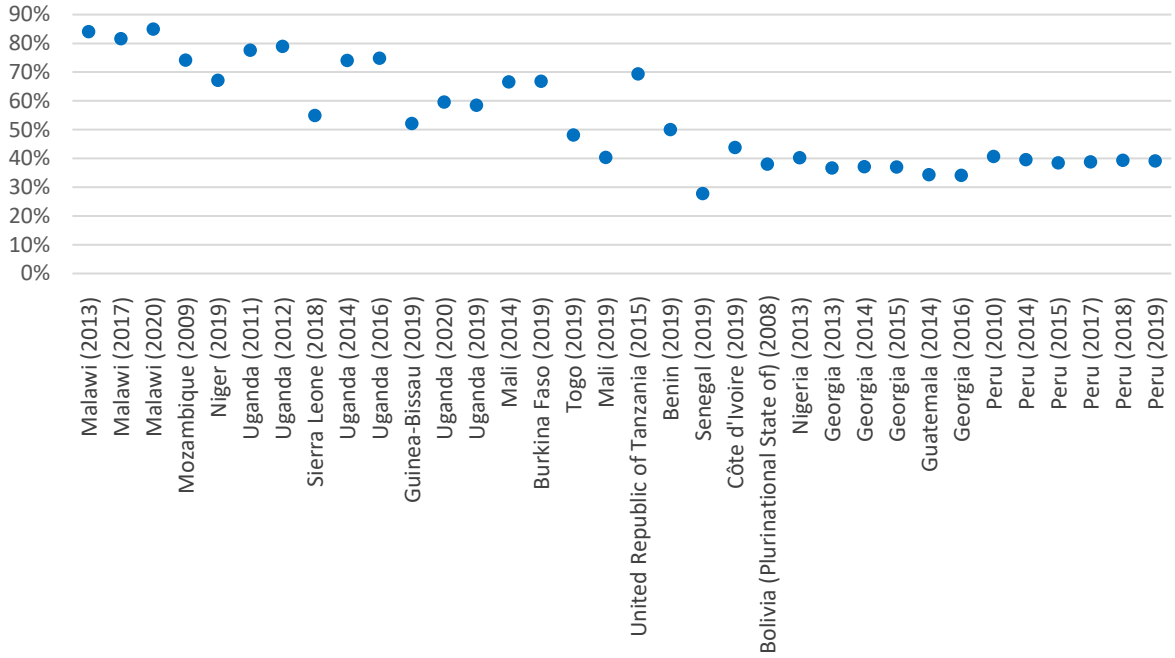
A detailed analysis at the country level illustrates the challenge that the underlying data pose for an accurate estimation. In Uganda, for example, the share of engagement in the working-age population decreased from 78 percent in 2011 to 60 percent in 2020. However, this drop is likely linked to the change in the level of detail collected in the Uganda National Panel Survey over that time. While in 2019 and 2020 the labour module collected data on main and second jobs and household farming activities in the last seven days, in earlier waves (2011, 2012, 2014) the survey also collected third and fourth jobs and household farming activities undertaken in the last 12 months. Moreover, time spent in non-labour market activities (e.g. fetching water, collecting firewood for the household, milling and other food processing) was also collected, which is likely to include some AFS activities missed in subsequent rounds without specific questions pertaining to these activities. Using the 2016 data, the share of engagement in AFS in the working-age population would be 83 percent if non-labour market activities were included in the computation of engagement in AFS, compared to 75 percent without these activities included.

Similarly, in Nigeria, while we found a slightly lower share of the population engaged in AFS in 2016, compared to the prior survey round (2013), the survey instrument had been changed during that time. In 2016, data were collected on main and second jobs and household farming activities in the previous seven days, plus the main job in the previous 12 months. But in 2013, data were also collected for household farming activities and the second job in the prior 12 months. As a result, the lower estimate in 2016 could

[15] In Peru, the question about the household farming activity is asked to the young population between 15 and 18 years old.

reflect a true decline, or it could reflect reduced information regarding secondary jobs and household farming throughout the year.

Figure 12. Share of engagement in agrifood systems in the working-age population

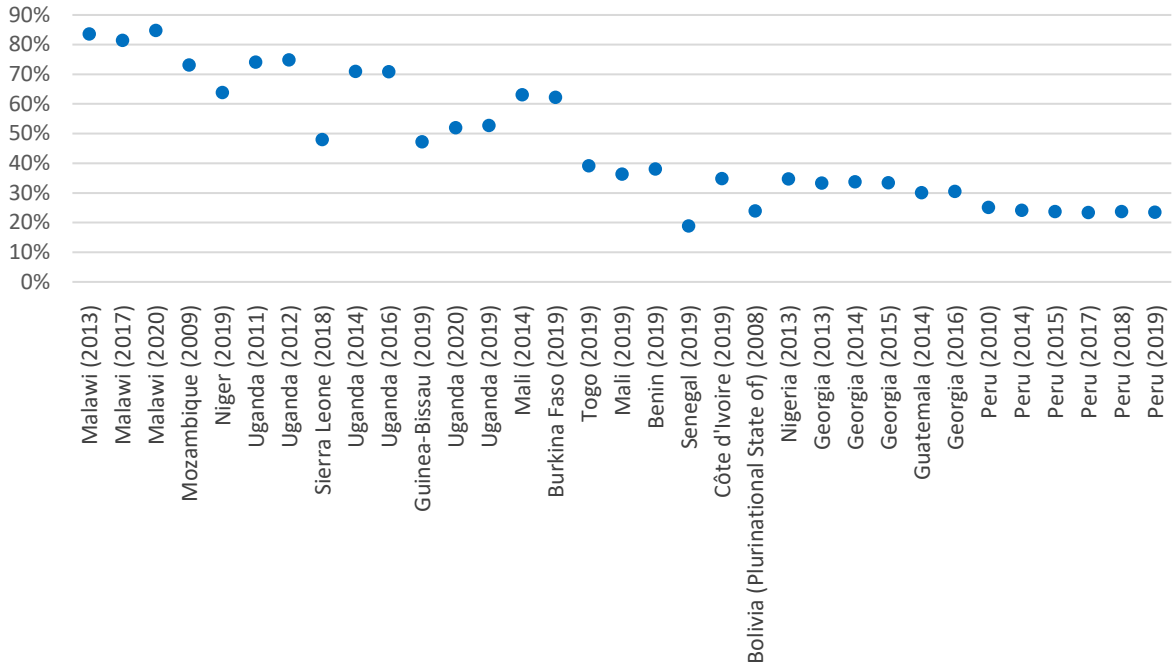


Source: Authors' own elaboration.

Understanding engagement in agrifood systems subsectors

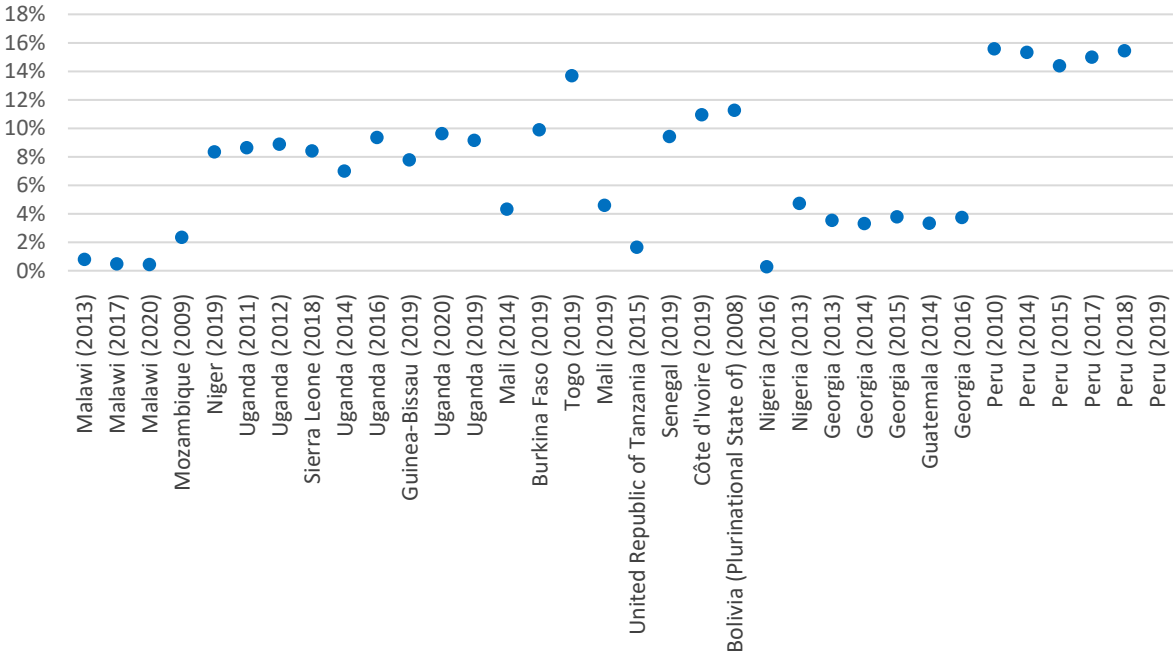
Next, we turn to the subsector disaggregation of engagement in AFS, beginning with those engaged in agriculture (Figure 13). The findings show that the share of engagement in agriculture, forestry and fishing ranges from 84 percent (Malawi, 2013) to 25 percent (Peru, 2019) in the working-age population, broadly corresponding to increasing GDP per capita. Looking at food processing and services (Figure 14), 3–16 percent of the working-age population is engaged in this subsector. The manufacture of non-food agricultural products engages fewer than 5 percent of the working-age population across all countries (Figure 15).

Figure 13. Share of engagement in agriculture, forestry and fishing in the working-age population



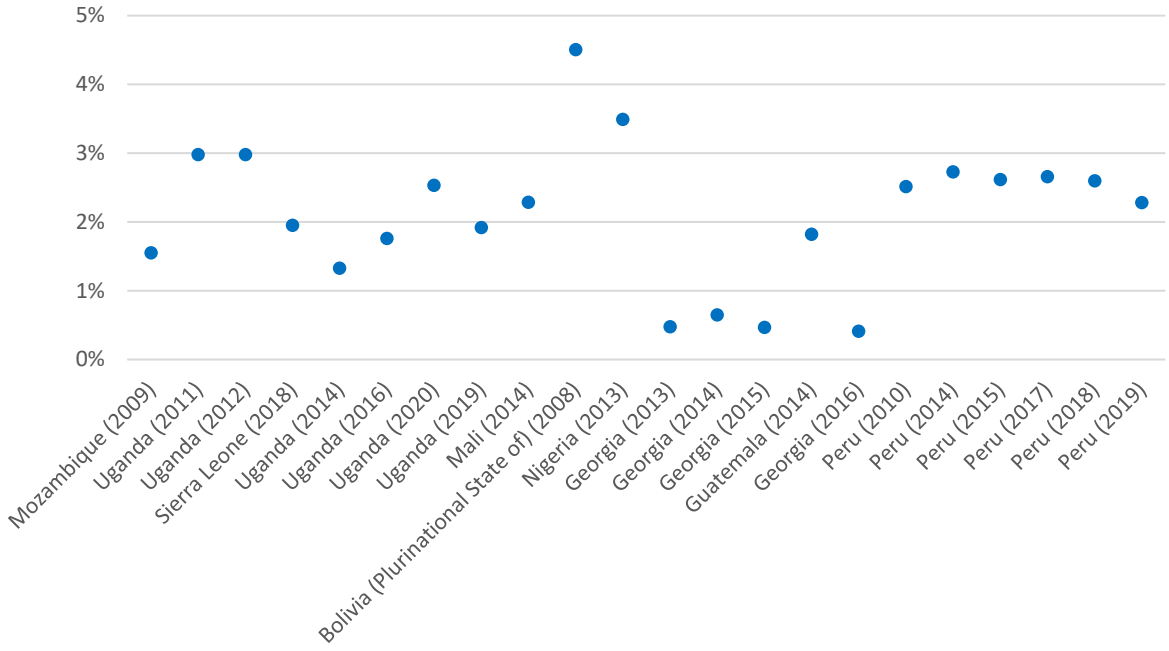
Source: Authors' own elaboration.

Figure 14. Share of engagement in food processing and services in the working-age population



Source: Authors' own elaboration.

Figure 15. Share of engagement in manufacture of non-food agricultural products in the working-age population



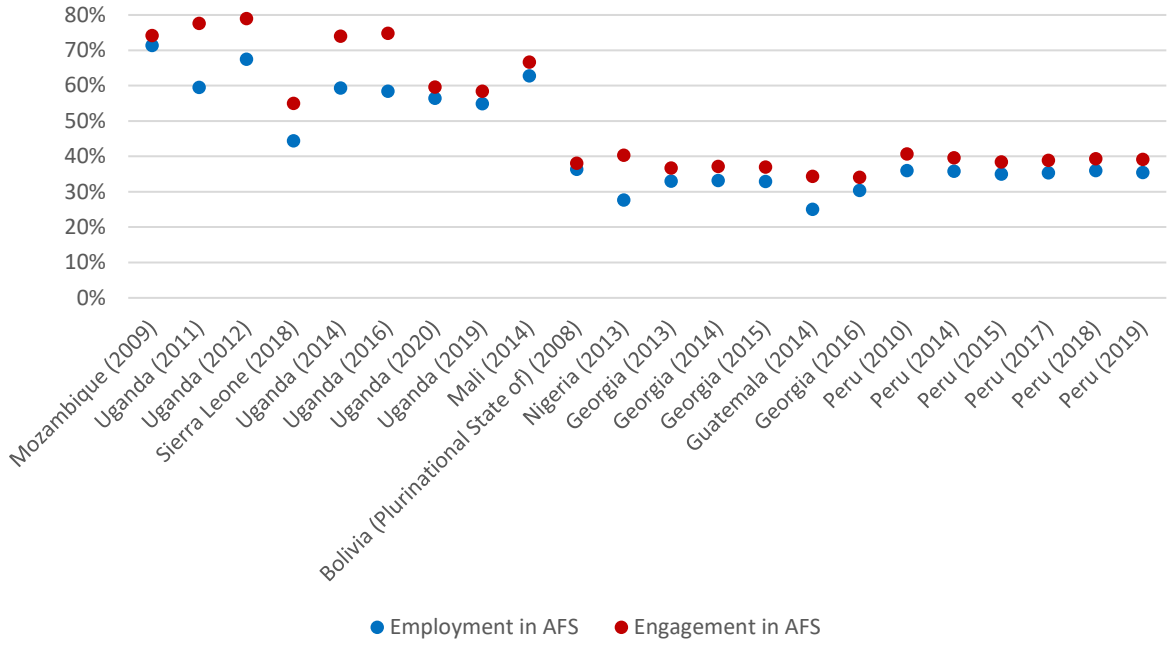
Source: Authors' own elaboration.

4.3 Engagement vs employment: investigating undercounting people working in agrifood systems

Figure 16 compares the shares of engagement with the shares of employment in AFS by countries ordered by GDP per capita, increasing from left to right. The results show that engagement is systematically higher, though the magnitude of the difference varies by country and year.[16] This is to be expected given the high likelihood that secondary jobs include some farming or food vending and the seasonal nature of agricultural work. The differences between employment and engagement are primarily driven by agriculture, forestry and fishing, given that primary production accounts for such a large share of engagement in AFS (Figure 17).

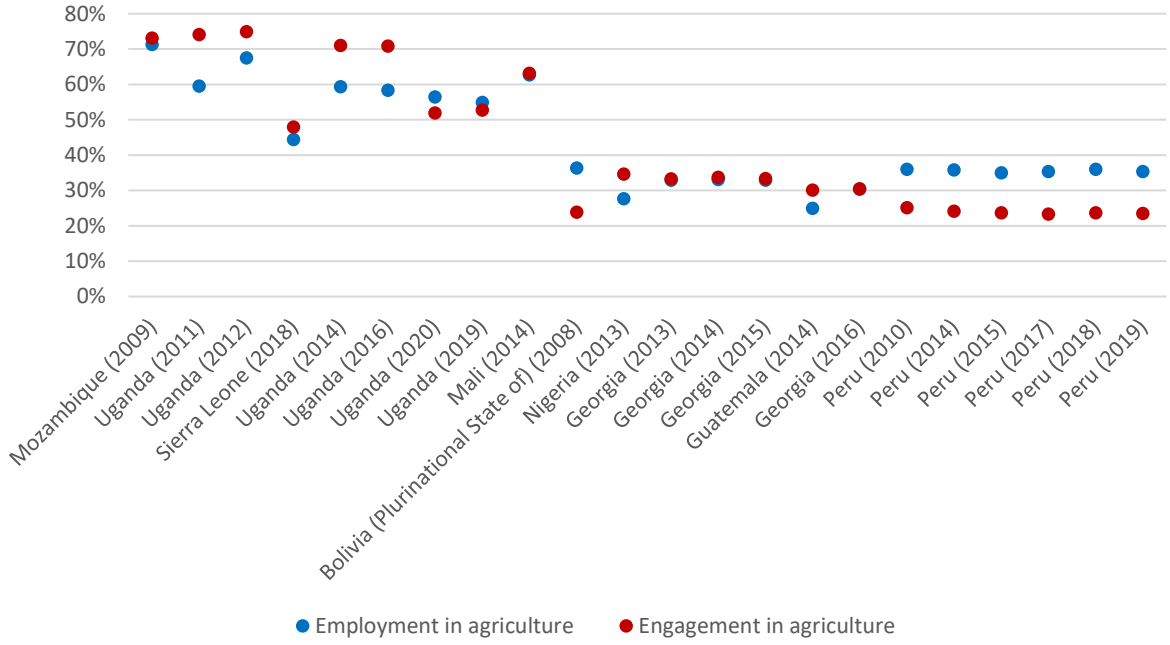
[16] Figures on employment in AFS using RuLIS are not computed for surveys from WAEMU countries and Malawi (2013, 2017, 2020), Nigeria (2013) and the United Republic of Tanzania (2015) – because the available data do not allow for the computation of employment in AFS.

Figure 16. Share of engagement and employment in agrifood systems in the working-age population



Source: Authors' own elaboration.

Figure 17. Share of employment and engagement in agriculture, forestry and fishing in the working-age population



Source: Authors' own elaboration.

The higher estimated engagement in agriculture when including work beyond the main job can be substantial (Table 6).[17] Estimates of engagement in agriculture are also higher when the household surveys ask about employment on the longer recall period (i.e. 12 months), particularly for the household farming activities as for the case of Nigeria (2013) and Uganda (2011).

Table 6. People engaged in agriculture, forestry and fishing by activity

Country	Main job – 7 days	Household farming – 7 days	Second job – 7 days	Main job – 12 months	Household farming – 12 months	Other	Total engagement in agriculture
Bolivia (Plurinational State of) (2008)	1 426 092	2 423	134 546	-	-	-	1 563 061
Georgia (2016)	978 932	539	101 359	-	-	42 714	1 123 544
Guatemala (2014)	2 058 443	-	217 137	-	91 564	727 532	3 094 675
Mali (2014)	5 394 080	371 797	19 760	54 243	-	1 678	5 841 559
Mozambique (2009)	7 729 695	290 860	63 271	-	-	-	8 083 826
Nigeria (2013)	21 759 804	3 911 654	645 079	6 183 985	1 355 088	68 216	33 923 826
Peru (2019)	4 925 700	24 028	804 994	-	-	-	5 754 722
Sierra Leone (2018)	1 788 593	362 041	13 711	-	187 656	1 428	2 353 431
Uganda (2011)	7 947 015	597 352	38 541	-	2 389 717	29 806	11 002 430
Uganda (2020)	10 563 050	1 029 846	45 899	-	-	-	11 638 795

Notes: Empty cells mean no data collected. "Other" refers to i) household farming activities in the previous day in Guatemala, ii) second job in the previous 3 months in Georgia), iv) third job in the previous 12 months in Sierra Leone, v) second job in the previous 12 months in Nigeria, vi) third and fourth job in the previous 12 months in Uganda (2011).

Source: Authors' own elaboration.

In Nigeria, 34 million people were engaged in agriculture in 2013, of which 22 million held a main job in the sector in the previous seven days. In addition to these workers, almost 4 million people reported doing some household farming activities in the short recall period of seven days. However, the longer recall period reveals an additional 6.1 million people who held a main job in agriculture in the previous 12 months, and almost 1.4 million more were engaged in household farming throughout the year.

[17] The following steps were taken to count the number of people engaged in the agricultural sector in addition to their main employment in the past seven days. First, those who were not employed in the sector but carried out household farming activities in the previous seven days are counted. As a second step, those not involved in any of the previous two activities, but holding a secondary job in the sector are counted. Then, the same logic is applied to household farming activities in the previous 12 months and other jobs. Each individual is counted only once, and the sum of individuals carrying out at least one activity (main or second job, household farming activities, other) represents the overall number of people engaged in agriculture, forestry and fishing. For example, the number of people engaged in agriculture in Bolivia (Plurinational State of) in 2008 was almost 1 563 061 million, among which 1 426 092 held a main job in the sector. The difference between engagement and employment is explained by an additional 136 969 people who were involved in household farming activities, or who held a second job in agriculture. Starting from 1.4 million people holding the main job in agriculture, an additional 2 423 people – who did not hold the main job in agriculture – were involved in household farming activities, and an additional 134 546 people – who did not hold the main job in agriculture nor were involved in household farming activities – held a second job in agriculture.

In Uganda, 11 million people were engaged in agriculture, forestry and fishing in 2011, but only 7.9 million people would be counted under the definition of employment. The difference between employment and engagement is mainly comprised of individuals involved in household farming activities in the previous 12 months (2.4 million). These individuals did not hold a main or second job in agriculture, nor were involved in the household farming in the short recall period of seven days, however they had a role in household farming in the previous 12 months. In 2020, the difference between engagement and employment was smaller – only 1 million – mainly comprised of people engaged in household farming activities in the previous seven days. As noted above, however, the 2020 survey did not ask about the last 12 months, so the smaller difference may be a true decline, or it may reflect the change in the survey instrument.

In Guatemala, 3 million people were engaged in agriculture in 2013, for 2 million of whom it was their main job. While 727 532 people were involved in household farming in the day prior to the interview, another 217 137 people held a second job in agriculture, and 91 564 people reported to be engaged in farming.

As reported in Table 7, the percentage difference between employment and engagement in the share of individuals participating in agriculture ranges from 5 percent higher in Mozambique to over 50 percent higher in Guatemala and Nigeria. The simple average over the 10 countries analysed[18] results in an estimated 24 percent greater share of total employment. As a share of the working-age population, which reflects the relative magnitude of the importance of agricultural employment in a country, the difference is still relevant in several countries, reaching 21 percentage points higher than employment-based estimates in the case of Uganda (2011).

In more industrialized countries such as Georgia and Peru, household farming plays a smaller role in livelihood strategies, and therefore has less impact on our estimates of engagement.[19] While engagement increases the number of individuals participating in agriculture by 15 and 17 percent, respectively, the increase in the share of adults in agriculture increases only 3 and 4 percentage points, respectively. In both Georgia and Peru, the difference between employment and engagement is driven by the number of people with a second job in agriculture, forestry and/or fishing.

Similarly, the shares of the population engaged in other AFS activities such as food processing, service, and manufacture of non-food agricultural products are higher than the shares employed (Figures 18 and 19). In this case, the difference between employment and engagement is mostly driven by people with second jobs. Again, the results suggest that statistics on employment are likely to miss are people who depend on multiple sources of income for their livelihoods.

[18] Uganda is counted twice, given the substantial changes in survey design between years.

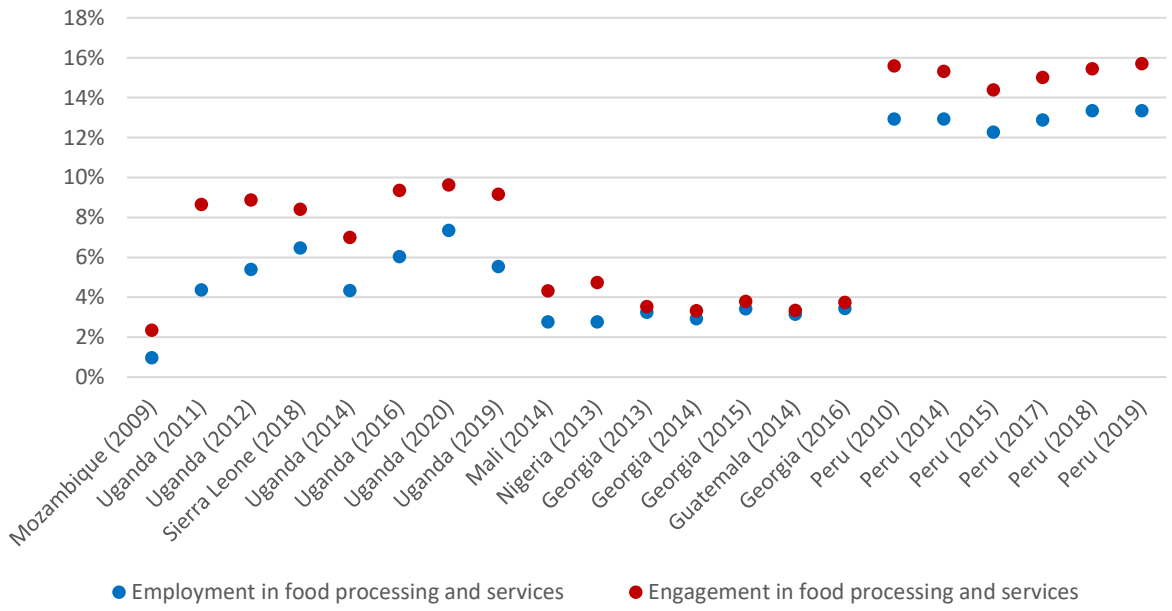
[19] In Peru, the question on the household farming activity is asked to the young population between 15 and 18 years old.

Table 7. Percentage difference between estimates of employment versus engagement in agriculture, forestry and fishing in the working-age population

	Percentage difference in agricultural employment	Share of employment in agriculture in the working-age population (percent)	Share of engagement in agriculture in the working-age population (percent)	Difference between engagement and employment (percentage points)
Bolivia (Plurinational State of) (2008)	10	22	24	2
Georgia (2016)	15	27	30	3
Guatemala (2014)	50	20	30	10
Mali (2014)	8	58	63	5
Mozambique (2009)	5	70	73	3
Nigeria (2013)	56	22	35	13
Peru (2019)	17	20	24	4
Sierra Leone (2018)	32	36	48	12
Uganda (2011)	38	53	74	21
Uganda (2020)	10	47	52	5

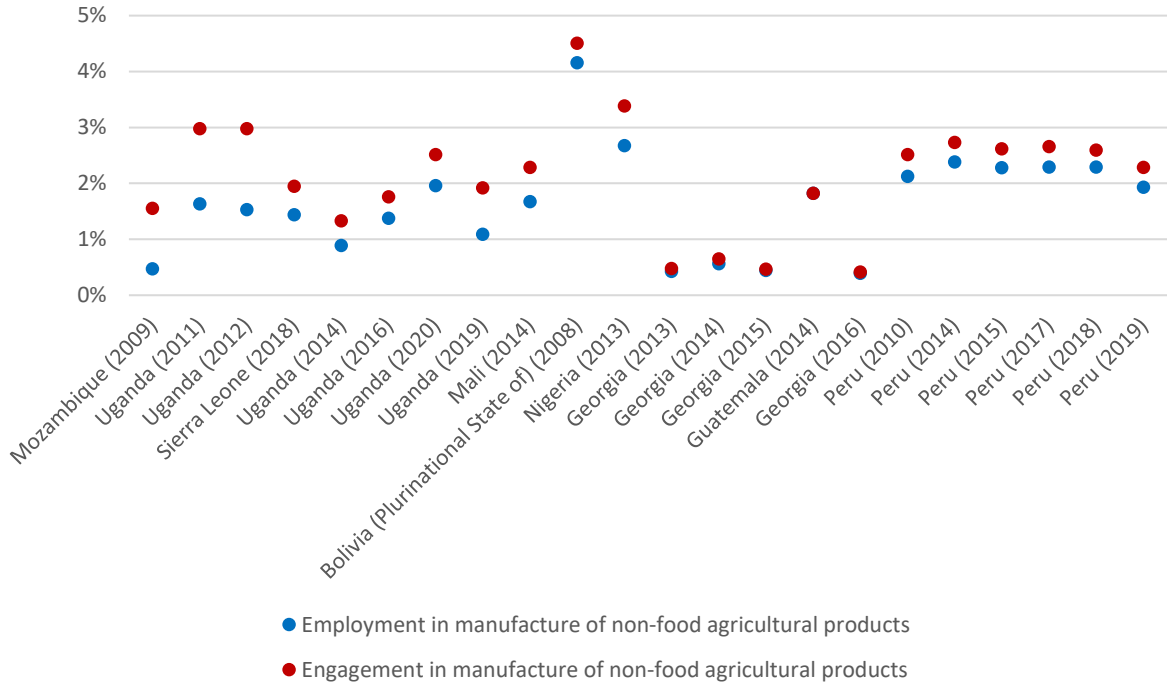
Source: Authors' own elaboration.

Figure 18. Share of engagement and employment in food processing and services in the working-age population



Source: Authors' own elaboration.

Figure 19. Share of engagement and employment in manufacture of non-food agricultural products in the working-age population



Source: Authors' own elaboration.

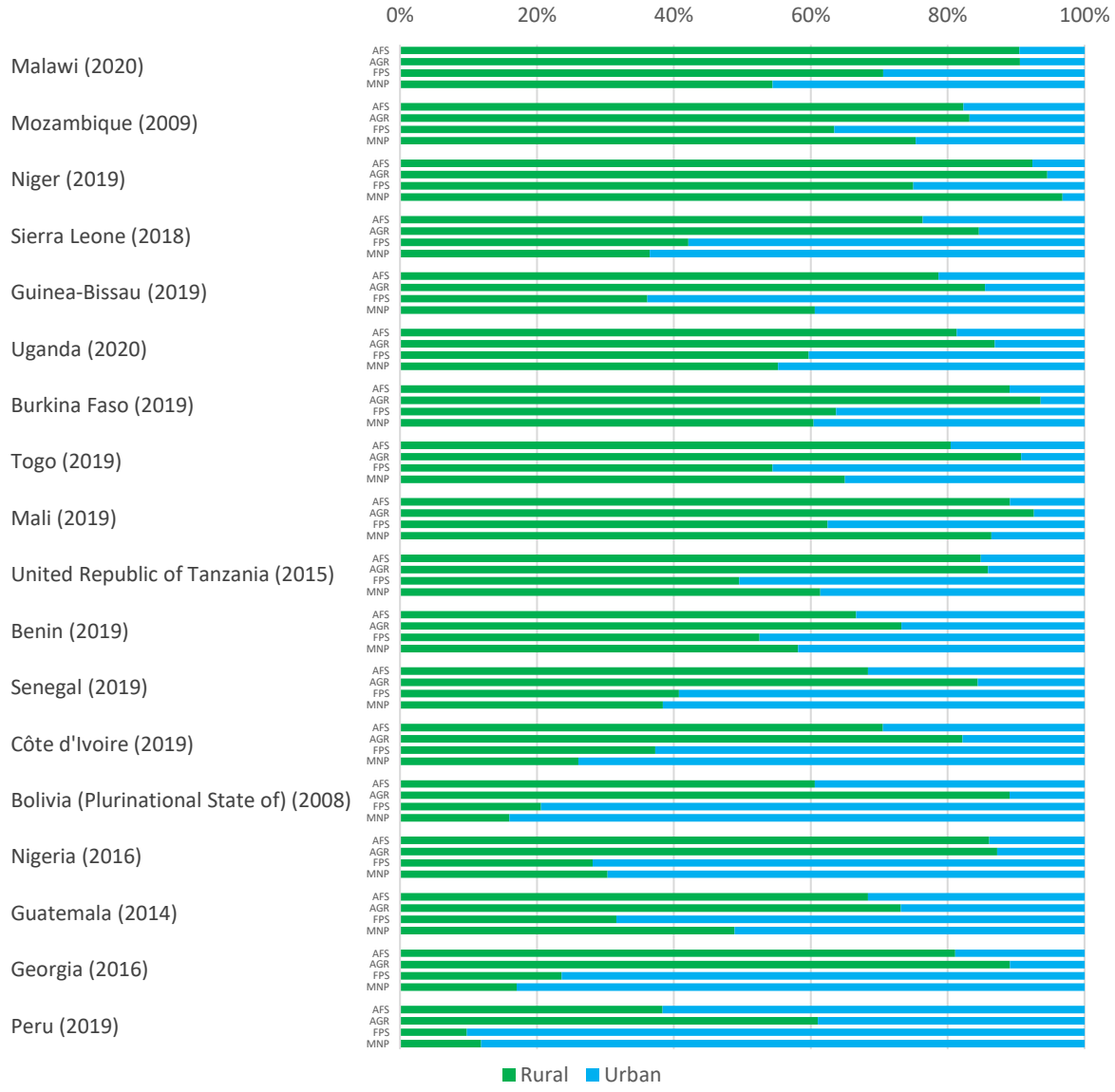
4.4 Engagement in agrifood systems by selected socioeconomic variables

The household survey data from RuLIS also allow us to look at socioeconomic characteristics of those engaged in AFS. We focus on residence (rural or urban), gender, age and poverty status.[20]

In all countries except for Peru, most individuals engaged in AFS reside in rural areas (Figure 20). However, the share of rural individuals engaged in AFS tends to decrease with rising GDP per capita and employment in AFS becomes increasingly urban. As countries develop, people leave jobs in agriculture, so the relative proportion of people engaged in the non-agriculture segments of AFS (food processing and services and manufacture of non-food agricultural products) increases.

[20] Unless indicated otherwise, countries included in the graphs in this section are ranked by GDP per capita. GDP per capita from previously available data were used for Malawi (2017) and Uganda due to missing data.

Figure 20. Residence of people engaged in agrifood systems by subsector (aged 15 and over)

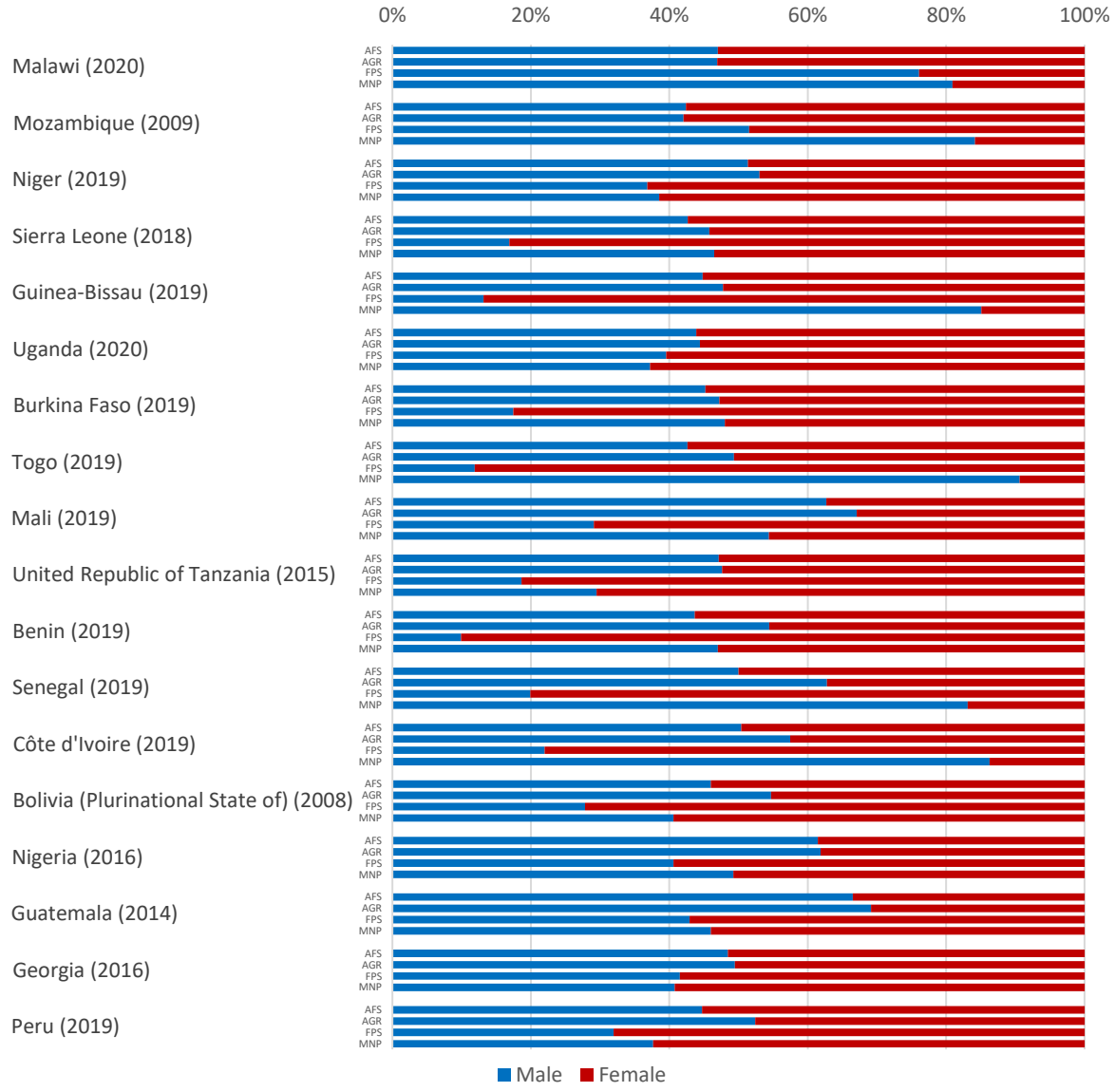


Note: AFS = Agrifood systems; AGR = Agriculture; FPS = Food processing and services; MNP = Manufacture of non-food agricultural products

Source: Authors' own elaboration.

In most of the countries for which we have data, women represent around half of the workers engaged in AFS (Figure 21). Guatemala, Mali and Nigeria have the lowest share of women among individuals engaged in AFS (33, 37 and 38 percent, respectively). Except for Malawi and Mozambique, women make up the majority of those engaged in the food processing and services sector, in many countries representing over 80 percent of workers. The manufacture of non-food agricultural products is dominated by men in six countries (Togo, Côte d'Ivoire, Guinea-Bissau, Mozambique, Senegal and Malawi), and is evenly distributed in the other countries.

Figure 21. Gender of people engaged in agrifood systems by subsector (aged 15 and over)

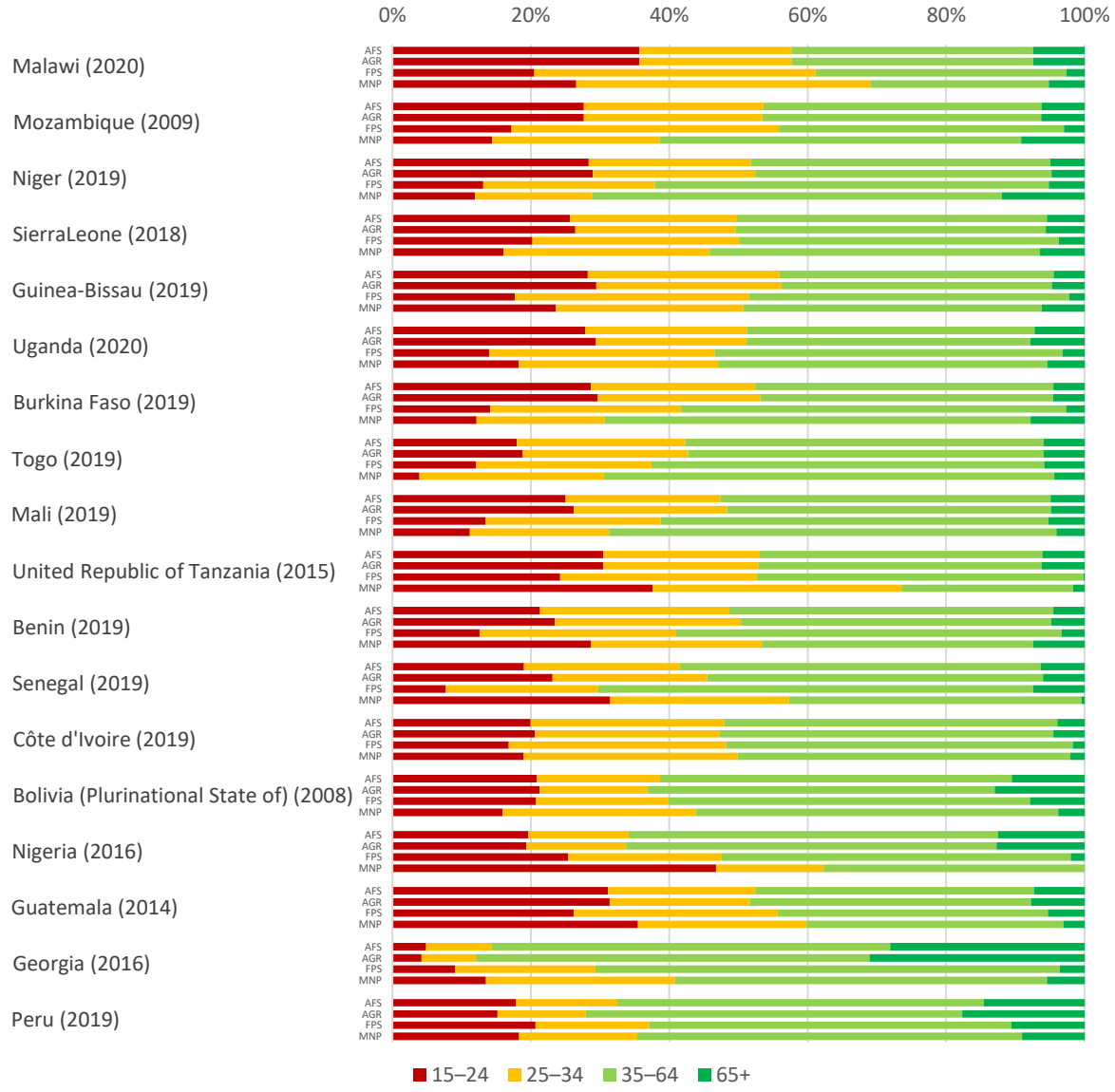


Note: AFS = Agrifood systems; AGR = Agriculture; FPS = Food processing and services; MNP = Manufacture of non-food agricultural products

Source: Authors' own elaboration.

Youth (defined as people aged 15–35) make up around half of all AFS workers, with lower shares in Georgia, Peru, Nigeria, Bolivia (Plurinational State of), Senegal, and Togo (Figure 22). In most of the countries, youth represent half of the workers engaged specifically in agriculture and more than half of the people engaged in food processing and services. A relatively higher share of youth is engaged in manufacturing of non-food agricultural products in the United Republic of Tanzania, Malawi, Nigeria and Guatemala, and a relatively smaller share in the Niger, Togo, Burkina Faso, Mali, Peru and Mozambique.

Figure 22. Age distribution of people engaged in agrifood systems by subsector (aged 15 and over)

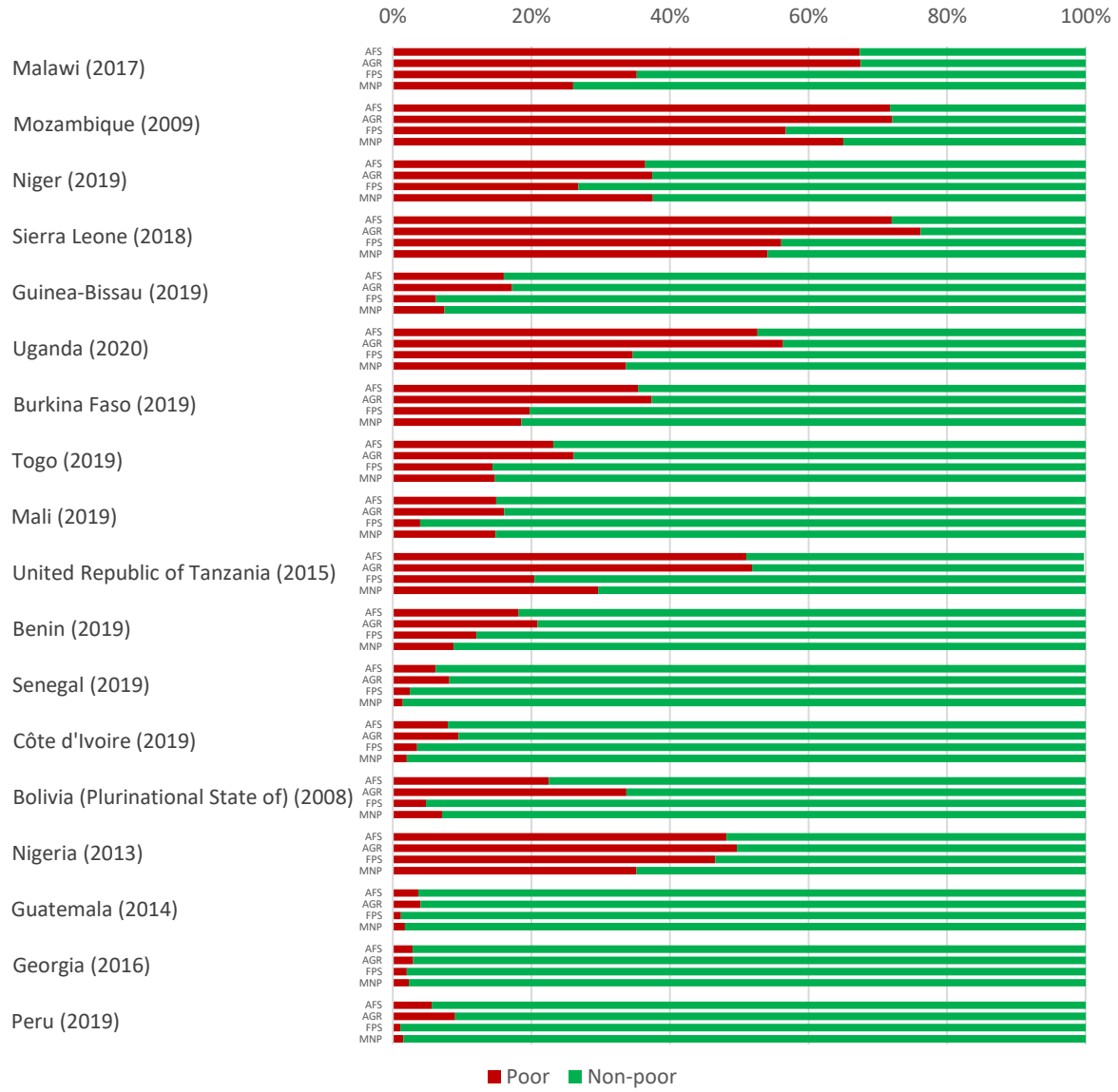


Note: AFS = Agrifood systems; AGR = Agriculture; FPS = Food processing and services; MNP = Manufacture of non-food agricultural products

Source: Authors' own elaboration.

In terms of poverty, consistent with the process of structural transformation, as GDP increases, the share of poor individuals engaged in AFS declines (Figure 23). Specifically, the poverty share of AFS-engaged people ranges from about 72 percent in Sierra Leone to approximately 3–5 percent in Georgia, Guatemala and Peru. The big exception is Nigeria, which, with a relatively high level of GDP per capita, has a very large share of those engaged in AFS still living in poverty. Second, in almost all countries, the share of individuals in poverty in AFS outside of agriculture is almost uniformly lower than the share of individuals in poverty engaged in agriculture. This is evident at both high and low levels of per capita GDP.

Figure 23. Poverty status of people engaged in agrifood systems by subsector (aged 15 and over), USD 1.90 poverty line (PPP 2011 prices)



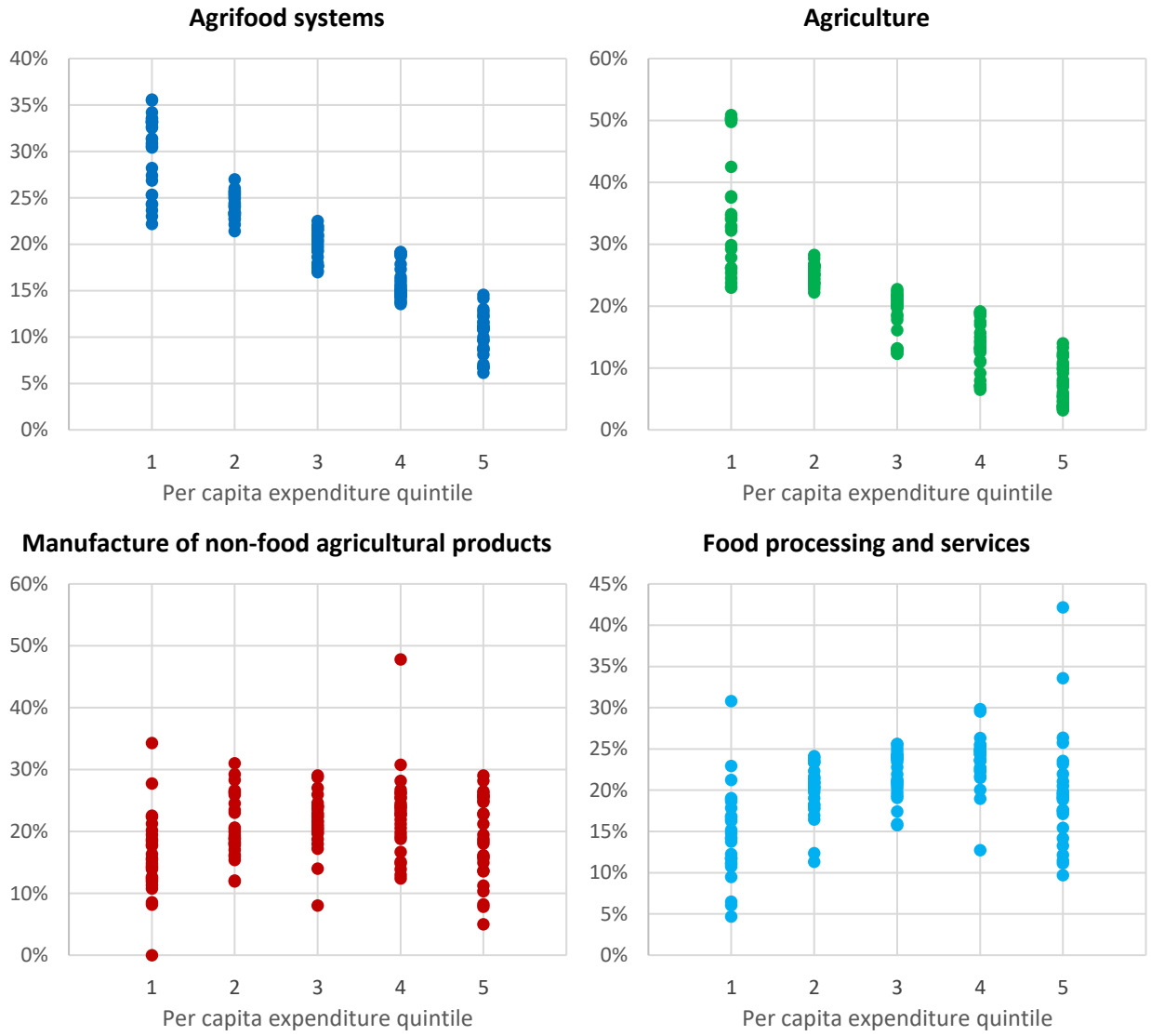
Note: GDP per capita from previously available data were used for Uganda (2020) due to missing data. The sample for Nigeria (2013) excluded 400 observations without information on consumption expenditures. The latest 2020 survey in Malawi was not used since information on the consumption aggregate used for the computation of the poverty was not available. AFS = Agrifood systems; AGR = Agriculture; FPS = Food processing and services; MNP = Manufacture of non-food agricultural products

Source: Authors' own elaboration.

Figure 24, which aggregates engagement in AFS and its subcomponents over all countries by expenditure quintiles (USD 2011 PPP), gives a similar story. Panel A (engagement in AFS) and panel B (engagement in agriculture) clearly show a higher association with lower expenditure quintiles. Panel C (engagement in

manufacture of non-food agricultural products) and panel D (engagement in food processing and services) show a more even distribution across expenditure quintiles.

Figure 24. Share of engagement in agrifood systems and subsectors by per capita expenditure quintiles



Source: Authors' own elaboration.

4.5 Counting jobs or individuals?

To complement the analysis on the people engaged in AFS (the number of people holding a job in AFS, or engaged in household farming activities), we investigate the number of jobs existing in the AFS sector. This analysis incorporates the reality that workers can hold more than one job (i.e. main, second, third

and fourth job) in different economic sectors and may differ in periodicity and therefore be counted (or missed) in surveys depending on the recall period (7 days, 3 months, 12 months).[21]

We count the total number of jobs reported for a constant recall period (seven days) to correctly identify the number of jobs in AFS (Table 1 – Annex II).[22] We use seven days because it is aligned with official statistics on employment, except for WAEMU countries[23] where only a 12-month recall period is available. We construct count variables of number of jobs held per person by the total number of jobs (i.e. one job, and two jobs, three and four if available). The total number of jobs is calculated by summing up the number of jobs held by each worker (one job if the person holds only one job, two jobs if the person holds two jobs, etc.) for the same recall period. The information on the economic sector of employment reported by each worker is used to identify the jobs in AFS, and to calculate the respective share of jobs in AFS in total jobs.

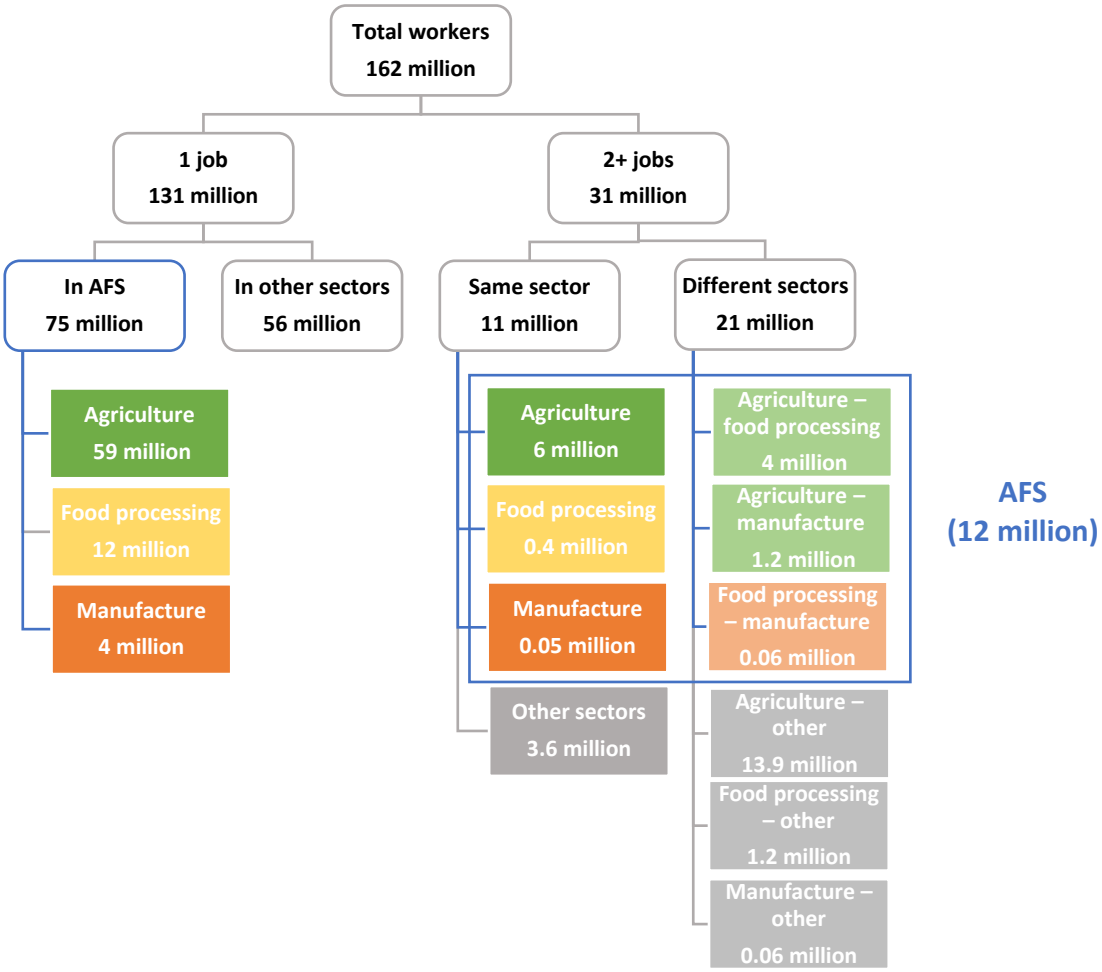
Among the 16 countries for which data are available, 162 million workers hold any job (Figure 25). Of these, 81 percent (131 million) have only one job, and among these, 57 percent (75 million) are employed in AFS, where agriculture is the largest sector of employment (59 million workers). The remaining 19 percent of workers (31 million) hold more than one job. Of these, 35 percent have more than one job in the same sector, while 65 percent have additional jobs across sectors. Of all the 31 million workers with more than one job, 12 million hold both jobs in AFS (different combination of subsectors of AFS), and another 15 million have additional jobs in combination with AFS. Only 12 percent (3.6 million) hold all their multiple jobs outside of AFS.

[21] Please consider these examples: 1)Person A hold a job in agriculture in the previous 12 months prior the interview [1 job, 1 sector (agriculture), 1 recall period (12 months)]; 2)Person B hold a job in agriculture and the second job in fishery in the previous 12 months prior the interview [2 jobs, 1 sector (agriculture), 1 recall period (12 months)]; 3)Person C hold hold a job in agriculture in the previous 12 months prior the interview and hold a second job in the wholesale of processed meat in the previous week of the interview [2 jobs, 2 sectors (agriculture and food processing), 2 recall periods (7 days, and 12 months)].

[22] Benin (2019), Bolivia (Plurinational State of) (2008), Burkina Faso (2019), Côte d'Ivoire (2019), Georgia (2016), Guatemala (2014), Guinea-Bissau (2019), Mali (2019), Mozambique (2009), the Niger (2019), Nigeria (2013), Peru (2019), Senegal (2019), Sierra Leone (2018), Togo (2019), Uganda (2020). Malawi, Nigeria (2016) and the United Republic of Tanzania have been excluded as the surveys account for only waged employees.

[23] Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, the Niger, Senegal, Togo.

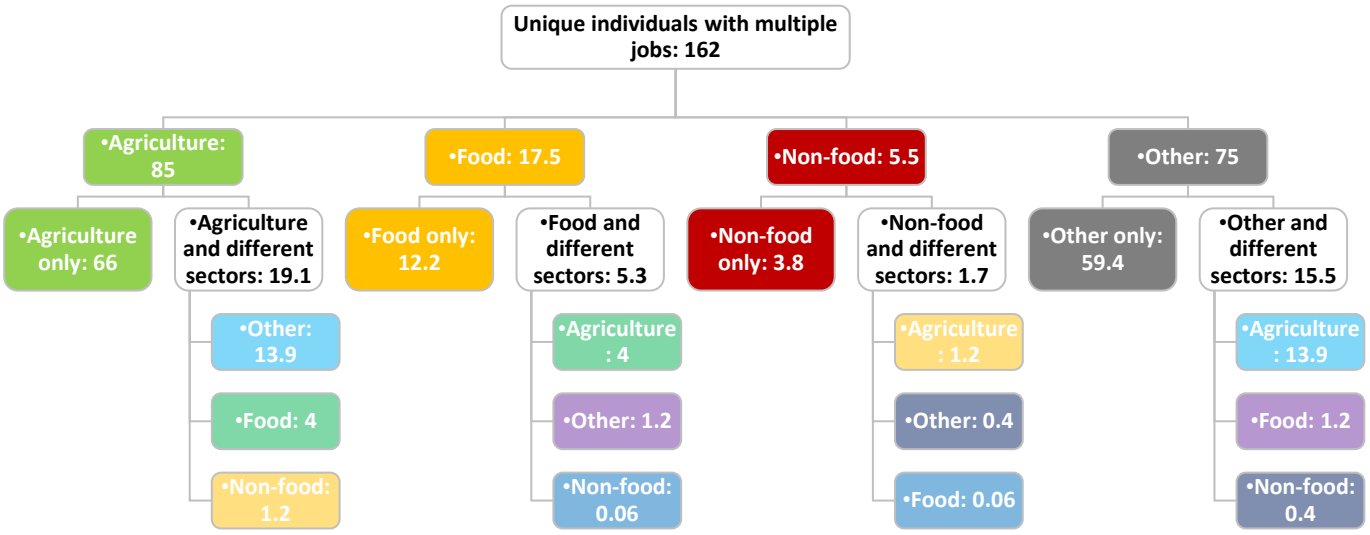
Figure 25. Number of workers holding multiple jobs with sector combinations



Source: Authors' own elaboration.

Moreover, the data also reveal the sectoral combinations of employment, i.e. showing how people diversify their work when holding more than one job (Figure 26). The largest proportion of people work in the agriculture sector. People working in agriculture have the highest proportion (about 70 percent) of workers diversifying their livelihood outside of AFS. Food processing and services or manufacture of non-food agricultural products each have only about 20 percent of workers diversifying beyond AFS.

Figure 26. Number of workers with sector breakdown (million)



Source: Authors' own elaboration.

4.6 How many people are reliant on food systems?

The aim of this section is to present the steps used to predict a global number of the people reliant on AFS, who are all those individuals living in a household where at least one person is engaged in AFS. In other words, if at least one person from a household of size four is engaged in AFS, the total number of people reliant on AFS from that household is four. For this purpose, we use the household surveys available in RuLIS from 18 countries where the engagement in AFS can be computed.[24]

First, we use the information on household size for households where there is at least one person engaged in AFS to compute the number of individuals reliant on AFS for the 18 RuLIS countries. Then, we calculate a multiplier for each country defined as: $Factor_{it} = \frac{People\ reliant\ on\ AFS}{Employment\ in\ AFS}$. This factor can be interpreted as a dependency ratio, i.e. the average number of persons relying in AFS for one person employed in AFS.

As a second step, we produce a complete dataset for the 18 RuLIS countries with information on $Factor_{it}$ for the years 2017, 2018 and 2019 by imputing the missing values for any year (if any) using linear interpolation.[25] This helps in capturing any major change in the variable with respect to time.

[24] Benin, Bolivia (Plurinational State of), Burkina Faso, Côte d'Ivoire, Georgia, Guatemala, Guinea-Bissau, Malawi, Mali, Mozambique, the Niger, Nigeria, Peru, Senegal, Sierra Leone, the United Republic of Tanzania, Togo, Uganda.

[25] For six countries which have data on $Factor_{it}$ available for more than 2 years (Mali, Malawi, the Niger, Nigeria, Peru, Uganda), we extracted a dataset between 2017 and 2019 using linear interpolation. For the remaining RuLIS countries, the $Factor_{it}$ was available only for one year, and a simple linear regression model was used to predict the missing values.

Then, we integrate the dataset with information on the share of employment in agriculture in total employment, and the share of urban population for each country and year from external sources.[26] Using this resulting dataset, we run the following regression where $Factor_{it}$ is the dependent variable:

$$Factor_{it} = \alpha + \beta_1 share\ ag\ employ_{it} + \beta_2 urban\ pop\ share\_it + \beta_3 region\_i + \gamma_t year_t + \epsilon_{it}$$

We use this model to predict $Factor_{it}$ for the 168 countries that are not available in RuLIS, and for which the engagement in AFS and people reliant on AFS could therefore not be computed.[27] The out-of-sample prediction is computed for all countries for the years 2017, 2018 and 2019.

As the final step, we use the $Factor_{it}$ together with data on employment in AFS to compute the global number of people reliant on AFS. Our results estimate that in 2019, people reliant on AFS numbered 3.83 billion including the 1.23 billion people who are directly employed in AFS. With 2.36 billion people reliant on AFS, Asia is the region with the highest total number, followed by Africa with almost 1 billion people reliant on AFS (Table 8).

Table 8. Regional and global estimates of people reliant on agrifood systems in 2019

Region	People reliant on AFS (billion)
Africa	0.941
Americas	0.280
Asia	2.359
Europe	0.234
Oceania	0.016
World	**3.830**

Source: Authors' own elaboration.

[26] A complete dataset for the share of employment in agriculture, and the share of urban population was produced for the years 2017, 2018 and 2019 for 168 countries. Linear interpolation was used to create the time series between 2017, 2018 and 2019 for Eritrea, Kiribati and Seychelles. The Cook Islands, Kosovo, Montserrat and Taiwan Province of China were dropped from the final dataset because there was no data availbale for any year for these indicators.

[27] Although one of the limitations of the model is that we use data from 18 RuLIS countries to predict the $Factor_{it}$ for 168 countries, the adjusted R^2 shows that the model can predict the number of people reliant on AFS at the regional and global level with 80 percent accuracy.

5 Conclusion

This paper provides an estimate of the total global population engaged in AFS. Our analysis relies on the economic activity classifications that can be identified as AFS using ISIC 2-digit codes, with more detailed codes examined in a few household surveys. These include the subsectors of primary production (agriculture, livestock, forestry, fishing, aquaculture, hunting), food processing and services, and manufacturing of non-food agricultural products. Using this approach, at the global level we estimate the number of people employed, according to the official definitions of employment adopted by the ICLS, in the subsectors of AFS. We arrive at a lower-bound estimate of 1.06 billion people employed in AFS in 2019.

In addition, we develop an approach and make an additional estimation that includes employment in trade and transportation where many people contribute to AFS but jobs cannot be directly classified as such. Including these numbers, we arrive at 1.23 billion people employed in AFS. We also estimate that approximately 3.83 billion people worldwide live in households reliant on AFS-based livelihoods, at least in part.

Further, we demonstrate how international labour force statistics are likely to undercount the total number of people who are engaged in AFS for some part of their livelihood. This undercounting may arise from three factors: 1) that people (especially those living in poverty) hold multiple jobs; 2) that many jobs in AFS are seasonal or intermittent and might be missed with only a 7-day recall period; and 3) that many of the world's poorest people engage in household farming for their own consumption as their primary occupation, which has been recently excluded from the formal definition of employment.

Household survey data from the harmonized RuLIS database provide the opportunity to explore the implications of each of these factors. Using 35 surveys from 18 unique countries over 12 years (2008–2020), we explore the magnitude of the potential undercounting by considering additional jobs, longer and multiple recall periods, and more detailed activity codes. Although the estimates are not strictly comparable across countries, we are able to compare the expanded estimate of engagement in AFS to the estimated magnitude of employment in AFS (as officially defined) from this set of countries. We find that the number of people engaged in AFS is on average 24 percent higher than employment, showing the relevance of secondary jobs and household farming activities to identify all individuals whose livelihood depends on AFS. However, the difference gets smaller as GDP increases as the most common reason individuals are considered engaged compared to employed is that they work in household farming activities as a secondary job or over a longer (12-month) recall period but were not surveyed in an agricultural season.

Finally, we explore the socioeconomic and demographic patterns of engagement in AFS, using the latest round of household surveys from each of the 18 countries. Our results confirm that as countries develop, the relative proportion of people engaged in the non-agriculture segments of AFS – which are more likely to be located in peri-urban or urban areas (Dolislager *et al.*, 2021) – increases. This is consistent with structural transformation processes whereby urban and rural areas become increasingly connected through more complex value chains (Arslan *et al.*, 2022). We find that in most of the countries in our sample, women represent about half of the workers, and in most countries have a much higher share of participation in food processing services. Our results also show that a significant share of youth is engaged in AFS, particularly in sub-Saharan African countries, in line with recent evidence (Dolislager *et al.*, 2021;

Yeboah and Jayne, 2018). This pattern is related to the youth bulge in these countries, with a large youth population located in rural and peri-urban areas who have few other options than to rely on AFS for their livelihoods (Allen *et al.*, 2016; Yeboah and Jayne, 2018).

This analysis contributes to the existing literature in two ways. First, it provides the first documented global estimate of employment in AFS. Second, it systematically demonstrates the implications of using global labour force data in making this estimate, and how much it may be undercounting livelihoods in AFS. Despite this contribution, limitations remain. The first is in the lack of comparability across household surveys used in our analysis due to different survey instruments across countries, and over time within countries. These have been detailed above, but broadly relate to the same factors that may lead to an undercount when using only the global labour force data: how many jobs are recorded, the reference period(s) used, the level of detail of ISIC coding, and the extent of information about household farming, non-market labour, and private enterprises.

Beyond the specific limitations of the approaches used herein, some additional limitations complicate identifying and quantifying all people engaged in AFS. Most of these owe to the nature of the available data, and the fact that statistical systems were not designed with a food system perspective in mind. The way labour data are collected, exactly what data are collected, and how the data are aggregated and reported present researchers with a set of imperfect choices. These lead to possible measurement errors. Our analysis concentrates on the potential undercounting of the total AFS workforce that may occur as a result. Other research is necessary to also consider the possible overcounting that arises from the definition of employment as work for at least one hour during the recall period, and the concomitant potential to underestimate the extent of underemployment and low labour productivity particularly in agriculture (Azzarri, 2022; McCullough, 2017). Future research is also needed to better understand the quality of jobs and labour in AFS, and the relationship between holding such jobs, various livelihood strategies that include some engagement in AFS, and welfare outcomes including issues of equity, inclusion, health, education and poverty. As AFS continue to transform at a rapid pace, people can benefit from job creation. However, the quality of those jobs and the welfare of those engaged in AFS must be of paramount concern (Davis *et al.*, 2022).

Despite the limitations, this analysis sheds light on the relevance of AFS within economies and the interlinkages between the different parts of agrifood systems. A permanent statistical series counting and identifying these individuals is key to provide evidence on the evolution of rural and food system transformation. The availability of new data will help to improve existing models and overall estimates on people engaged in AFS to characterize the dynamics of the sector. Moreover, statistics on AFS serve as an input into policymaking and programme design, monitoring and evaluation.

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Annex I: List of household surveys analysed and ISIC codes

Table 1. Number of countries and surveys analysed as of February 2022

Country	Year	Survey
Benin	2019	Enquête harmonisée sur les conditions de vie des ménages (EHCVM)
Bolivia (Plurinational State of)	2008	Encuesta de los Hogares
Burkina Faso	2019	Enquête harmonisée sur les conditions de vie des ménages (EHCVM)
Georgia	2013, 2014, 2015, 2016	Integrated Household Survey
Guatemala	2014	Encuesta Nacional de Condiciones de Vida
Guinea-Bissau	2019	Enquête harmonisée sur les conditions de vie des ménages (EHCVM)
Côte d'Ivoire	2019	Enquête harmonisée sur les conditions de vie des ménages (EHCVM)
Malawi	2013, 2017, 2020	Integrated Household Survey
Mali	2014, 2019	Enquête harmonisée sur les conditions de vie des ménages (EHCVM)
Mozambique	2009	Inquérito sobre Orçamento Familiar
Niger	2019	Enquête harmonisée sur les conditions de vie des ménages (EHCVM)
Nigeria	2013, 2016	General Household Survey
Peru	2010, 2014, 2015, 2017, 2018, 2019	Encuesta Nacional de Hogares
Senegal	2019	Enquête harmonisée sur les conditions de vie des ménages (EHCVM)
Sierra Leone	2018	Integrated Household Survey
Togo	2019	Enquête harmonisée sur les conditions de vie des ménages (EHCVM)
Uganda	2011, 2012, 2014, 2016, 2019, 2020	The Uganda National Panel Survey
United Republic of Tanzania	2015	National Panel Survey

Source: Authors' own elaboration.

Table 2. Household farming activities

Survey	Purpose of household farming activities	Questions in the surveys
Bolivia (Plurinational State of) (2008)	No specified purpose	During the last week, did you spend at least one hour: 1. Working on agricultural crops or raising animals?
Georgia (2013, 2014, 2015, 2016)	Both own consumption/sales purpose	Were you engaged in farming, hunting, fishing or gathering forest fruits, mushrooms, medical plants etc. for own consumption or for sale, for at least one hour during the last 7 days inside the country?
Guatemala (2014)	Own consumption	Yesterday, did you work helping with the activities of the farm, plot or household business without receiving income? Yesterday, did you raise animals for household consumption?
	Sales purpose	Did you receive money from the sale of crops or animals such as: pigs, chickens, cows or other domestic animals?
Mozambique (2009)	Both own consumption/sales purpose	In the last 7 days, how many hours did [NAME] work on the farm, including livestock, or fishing, both for sale and for household consumption?
Mali (2014)	No specified purpose	During the last 7 days, has [NAME] worked at least one hour in a field or garden belonging to him or her or has [NAME] raised animals, fished or hunted for his or her own account?
Nigeria (2013)	No specified purpose	Have you worked on a farm owned or rented by a household member?
Nigeria (2016)	No specified purpose	During the last 7 days, has [NAME] worked on a farm owned or rented by a member of this household, either in cultivating crops or in other farming tasks, or has [NAME] cared for livestock belonging to [NAME] or a member of this household?
Peru (2010, 2014, 2015, 2017, 2018, 2019)	No specified purpose Respondents aged until 20 years old (2010), Respondents aged between 15 and 18 years old (2014, 2015, 2017, 2018, 2019)	Did you help in the farm or herding animals in the last week?
Sierra Leone (2018)	No specified purpose	In the last 7 days, how many hours did you work at any farm work on a farm or garden belonging to the household or looking after animals or fishing or hunting or cutting wood?

Survey	Purpose of household farming activities	Questions in the surveys
Uganda (2011, 2012, 2014, 2016, 2019, 2020)	No specified purpose	In the last 7 days, did [NAME] work on this household's farm? (example: tending crops, feeding animals, etc.)

Source: Authors' own elaboration.

Table 3. Variables available in household surveys used to compute engagement

	7 days				12 months							3 months		1 day
Survey	1st job	2nd job	Ganyu	Household farming activity	1st job	2nd job	3rd job	4th job	Ganyu	Household farming activity	Unpaid apprenticeship	1st job	2nd job	Household farming activity
Bolivia (Plurinational State of) (2008)	x	x		x										
Georgia (2013, 2014, 2015, 2016)	x	x		x								x	x	
Guatemala (2014)	x	x								x				x
Malawi (2013)			x	x	x				x	x	x			
Malawi (2020)			x	x	x	x			x	x	x			
Mali (2014)	x	x		x	x	x								
Mozambique (2009)	x	x		x										
Nigeria (2013)	x	x		x	x	x				x				
Nigeria (2016)	x	x		x	x									
Peru (2010)	x	x		x										
Peru (2014, 2015, 2017, 2018, 2019)	x	x		x										
Sierra Leone (2018)	x	x		x			x			x				
United Republic of Tanzania (2015)	x	x		x						x				
Uganda (2011)	x	x		x			x	x		x				
Uganda (2012)	x	x		x			x	x		x				
Uganda (2014)	x	x		x			x	x		x				
Uganda (2016)	x	x		x			x	x		x				
Uganda (2019)	x	x		x										
Uganda (2020)	x	x		x										
WAEMU (2019)				x	x	x								

Source: Authors' own elaboration.

Table 4. ISIC codes used to identify the agrifood system

AFS sector	AFS subsector	ISIC code	ISIC Description
Agriculture, forestry and fishing	**Agriculture**	**1**	**Crop and animal production, hunting and related service activities**
		11	*Growing of non-perennial crops*
		111	Growing of cereals (except rice), leguminous crops and oil seeds
		112	Growing of rice
		113	Growing of vegetables and melons, roots and tubers
		114	Growing of sugar cane
		115	Growing of tobacco
		116	Growing of fibre crops
		119	Growing of other non-perennial crops
		12	*Growing of perennial crops*
		121	Growing of grapes
		122	Growing of tropical and subtropical fruits
		123	Growing of citrus fruits
		124	Growing of pome fruits and stone fruits
		125	Growing of other tree and bush fruits and nuts
		126	Growing of oleaginous fruits
		127	Growing of beverage crops
		128	Growing of spices, aromatic, drug and pharmaceutical crops
		129	Growing of other perennial crops
		13	*Plant propagation*
		130	Plant propagation
		14	*Animal production*
		141	Raising of cattle and buffaloes
		142	Raising of horses and other equines
		143	Raising of camels and camelids
		144	Raising of sheep and goats
		145	Raising of swine/pigs
		146	Raising of poultry

AFS sector	AFS subsector	ISIC code	ISIC Description
		149	Raising of other animals
		15	*Mixed farming*
		150	Mixed farming
		16	*Support activities to agriculture and post-harvest crop activities*
		161	Support activities for crop production
		162	Support activities for animal production
		163	Post-harvest crop activities
		164	Seed processing for propagation
		17	*Hunting, trapping and related service activities*
		170	Hunting, trapping and related service activities
	Forestry and logging	**2**	**Forestry and logging**
		21	*Silviculture and other forestry activities*
		210	Silviculture and other forestry activities
		22	*Logging*
		220	Logging
		23	*Gathering of non-wood forest products*
		230	Gathering of non-wood forest products
		24	*Support services to forestry*
		240	Support services to forestry
	Fishing	**3**	**Fishing and aquaculture**
		31	*Fishing*
		311	Marine fishing
		312	Freshwater fishing
		32	*Aquaculture*
		321	Marine aquaculture
		322	Freshwater aquaculture
Food processing and services	Manufacture of food products	**10**	**Manufacture of food products**
		101	*Processing and preserving of meat*
		1010	Processing and preserving of meat

AFS sector	AFS subsector	ISIC code	ISIC Description
		102	*Processing and preserving of fish, crustaceans and molluscs*
		1020	Processing and preserving of fish, crustaceans and molluscs
		103	*Processing and preserving of fruit and vegetables*
		1030	Processing and preserving of fruit and vegetables
		104	*Manufacture of vegetable and animal oils and fats*
		1040	Manufacture of vegetable and animal oils and fats
		105	*Manufacture of dairy products*
		1050	Manufacture of dairy products
		106	*Manufacture of grain mill products, starches and starch products*
		1061	Manufacture of grain mill products
		1062	Manufacture of starches and starch products
		107	*Manufacture of other food products*
		1071	Manufacture of bakery products
		1072	Manufacture of sugar
		1073	Manufacture of cocoa, chocolate and sugar confectionery
		1074	Manufacture of macaroni, noodles, couscous and similar farinaceous products
		1075	Manufacture of prepared meals and dishes
		1079	Manufacture of other food products n.e.c.
		108	*Manufacture of prepared animal feeds*
		1080	Manufacture of prepared animal feeds
	Manufacture of beverages	**11**	**Manufacture of beverages**
		110	*Manufacture of beverages*
		1101	Distilling, rectifying and blending of spirits
		1102	Manufacture of wines
		1103	Manufacture of malt liquors and malt
		1104	Manufacture of soft drinks; production of mineral waters and other bottled waters
		2012	Manufacture of fertilizers and nitrogen compounds
		2021	Manufacture of pesticides and other agrochemical products

AFS sector	AFS subsector	ISIC code	ISIC Description
		2821	Manufacture of agricultural and forestry machinery
		2825	Manufacture of machinery for food, beverage and tobacco processing
		462	Wholesale of agricultural raw materials and live animals
		4620	Wholesale of agricultural raw materials and live animals
		463	*Wholesale of food, beverages and tobacco*
		4630	Wholesale of food, beverages and tobacco
		4653	Wholesale of agricultural machinery, equipment and supplies
		4711	Retail sale in non-specialized stores with food, beverages or tobacco predominating
		4721	Retail sale of food in specialized stores
		4722	Retail sale of beverages in specialized stores
		4781	Retail sale via stalls and markets of food, beverages and tobacco products
	Food and beverage service activities	**56**	**Food and beverage service activities**
		561	Restaurants and mobile food service activities
		5610	Restaurants and mobile food service activities
		562	*Event catering and other food service activities*
		5621	Event catering
		5629	Other food service activities
		563	Beverage serving activities
		5630	Beverage serving activities
	Undifferentiated goods- and services-producing activities of private households for own use	**98**	**Undifferentiated goods- and services-producing activities of private households for own use**
		981	*Undifferentiated goods-producing activities of private households for own use*
		9810	Undifferentiated goods-producing activities of private households for own use
		982	*Undifferentiated service-producing activities of private households for own use*
		9820	Undifferentiated service-producing activities of private households for own use
Manufacture of non-food	Manufacture of tobacco products	**12**	**Manufacture of tobacco products**
		120	*Manufacture of tobacco products*
		1200	Manufacture of tobacco products

AFS sector	AFS subsector	ISIC code	ISIC Description
agricultural products	Manufacture of textiles	**13**	**Manufacture of textiles**
		131	*Spinning, weaving and finishing of textiles*
		1311	Preparation and spinning of textile fibres
		1312	Weaving of textiles
		1313	Finishing of textiles
		139	*Manufacture of other textiles*
		1391	Manufacture of knitted and crocheted fabrics
		1392	Manufacture of made-up textile articles, except apparel
		1393	Manufacture of carpets and rugs
		1394	Manufacture of cordage, rope, twine and netting
		1399	Manufacture of other textiles n.e.c.
		142	Manufacture of articles of fur
		1420	Manufacture of articles of fur
	Manufacture of leather and related products	**15**	**Manufacture of leather and related products**
		151	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
		1511	Tanning and dressing of leather; dressing and dyeing of fur
		1512	Manufacture of luggage, handbags and the like, saddlery and harness
		152	*Manufacture of footwear*
		1520	Manufacture of footwear
	Manufacture of wood and of products of wood and cork, except furniture	**16**	**Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials**
		161	*Sawmilling and planing of wood*
		1610	Sawmilling and planing of wood
		162	*Manufacture of products of wood, cork, straw and plaiting materials*
		1621	Manufacture of veneer sheets and wood-based panels
		1622	Manufacture of builders' carpentry and joinery
		1623	Manufacture of wooden containers

AFS sector	AFS subsector	ISIC code	ISIC Description
		1629	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
	Manufacture of paper and paper products	**17**	**Manufacture of paper and paper products**
		170	*Manufacture of paper and paper products*
		1701	Manufacture of pulp, paper and paperboard
		1702	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
		1709	Manufacture of other articles of paper and paperboard
	.	2826	Manufacture of machinery for textile, apparel and leather production
	.	4641	Wholesale of textiles, clothing and footwear
	.	4723	Retail sale of tobacco products in specialized stores
	.	4751	Retail sale of textiles in specialized stores
	.	4771	Retail sale of clothing, footwear and leather articles in specialized stores
	.	4782	Retail sale via stalls and markets of textiles, clothing and footwear

Source: Authors' own elaboration.

Annex II: Methodology to compare counting jobs vs counting people

Table 1. Comparison between the number of jobs and the number of workers in agrifood systems

Country and year	Jobs			Workers			Difference between the shares of jobs and workers in AFS
	All jobs	Jobs in AFS	Share of AFS jobs in total jobs	All workers	Workers in AFS	Share of AFS workers in total workers	
Mozambique (2009)	11 035 663	8 720 266	0.79	9 547 658	8 087 833	0.85	0.06
Niger (2019)	10 897 475	8 987 329	0.82	7 539 541	6 825 882	0.91	0.08
Sierra Leone (2018)	4 242 042	2 880 385	0.68	3 374 257	2 408 123	0.71	0.03
Guinea-Bissau (2019)	843 776	629 674	0.75	651 010	503 855	0.77	0.03
Uganda (2020)	20 024 584	15 083 360	0.75	17 082 403	13 347 500	0.78	0.03
Burkina Faso (2019)	10 938 074	8 642 239	0.79	8 458 395	7 172 495	0.85	0.06
Togo (2019)	3 642 596	2 320 164	0.64	3 039 996	2 055 922	0.68	0.04
Mali (2019)	6 614 691	4 447 959	0.67	5 617 794	4 041 611	0.72	0.05
Benin (2019)	5 430 009	3 458 447	0.64	4 549 966	3 038 742	0.67	0.03
Senegal (2019)	5 272 468	2 678 595	0.51	4 627 740	2 452 362	0.53	0.02
Côte d'Ivoire (2019)	10 856 515	6 953 359	0.64	9 713 882	6 392 713	0.66	0.02
Bolivia (Plurinational State of) (2008)	5 084 348	2 669 416	0.53	4 577 392	2 487 122	0.54	0.02
Nigeria (2013)	6 734 2070	31 963 009	0.47	57 035 904	30 387 036	0.53	0.06
Guatemala (2014)	7 289 348	3 356 004	0.46	6 247 003	2 793 921	0.45	-0.01
Georgia (2016)	2 263 327	1 241 013	0.55	2 102 935	1 213 186	0.58	0.03
Peru (2019)	2 1907 453	11 051 597	0.50	18 018 117	9 567 091	0.53	0.03
Total	193 684 439	115 082 813	0.59	162 183 993	102 775 394	0.63	

Note: Countries are ranked by ascending GDP per capita (constant prices USD 2015).
Source: Authors' own elaboration.

Contact:

Statistics Division – Economic and Social Development
FAO-statistics@fao.org
www.fao.org/food-agriculture-statistics/resources/publications/working-papers/en/

Food and Agriculture Organization of the United Nations
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