IFPRI Discussion Paper 02339

May 2025

Measuring Agrifood Systems

New Indicators and Global Estimates

James Thurlow

Brian Holtemeyer

Shiyun Jiang

Karl Pauw

Josee Randriamamonjy

Foresight and Policy Modeling Unit

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

The International Food Policy Research Institute (IFPRI), a CGIAR Research Center established in 1975, provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition. IFPRI's strategic research aims to foster a climate-resilient and sustainable food supply; promote healthy diets and nutrition for all; build inclusive and efficient markets, trade systems, and food industries; transform agricultural and rural economies; and strengthen institutions and governance. Gender is integrated in all the Institute's work. Partnerships, communications, capacity strengthening, and data and knowledge management are essential components to translate IFPRI's research from action to impact. The Institute's regional and country programs play a critical role in responding to demand for food policy research and in delivering holistic support for country-led development. IFPRI collaborates with partners around the world.

AUTHORS

James Thurlow (j.thurlow@cgiar.org) is Unit Director of the Foresight and Policy Modeling (FPM) Unit of the International Food Policy Research Institute (IFPRI), Washington, DC.

Brian Holtemeyer (b.holtemeyer@gmail.com) is a Data Scientist at the Federal Reserve Bank of Minneapolis, Minneapolis, MN.

Shiyun Jiang (j.jiang@cgiar.org) is a Research Analyst in IFPRI's FPM Unit, Washington, DC.

Karl Pauw (k.pauw@cgiar.org) is a Senior Research Fellow in IFPRI's FPM Unit, Washington, DC.

Josee Randriamamonjy (j.randriamamonjy@cgiar.org) is a Senior Scientist in IFPRI's FPM Unit, Washington, DC.

Abstract

Transformation of the agrifood system is a cornerstone of many governments' national development plans. This reflects the importance of agrifood systems for the livelihoods and wellbeing of poor populations as well as the continued strong association of agricultural transformation with longer-term economic development and structural change. Agrifood transformation is also key to healthier diets and more sustainable production systems. However, adopting an agrifood system perspective is not trivial—it requires looking "beyond agriculture" when prioritizing policies and tracking outcomes by also considering upstream and downstream agrifood-related activities, such as agro-processing and food distribution. Measuring transformation therefore requires economywide data and innovative metrics. This study introduces two such metrics: AgGDP+, which captures the total value-added across the on- and off-farm sectors of the agrifood system, and AgEMP+, which reflects the employment generated across its various components. It further explains how consistent estimates of AgGDP+ and AgEMP+ were produced for 211 and 186 countries, respectively, over the period between 2000 and 2021, and demonstrates how this Agri-Food System Dashboard—a publicly available resource—can be used to monitor transformation, prioritize investments, and better understand the evolving role of agrifood systems in national economies or at regional or global scales.

Keywords: Agrifood system transformation, economic development, AgGDP+, AgEMP+

Acknowledgments

This study was funded by the CGIAR Science Program on Policy Innovations and by contributors to the CGIAR Trust Fund. The study's data system was previously support by the United States Agency for International Development. The findings and conclusions in this study are those of the authors and do not necessarily reflect the views of the CGIAR or its funders. We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund: https://www.cgiar.org/funders/.

1. Introduction

Agricultural growth is an important driver of structural change during the early stages of a country's development when rising farm incomes generate demand for nonagricultural products and spur economywide growth (Diao et al. 2010). However, as countries develop, the nature of agriculture's contribution evolves, with production linkages playing an increasingly important role as demand for processed food rises (Vogel 1994). This leads to longer supply chains stretching beyond the farm and stronger interindustry demand for agricultural inputs (Barret et al. 2022). Eventually, non-agricultural incomes and urban consumers drive agricultural growth. This stylized evolution is referred to as agricultural transformation (Timmer 1988). Accelerating transformation and ensuring that this process generates inclusive employment opportunities is a policy objective for many developing countries. It has also motivated the international development community's shift from a more agriculture-oriented agenda to one that emphasizes broader agrifood systems (World Bank 2017; Von Braun et al. 2021).

Despite successful agricultural growth in many countries and a growing emphasis on the role of broader agrifood systems in growth and structural change (Diao et al. 2025), indicators that measure the size and structure of countries' agrifood systems are still evolving. This makes it difficult to assess the pace of agricultural transformation and complicates the design and evaluation of policies from an "agrifood systems perspective", that is, one that recognizes the integrated nature of the on-farm and off-farm components of agrifood value chains and the role of market development and expansion of agrifood products. Without suitable metrics, research and policies often rely on indicators that focus exclusively on primary agriculture, such as on-farm employment or agricultural gross domestic product (GDP). These indicators overlook off-farm components of the agrifood system, which become more important over time for economywide growth and employment (Christiaensen et al. 2021). In fact, the off-farm components may augment, or even eventually outweigh, primary agricultural growth's traditionally dominant role in reducing national poverty (Christiaensen et al. 2011; Dorosh and Thurlow 2018).

To address this gap in our metrics, we present two new indicators that measure the size of a country's agrifood system. The first indicator, called agrifood system GDP (or AgGDP+), captures the total value-added or GDP generated across all the major components of the agrifood system, including primary agriculture, food industries, and related services. The second indicator, called agrifood system employment (or AgEMP+), captures total employment across the agrifood system, including informal work and self-employment. This indicator is further disaggregated across male and female workers. Using a combination of data and statistical imputation, we generate consistent estimates of AgGDP+ and AgEMP+ at national, regional, and global levels for the 2000–2021 period, which is published as the *Agri-Food System Dashboard* (IFPRI 2025a).

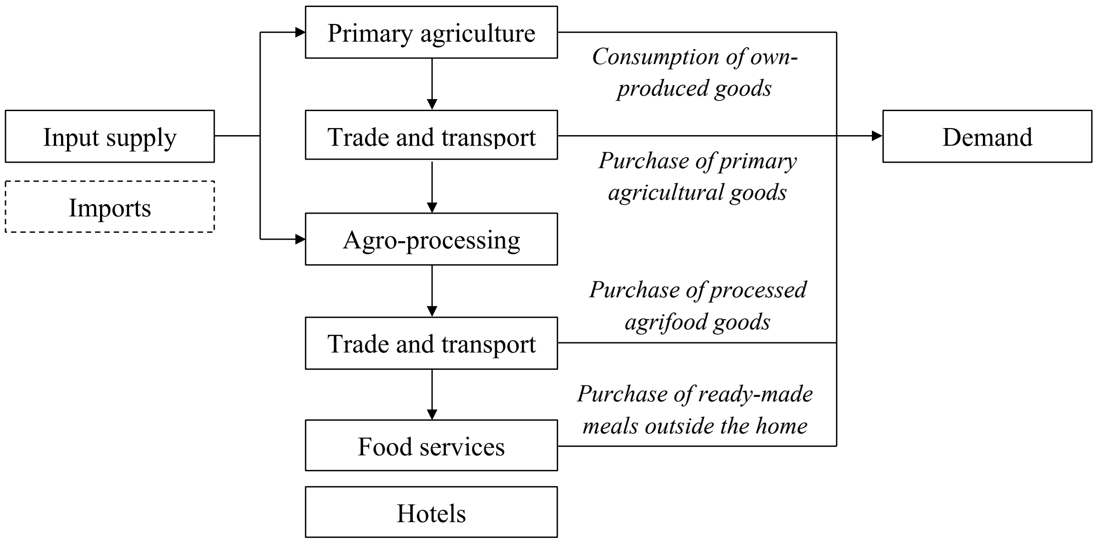
The paper is structured as follows: Section 2 presents our conceptualization of the agrifood system and offers definitions of the AgGDP+ and AgEMP+ indicators. Section 3 describes the data used to generate estimates, as well as the methods used to impute estimates for countries without data and to extrapolate for missing years. Section 4 describes the size and structure of the global agrifood system in 2021 and how it has evolved since 2000 based on the constructed *Agri-Food System Dashboard* (IFPRI 2025a). Section 5 compares our methods and estimates to those of other studies. Finally, Section 6 summarizes our findings and identifies areas where our data and approach can be applied. An Appendix includes additional technical information, while additional results are supplied in a Supplementary Materials section.

2. Defining the Agrifood System

There are numerous conceptual frameworks of the agrifood system (see, for instance, Fanzo et al. 2020, GLOPAN 2020, or Hasnain et al. 2020). For some, the food system is best described by the actors involved in the complex supply chains linking food production, processing, distribution, and consumption (Barrett et al. 2022). For others, the food system is a broader concept that also includes the natural and food environments and an explicit consideration of food system *outcomes* such as food security, nutrition, equity, and environmental sustainability (Ingram and Thornton 2022). Given our objective of generating quantifiable economic indicators at a global scale that can be easily updated we adopt a narrower conceptualization that separates the agrifood system into six broad components (see Figure 1). These include primary agriculture, plus all upstream and downstream agriculture-related activities. Our agrifood system is essentially the sum of all food and nonfood agricultural value chains within an economy, as seen from a production-based supply-side perspective of the economy.

The six components are defined using the International Standard Industrial Classification (ISIC), which determines which kinds of economic activities fall within specific sectors, such as primary agriculture versus food processing or food services (UNDESA 2008). The System of National Accounts (SNA) uses ISIC, or a local variant, to assign GDP to sectors, and household surveys use ISIC to track workers' sector of employment. Some of the agrifood system's components are drawn directly from national accounts, while others require more detailed information. In the SNA, GDP is equal to the total value of gross output minus the cost of intermediate inputs. The latter determines interindustry demand or production linkages, which become more important as agricultural transformation progresses. The various intermediate inputs used by producers in different sectors are recorded in Supply-Use Tables (SUT) or Input-Output Tables (IOT). These are an integral part of a country's SNA, and we use them to classify which upstream and downstream activities are included in our definition of the agrifood system. Each component of the agrifood system is described below, and a formal definition is provided in the Appendix.

Figure 1. Components of the Agrifood System



Source: Authors' representation.

The first component, *Primary Agriculture*, includes all activity within the agricultural sector, including crops, livestock, forestry, and fishing. Some primary products are produced, prepared, and consumed directly, while others are purchased in markets and/or supplied downstream for further processing. The *Agro-Processing* component includes all agriculture-related activities within the manufacturing sector, including the processing of foods, feed, beverages, and tobacco. The distinction between primary and processed products, while not always clear, often depends on whether primary products are transported off the farm or change ownership before being processed. The *Food Services* component includes the selling of beverages and ready-made meals, such as at restaurants and bars or by street vendors. The distinction between food processing and food services depends on where the final preparation and consumption of food takes place (i.e., within or outside of the home). These three components—primary agriculture, agro-processing, and food services—have distinct ISIC codes and can therefore be drawn directly from the SNA and survey data. The remaining components require additional information from SUTs and IOTs and are more complicated to estimate.

The *Input Supply* component includes all activities associated with the domestic production of inputs used by producers in the primary agriculture and agro-processing sectors (e.g., fertilizers and electricity). Inputs produced and used by primary agriculture and agro-processing themselves are excluded to avoid double-counting (i.e., these are captured in the agriculture and processing components above). Only a portion of the GDP and employment generated by input producers is considered part of the agrifood system, because their products can be used by many sectors throughout the economy. The portion attributed to the agrifood system is calculated based on the share of agriculture and agro-processing's input demand in total economywide demand for a product. For example, if agriculture and agro-processing use a third of all petroleum available in the economy, then a third of the petroleum sector's GDP is assigned to the agrifood system. If petroleum is entirely imported, then petroleum input use does not contribute to the national agrifood system, because all value-added and employment associated with petroleum production occurs outside the country.

The *Trade and Transport* component appears twice in Figure 1. It includes the transporting and trading (i.e., aggregating, retailing, and wholesaling) of agrifood products between farms, firms, and final demanders, regardless of whether those are domestic, imported, or exported products. ISIC does not separate trade and transport sectors into food and nonfood parts, but this can be derived from product-level data on transaction cost margins within SUTs (i.e., the gap between producer and consumer prices, less any product taxes).[1] Transaction costs are the primary source of demand for trade services, and so a portion of this sectors' GDP can be attributed to the agrifood system based on the share of agrifood margins relative to the total margins on all marketed products.[2] Being able to isolate the agrifood portion of the trade and transport sectors is the main advantage of using SUTs, since, as shown later, it is the largest off-farm component of the agrifood system in lower-income countries.

The final component, *Hotels*, is the part of the hotels and accommodation sector associated with the preparation and sale of food and beverages (e.g., bar and restaurant operations inside hotels). The portion of this sector's GDP that we attribute to the agrifood system is based on the share of agrifood inputs in total intermediate input costs. For example, if foods and beverages make up half of the hotel sector's input costs, then we assign half of this sector's total GDP to the agrifood system. This assumes that labor and capital costs (i.e., worker remuneration and operating profits) in the hotel sector are proportional to intermediate input costs (i.e., that selling food and beverages is, on average, as labor-intensive and as profitable for hotels as renting rooms or other sources of revenues).

Together, these six components capture the main economic activities within the agrifood system. Our framework closely aligns with the SNA, and hence with readily available GDP and employment data. This allows us to apply the same data framework across countries and produce consistent global and regional estimates. Due to data constraints, however, we exclude certain activities that could be considered part of the agrifood system. We exclude, for example, the GDP and employment generated by the Ministry of Agriculture and by agriculture-related departments at universities and training institutes. Expanding our framework to include such detailed subsectors would require country-specific data that may not be comparable over time or across countries. Since we expect that any omitted subsectors are relatively small in terms of

[1] In principle, ISIC has separate codes for trade in agricultural inputs and food, beverages, and tobacco. To our knowledge, however, no (developing) country's national accounts report such detailed sectoral GDP, and surveys are often unreliable at this level of detail. Indirect estimation via transaction cost margins is therefore preferable.

[2] We exclude transaction costs on the non-agrifood inputs used by farmers and processors, i.e., margins on products produced by the *Primary Agriculture* and *Agro-Processing* components are included, but margins on products in the *Input Supply* component are not.

GDP and employment, excluding them from our definition should not lead to substantial mismeasurement of global and national agrifood systems.

3. Data and Estimation Procedure

3.1 Country data

Estimating AgGDP+ and AgEMP+ for a country requires a SUT or IOT, which describes a country's economic structure during a given year. We compiled a sample database of 1,389 SUT/IOTs from national statistical agencies and repositories maintained by international organizations, including the Asian Development Bank (ABD), the International Food Policy Research Institute (IFPRI), and the Organization for Economic Cooperation and Development (OECD).[3] In total, there are 131 countries in our sample with an SUT/IOT for at least one year. Our sample is missing 86 countries out of a total of 217 countries and territories identified by the World Bank. About half of the missing countries are small island states or territories with populations of less than one million people. Overall, Table 1 shows that the 131 countries in our sample accounted for 98 percent of global GDP and 96 percent of the global population and employment in 2021.

Table 1. Sample Country Coverage

	Number of countries		Sample share of group totals in 2021 (%)		
	All	Sample	Population	GDP	Employment
World	217	131	95.7	98.2	96.4
East Asia and Pacific	37	19	98.7	99.7	98.6
Europe and Central Asia	58	42	97.0	99.2	97.5
Latin America and Caribbean	42	21	97.0	93.4	97.2
Middle East and North Africa	21	12	88.1	77.9	84.6
North America	3	2	100.0	100.0	100.0
South Asia	8	7	97.9	99.6	98.8
Sub-Saharan Africa	48	28	86.1	88.5	87.5
Low-income countries	28	14	74.1	74.3	76.9
Lower-middle income countries	55	40	97.8	97.9	97.9
Upper-middle income countries	54	32	98.0	98.5	98.4
High income countries	80	45	97.8	98.3	97.6

Source: Global population data for 217 countries from UNDESA (2022); global GDP data for 211 countries from BEA (2022) and UNDESA (2023); and global employment data for 187 countries from ILO (2023).
Notes: Regions and country income groups are from the World Bank (fiscal year 2021).

Most statistical agencies only construct SUTs or IOTs when rebasing national accounts (i.e., updating GDP to incorporate more recent or improved data). This is a lengthy and technical process that ideally draws on detailed firm and household surveys and a wide range of other data. Accordingly, some countries, especially smaller and poorer countries, use less data-intensive approaches that do not generate SUTs or IOTs (see Jerven 2013). This is reflected in the

[3] See Table A2 in the appendix for a list of country data sources.

variation of our sample's coverage across regions and income groups. Coverage is lower for low-income countries, most of which are in Sub-Saharan Africa. The Middle East and North Africa region also has lower coverage, because our sample lacks some of the region's larger economies, such as the United Arab Emirates and Qatar. Imputation procedures are more important for regions and country income groups with lower coverage in the sample.

Since many statistical agencies only occasionally produce SUTs or IOTs, there are missing data for certain years in our sample. Even countries that produce these annually may do so with a significant lag, resulting in missing data for more recent years. Table 2 breaks down our sample based on the most recent years for which we have data. Most countries have SUT/IOTs from between 2018 and 2021.[4] Countries with data predating 2015 only represent a small share of the global population and economy. Therefore, in addition to imputing values for missing countries, we also extrapolate estimates for missing years to generate a completed time series of estimates for 2000–2021.

Table 2. Sample Countries' Most Recent SUT/IOTs

Year of most recent SUT/IOT	Number of countries	Share of global totals in 2019 (%)		
		Population	GDP	Employment
All sample countries	131	100	100	100
2021	34	62.9	62.5	65.0
2018-2020	75	32.2	35.6	31.5
2015-2017	9	3.0	1.2	2.1
2010-2014	10	2.7	0.8	1.9
2000-2009	7	0.6	0.2	0.5

Source: Population from UNDESA (2022); GDP from BEA (2022) and UNDESA (2023); and employment from ILO (2023).

The main employment data we used is from the Modeled Estimates and Projections database of the International Labor Organization (ILO), which covers 189 countries and territories and draws on household and labor force surveys (ILO 2023, 2024). The ILO uses econometric models to estimate the number of employed male and female workers across 14 broad ISIC sectors for the 2000–2021 period. As we elaborate in the appendix, we assume uniform worker-to-GDP ratios within these broad sectors.

An advantage of the ILO estimates is that they apply a consistent definition of employment across countries, i.e., people aged 15 years or older who are considered part of the workforce. Moreover, the ILO tracks workers rather than employees, which means that self-employed and informal workers are included in our estimates (see ICLS 2013). This is important for developing countries where many people engaged in farming or household enterprises are unpaid family workers producing goods and services for the market, or food and other commodities for their

[4] Table S4 includes data type and source for all countries over time.

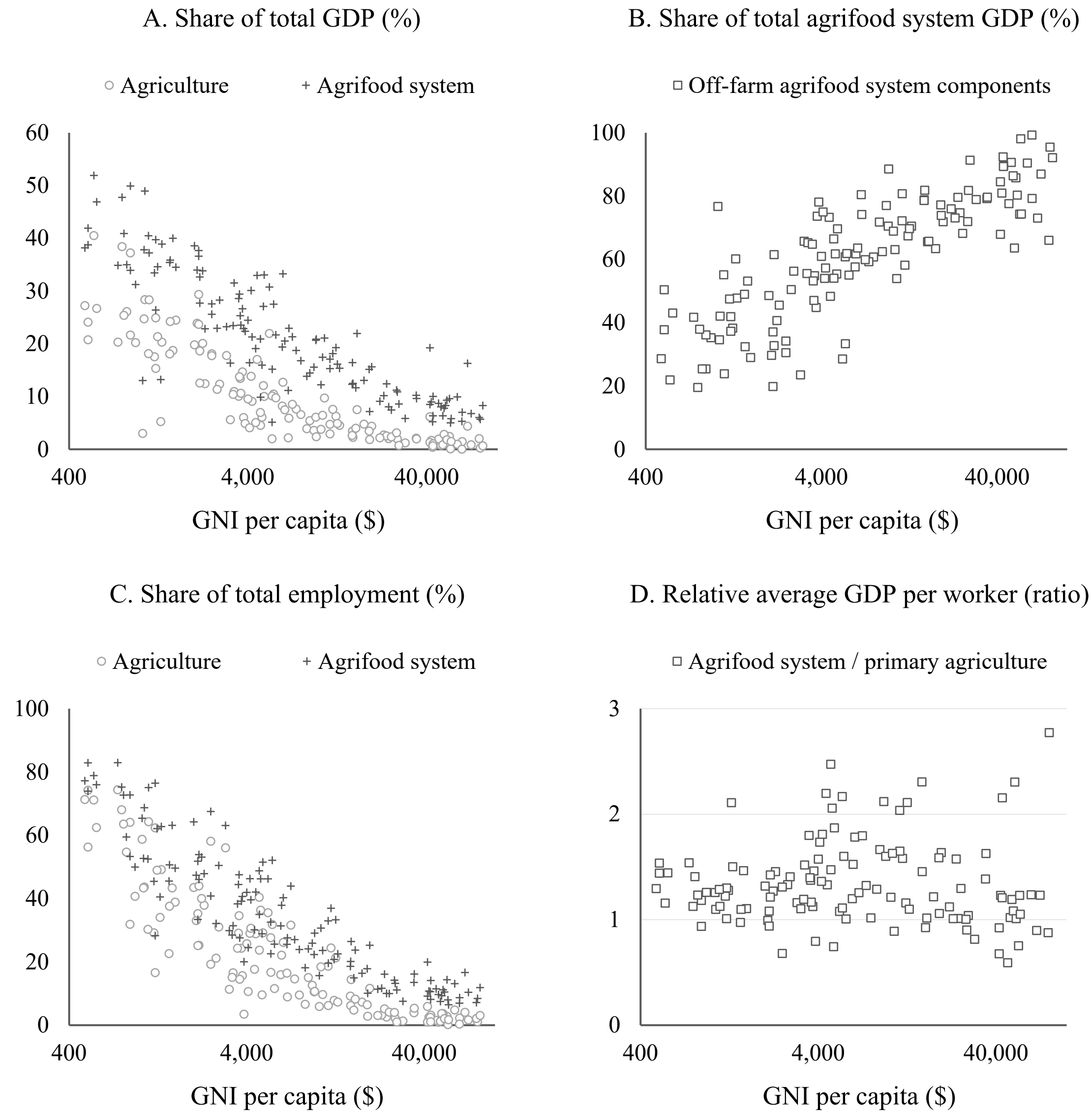
own use.[5] The ILO data also has some limitations. Given its focus on individuals' *primary* jobs and sectors of employment, it may incorrectly estimate the actual amount of time people spend working in a particular sector (see Gollin et al. 2014). Employment estimates also do not represent full-time equivalent jobs.

3.2 Sample estimates

We first estimate AgGDP+ and AgEMP+ for the 131 sample countries for each year where we have an IOT or SUT. Panel A in Figure 2 shows the shares of primary agriculture and the broader agrifood system in total GDP using the most recent estimate for each country in the sample.[6] Agriculture's declining GDP share as per capita GNI grows is consistent with the sector's declining importance as countries develop (Timmer 1998). This decreasing pattern also applies to the agrifood system's share of total GDP. At a per capita GNI of US$30,000 or higher, the agrifood system share stabilizes at around eight percent, which is consistent with the decelerating decline in household food consumption shares as their incomes rise (Moneta and Chai 2014).

[5] Family members engaged in household services such as food preparation for the household or caring for children in the household are not considered part of the labor force by this definition.
[6] The figure uses each sample country's most recent annual estimate.

Figure 2. Agrifood System Shares Across Sample Countries



Source: Authors' calculations using SUTs and IOTs for 131 countries using each country's most recent data year (see Tables A3 in the annex).
Notes: GNI is gross national income (Atlas method). Off-farm components include processing, trade and transport of agrifood products, food services, and supply of non-agrifood inputs to agriculture and processing.

Panel B plots the combined share of the off-farm components in AgGDP+ (i.e., the gap between agriculture and the agrifood system in Panel A). Off-farm components are less important for lower income countries but play a dominant role in the agrifood system at higher income levels. This is consistent with a lengthening of supply chains beyond the farm as countries develop and agrifood value chains transform (Barret et al. 2022).

Similar estimates are generated for employment. Panel C shows that, at a given income level, employment shares in the agrifood system are higher than GDP shares. This is consistent with lower labor productivity in agriculture (or GDP per worker) and the lower labor-intensity of non-agricultural production (Gollin et al. 2014; McMillan et al. 2014). This is confirmed in Panel D, which shows average GDP per worker in the agrifood system relative to average GDP per worker in primary agriculture. The ratio is generally greater than one, implying higher labor productivity in the off-farm components of the agrifood system. There are some countries, especially more developed ones, where the ratio is less than one. This may reflect greater mechanization of agriculture, such as in Canada (0.59) and Israel (0.68). It may also reflect a more food-service-oriented agrifood system because GDP per worker in food services is often low compared to other off-farm components (see discussion below).

3.3 Imputing and extrapolating missing values

With 98 percent coverage of global GDP and 96 percent coverage of populations and employment, we can directly estimate the size and structure of agrifood systems for most of the world using our sample data. Our objective, however, is to generate a time series of estimates for as many countries as possible, and so we impute values for missing countries and extrapolate estimates for missing years. From the sample countries, we estimate the determinants of the share of the off-farm agrifood system in total GDP and employment, as well as the share of female workers in off-farm agrifood system employment using econometric models. We consider a range of possible predictors, including gross national income (GNI) per capita, urban population, arable land, sectoral GDP and employment, GDP by expenditure category, and regional dummies. The Lasso approach is used to identify and select a parsimonious set of predictors for the econometric models (see Tibshirani 1996).[7]

Controlling other factors, we find that GDP production and expenditure patterns are the most efficient predictors of a country's off-farm agrifood system share in total GDP. Countries with larger manufacturing and trade sectors tend to have larger off-farm agrifood systems. This is expected given that our AgGDP+ definition includes agro-processing and trade components. Less export-intensive economies and economies oriented towards domestic private consumption also tend to have larger off-farm shares. This reflects the tendency of less developed countries to export primary unprocessed agricultural products.

Similar results were obtained for the off-farm agrifood system share of total employment. Sectoral employment patterns are again the most efficient predictors. Countries with more employment in trade and food services tend to have larger off-farm agrifood system shares. In addition to sectoral employment patterns, the share of female workers in the off-farm agrifood system depends on the overall share of women in nonfarm employment and on the gender-intensity of employment within broad sectors.

A dummy variable is included indicating whether a country's data is derived from an SUT or IOT. Interestingly, results show that off-farm agrifood system GDP and employment shares are four to five percentage points larger when based on SUTs. This may reflect the less detailed

[7] Results from the econometric models are provided in Supplementary Materials, Tables S1–S3.

treatment of transaction cost margins in IOTs, which leads to an underestimation of the *Trade and Transport* component of the agrifood system.[8]

The cross-country coefficients from the regression analysis are used to impute indicator values for the 86 countries outside our sample. The data sources used to impute values for the missing countries are the same as those used to estimate coefficients for the sample countries. These include sectoral GDP and employment from UNDESA (2023) and ILO (2023); urban population shares from UNDESA (2022); and GNI per capita from the World Bank (2023). Due to incomplete GDP and employment datasets, we can only impute AgGDP+ and AgEMP+ for 80 and 55 countries, respectively. There are 6 countries (out of 217) without AgGDP+ estimates and 31 countries without AgEMP+ estimates, which together account for less than 0.05 percent of the global population.

Although many countries have data covering multiple years, very few have data for the entire period. We extrapolate indicators for missing years to generate a consistent time series for 2000–2021. First, we impute AgGDP+ and AgEMP+ estimates for all countries and years based on the econometric models described above. For out-of-sample countries, the imputed estimates are the final indicators. For sample countries with gaps, we scaled the imputed time series using the nearest observed value. However, if the missing observation falls between two years with observations, then the imputed estimate is scaled using the two observed values. In other words, for the sample countries, the imputed time series provides information on how the indicators vary relative to observed estimates. The final *Agri-Food System Dashboard* (IFPRI 2025a) contains AgGDP+ and AgEMP+ estimates for 211 and 186 countries, respectively, covering the \2000–2021 period.[9]

4. Size, Structure, and Evolution of the Global Agrifood System

4.1 Global agrifood system GDP

Table 3 reports the final estimated values of GDP, including for primary agriculture (AGR) and the agrifood system (AFS) (or AgGDP+), by region and country income group in 2021. Global AgGDP+ was $11.7 trillion in 2021, equivalent to 12.8 percent of the global economy. Primary agriculture contributed $4.2 trillion in GDP, or about one-third of global agrifood system GDP. This means that for every dollar of GDP generated "on-farm", about two dollars were generated "off-farm" within the global agrifood system. This ratio is higher in high-income countries, where off-farm GDP is more than six times larger than agricultural GDP. Overall, high income countries account for two-fifths of the global agrifood system, even though they account for only one-fifth of global agricultural GDP. This is reflected in the large contributions of North America and Europe to AgGDP+ relative to their populations and agricultural sectors.

[8] Table A2 in the appendix identifies the countries with IOTs in our sample.
9 Table S4 in the Supplementary Materials identifies all the imputation and extrapolation data points in the database.

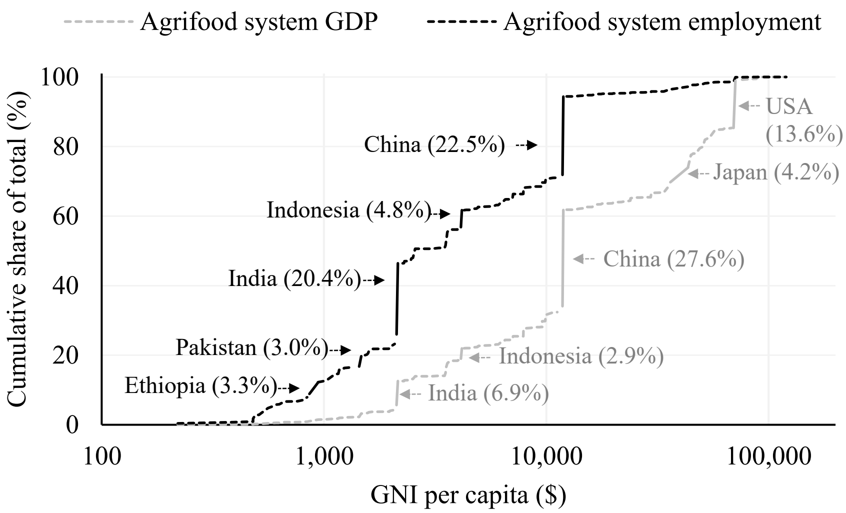
Table 3. Global Agrifood System GDP Estimates (2021)

	GDP in current prices (US$ billions)			Contribution to global GDP (%)		AGRS or AFS share in total GDP (%)	
	Total	AGR	AFS	AGR	AFS	AGR	AFS
World	91,643	4,157	11,729	100	100	4.5	12.8
East Asia and Pacific	29,851	1,863	4,914	44.8	41.9	6.2	16.5
Europe and Central Asia	22,498	507	2,058	12.2	17.5	2.3	9.1
Latin America and Caribbean	4,778	304	886	7.3	7.6	6.4	18.5
Middle East and North Africa	3,801	217	521	5.2	4.4	5.7	13.7
North America	25,176	242	1,739	5.8	14.8	1.0	6.9
South Asia	3,741	685	1,047	16.5	8.9	18.3	28.0
Sub-Saharan Africa	1,797	339	564	8.1	4.8	18.8	31.4
Low-income countries	484	138	204	3.3	1.7	28.5	42.1
Lower-middle income countries	8,521	1,393	2,411	33.5	20.6	16.3	28.3
Upper-middle income countries	26,240	1,871	4,661	45.0	39.7	7.1	17.8
High income countries	56,398	755	4,453	18.2	38.0	1.3	7.9

Source: Authors' calculations using IFPRI's Agri-Food System Dashboard (2025a).
Notes: AGR is primary agriculture; AFS is the agrifood system.

Figure 3 presents the cumulative distribution of global AgGDP+ in 2021, with countries ranked by average GNI per capita and the five countries with the largest shares labeled. Approximately two-fifths of global AgGDP+ were generated by middle-income countries, primarily in East Asia and the Pacific. This is largely driven by China, which accounted for 27.6 percent of global AgGDP+. Other large contributors include the United States, India, Japan, and Indonesia. In contrast, low-income countries contributed less than two percent of global AgGDP+ in 2021, despite comprising 9.1 percent of the world's population and generating 3.5 percent of global agricultural GDP.

Figure 3. Cumulative Agrifood System Shares Across Countries Ranked by Incomes (2021)

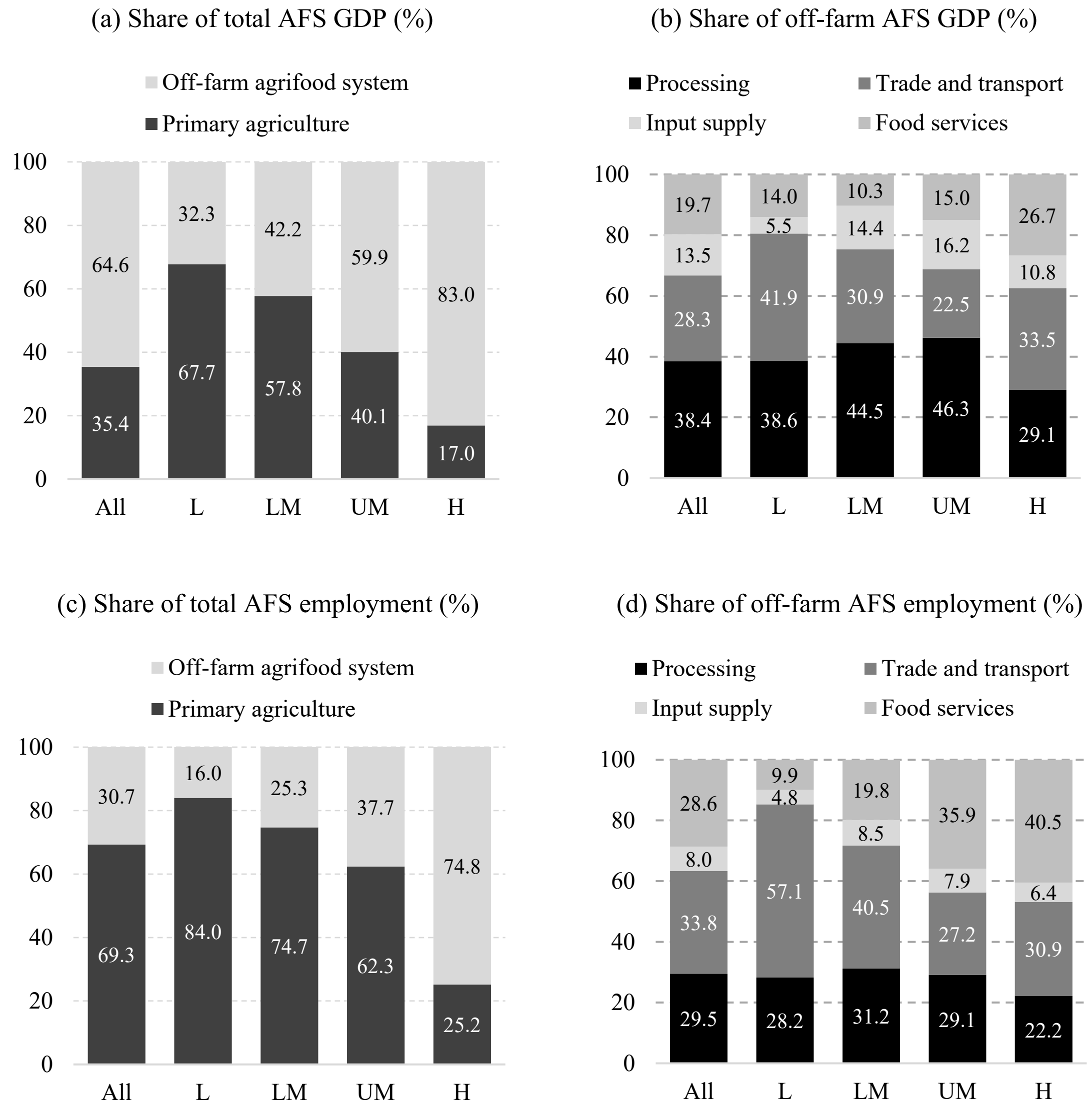


Source: Authors' calculations using IFPRI's Agri-Food System Dashboard (2025a).
Notes: Countries ranked by their 2019 GNI per capita. Figure indicates countries with the largest agrifood GDP and employment shares.

Figure 4 decomposes total AgGDP+ in 2021 across country income groups. Panel A shows that 62.9 and 65.3 percent of AgGDP+ is derived from primary agriculture in low-income (L) and lower-middle-income (LM) countries, respectively. At higher income levels, the share of primary production in AgGDP+ declines and off-farm activities contribute more to the total agrifood system. These patterns using 2021 estimates align with the sample estimates shown in Figure 2 and are consistent with the stylized agricultural transformation process, i.e., as countries develop, the contribution of primary agriculture to the broader economy declines. While the contribution of the overall agrifood system also declines, it does so at a slower pace because the off-farm components of the agrifood system expand relative to primary agriculture.

Panel B in Figure 4 decomposes off-farm agrifood system activities (i.e., the dark grey bars from Panel A). Agro-processing is the largest off-farm activity for middle income countries, where it accounts for almost half of off-farm agrifood system GDP. Input supply activities also contribute larger shares of off-farm agrifood GDP in middle-income countries, indicating more input-intensive production processes. Food services are particularly important for high-income countries, reflecting higher-income consumers' greater demand for food prepared outside the home. Trade and transport GDP is an important component of off-farm agrifood system GDP across all income groups and is the largest component for both low- and high-income countries. While not shown in the figure, the source of trade and transport GDP changes at higher income levels. For low-income countries, the trading and transporting of primary agricultural products dominates, but this changes to trading and transporting of processed products in middle- and high-income countries. This is consistent with the lengthening of supply chains as countries develop and food systems transform.

Figure 4. Decomposing Agrifood GDP and Employment by Country Income Group (2021)



Source: Authors' calculations using IFPRI's Agri-Food System Dashboard (2025a).
Notes: AFS is agrifood system; L is low-income countries; LM is lower-middle income; UM is upper-middle income; and H is high-income.

4.2 Global agrifood system employment

Table 4 summarizes the estimates for agrifood system employment across regions and country income groups. In 2021, 1.3 billion people worked in the global agrifood system, equivalent to 38.5 percent of total global employment. Most workers in the agrifood system reside in lower-middle income countries and in the East Asia and Pacific region. However, work in the agrifood system is most important for low-income countries and in South Asia and Sub-Saharan Africa. The bottom two panels in Figure 4 decompose employment in the agrifood system. Panel A indicates that primary agriculture is overwhelmingly the largest source of agrifood system employment, except amongst high-income countries. Panel B shows that most off-farm agrifood system jobs are in trade and transport for low- and lower-middle-income countries, whereas food services account for most off-farm jobs for upper-middle-income and high-income countries.

Table 4. Global Agrifood System Employment Estimates (2021)

	Employment (millions of workers)			Contribution to global employment (%)		AGR or AFS share in total employment (%)	
	Total	AGR	AFS	AGR	AFS	AGR	AFS
World	3,271	871	1,258	100	100	26.6	38.5
East Asia and Pacific	1,210	289	447	33.1	35.6	23.9	37.0
Europe and Central Asia	408	31	68	3.6	5.4	7.7	16.6
Latin America and Caribbean	279	41	82	4.7	6.5	14.5	29.3
Middle East and North Africa	139	21	36	2.4	2.9	14.8	26.3
North America	179	3	19	0.3	1.5	1.6	10.4
South Asia	633	269	335	30.9	26.6	42.5	52.9
Sub-Saharan Africa	423	218	271	25.0	21.5	51.6	64.0
Low-income countries	253	148	176	17.0	14.0	58.4	69.6
Lower-middle income countries	1,223	454	607	52.0	48.3	37.1	49.6
Upper-middle income countries	1,213	253	405	29.0	32.2	20.8	33.4
High income countries	582	17	69	2.0	5.5	3.0	11.9

Source: Authors' calculations using IFPRI's Agri-Food System Dashboard (2025a).
Notes: AGR is primary agriculture; AFS is the entire agrifood system.

Table 5 shows sex-disaggregated employment estimates. In 2021, there were 1.3 billion female workers out of a global total of 3.2 billion workers. Given similar male and female population shares, this reflects lower female labor force participation. Amongst female workers, 39.0 percent were employed in the agrifood system in 2021, where 65.3 percent of them worked in primary agriculture. These shares differ across country income groups. In low- and lower-middle-income countries, more than two-thirds of female workers are employed in agrifood sectors, compared to only 10.9 percent of female workers in high-income countries. Overall, female workers play a key role in agrifood systems, and agrifood systems are an important source of employment for female workers. Unfortunately, due to data limitations, it is not possible to produce sex-disaggregated estimates of agrifood system GDP, which in turn makes it difficult to assess the contribution of male and female workers to changes in labor productivity or GDP per worker.

Table 5. Female Employment in Global Agrifood System Estimates (2021)

	Female employment (millions of workers)			AFS share of total female empl. (%)	AGR share of AFS female empl. (%)
	Total	AGR	AFS		
World	1,292	329	504	39.0	65.3
East Asia and Pacific	538	112	200	37.1	56.0
Europe and Central Asia	186	12	28	15.1	43.4
Latin America and Caribbean	113	9	28	25.2	33.0
Middle East and North Africa	25	4	6	25.1	64.2
North America	83	1	8	9.6	10.4
South Asia	154	90	103	67.1	87.4
Sub-Saharan Africa	194	100	130	66.9	77.1
Low-income countries	110	68	81	73.9	84.4
Lower-middle income countries	390	161	220	56.3	73.2
Upper-middle income countries	533	94	175	32.8	53.9
High income countries	259	5	28	10.9	19.2

Source: Authors' calculations using IFPRI's Agri-Food System Dashboard (2025a).
Notes: AGR is primary agriculture; OFF is off-farm components of the agrifood system; AFS is the entire agrifood system.

4.3 Transformation of the global agrifood system during 2000–2021

Table 6 presents average annual GDP growth rates in GDP and employment across country income groups during 2000–2021. High-income countries experienced the slowest annual growth in total GDP over the two decades (1.6 percent per year), compared to faster growth for upper-middle income countries (5.7 percent per year). In all income groups, however, primary agriculture and the broader agrifood system grew slower than the overall economy. This suggests that agriculture and the agrifood system's shares of total GDP declined over time. This is consistent with expected patterns of positive economic development. Except for low-income countries, primary agriculture grew faster than the population, but slower than the overall agrifood system, which is consistent with positive agricultural transformation. Across low-income countries, primary agriculture grew slightly slower than the overall agrifood system, but agriculture's high growth rate still indicates strong agricultural development since 2000. At the global level, however, agriculture and the agrifood system grew slightly faster than the broader economy. This reflects slower overall growth in higher-income economies, where non-agrifood system sectors dominate, and much faster growth in developing regions where most of the global agrifood system is located (see Table 4).

Table 6. Annual GDP and Employment Growth (2000-2021)

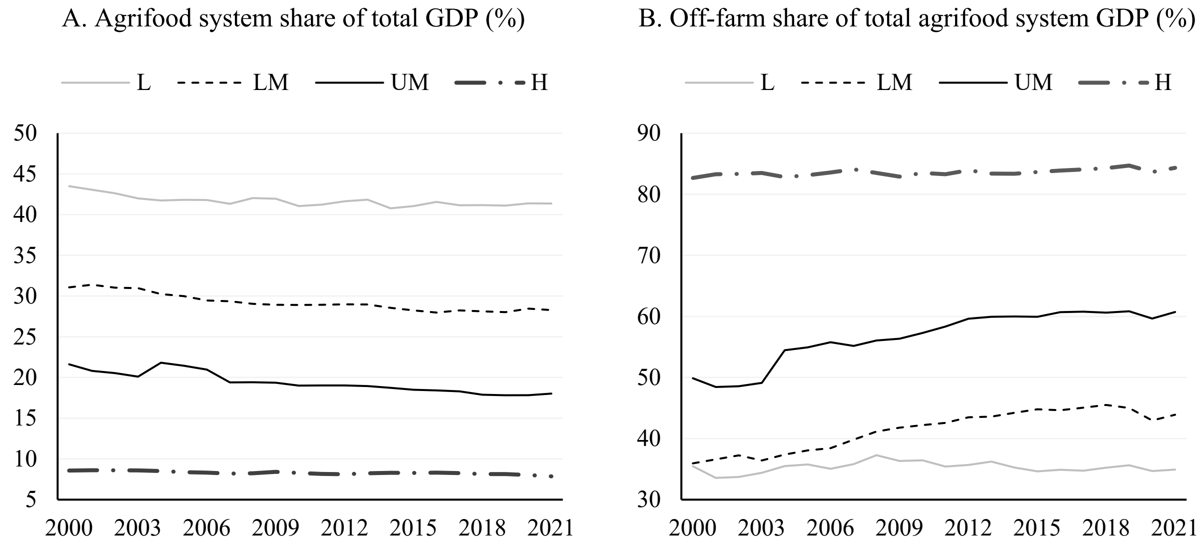
	Average annual growth rate during 2000-2021 (%)				
	World	L	LM	UM	H
Population	1.2	2.8	1.5	0.7	0.6
Total GDP	2.8	4.8	4.6	5.7	1.6
Agrifood system	3.0	4.5	4.2	4.8	1.2
Primary agriculture	2.9	4.7	3.5	3.6	0.7
Rest of the economy	2.7	4.9	4.8	5.9	1.6
Total employment	1.1	3.1	1.6	0.6	0.8
Agrifood system	-0.1	2.3	0.5	-1.4	-0.6
Primary agriculture	-0.8	2.1	-0.1	-2.6	-2.3
Rest of the economy	2.2	5.2	3.1	2.2	1.0
Average GDP per worker	1.6	1.7	3.0	5.0	0.8
Agrifood system	3.2	2.1	3.7	6.3	1.7
Primary agriculture	3.7	2.5	3.6	6.3	3.0
Rest of the economy	0.5	-0.3	1.7	3.6	0.6

Source: Authors' calculations using IFPRI's Agri-Food System Dashboard (2025a).
Notes: L is low-income countries; LM is lower-middle income; UM is upper-middle income; and H is high income.

Table 6 further shows that while global employment grew at an annual rate of 1.1 percent, the agrifood system experienced a slight decline at -0.1 percent, and employment in the agriculture sector decreased by 0.8 percent annually. Since 2000, low-income countries experienced rapid expansion in both agriculture and agrifood system employment, leading to slower average labor productivity growth. Growth in the agrifood system for low-income countries is, therefore, equally driven by a rising number of workers and rising average productivity per worker. This is not the case for other country income groups, where employment in the agrifood system increased modestly or declined. As a result, average productivity in these income groups' agrifood systems increased significantly, and it also increased at a much faster pace than in sectors outside the agrifood system.

In summary, there is clear evidence of positive structural and agricultural transformation across lower-middle, upper-middle, and high-income countries. This is evident in Figure 5, which presents the share of the agrifood system in total GDP (Panel A) and the off-farm agrifood system GDP share (Panel B) by country income group over the 2000–2021 period. Overall, as countries become wealthier, the agrifood system as a share of total GDP declines, while the off-farm component of the agrifood system becomes relatively larger. Within country groups, we see similar patterns of decline and growth in the two measures over time, with the largest changes in percentage-point terms taking place among lower-middle and upper-middle income countries. This transition is taking place alongside relatively high growth in overall GDP and signifies the dynamic development that is taking place in middle-income countries.

Figure 5. Changing Contribution and Composition of Agrifood Systems (2000-2021)



Source: Authors' calculations using IFPRI's Agri-Food System Dashboard (2025a).
Notes: L is low-income countries; LM is lower-middle income; UM is upper-middle income; and H is high-income countries.

5. Comparison with Related Studies

Several others have attempted to measure the size and structure of agrifood systems using a variety of methods and data. Most have focused on agrifood system employment. Broadly, the methods can be divided into direct observational approaches, often complemented by statistical imputations, and modeling approaches, where, typically, multiplier models are used to measure how economic sectors and workers are directly or indirectly linked to final demand for food or agrifood products via input-output linkages in the economy.

We consider our AgGDP+ and AgEMP+ indicators to fall under the first category. Others that might be classified as direct observational approaches include Hasnain et al. (2020), who use a national business survey to calculate the size of the United Kingdom's food system. They estimate agrifood system GDP at $162 billion in 2017, which is close to our $167 billion (measured in 2021 prices). They further show that primary agriculture was 8.9 and 11.3 percent of total agrifood GDP and employment, respectively, which is close to our 10.5 and 13.7 percent in 2017. Tschirley et al. (2015) use household survey data to estimate agrifood employment across six African countries. They find that primary agriculture is 90.4 percent of agrifood system employment, which is close to our estimate of 88.5 percent for the same countries.

As in our own study, Davis et al. (2023) use ILO employment data to measure employment in primary agriculture and non-agricultural sectors that they consider to be part of the agrifood system. However, rather than using national accounts data to disaggregate non-agricultural sectors such as trade and transport into their food and nonfood components, they use survey-based econometric models to estimate these employment shares. They find that 1.23 billion people were employed in the global agrifood system in 2019, which closely matches our own estimate of 1.25 billion. However, they also believe that since ILO data only focuses on primary sectors of employment, the true extent of employment in the agrifood system could be underestimated. Based on complementary household survey analysis of secondary jobs and household farming activities, they suggest that agrifood system employment could be 24 percent higher than employment defined only by the main sector of employment.

Consistency with survey-based estimates provides some validation of our "top-down" approach based on national accounts data. However, there are also limitations to "bottom-up" survey-based approaches. Small sample sizes, for example, make it difficult for household surveys to estimate employment at detailed sector levels, especially within trade and transport services. Similarly, business surveys often exclude small and informal enterprises in their sampling frames and so capture only part of total GDP and employment. This is most problematic for developing countries, where informality is more common. National accounts data, on the other hand, use a range of data sources, including firm and household surveys, to triangulate the level and structure of economic activity, including both formal and informal sectors.

Among the modeling approach to measuring the size of the agrifood system, perhaps the most familiar is the "Food Dollar" approach pioneered by the Economic Research Service (ERS) of the United States Department of Agriculture (USDA) (Canning et al. 2016). Originally applied in the United States, this method tracks how a representative $1 of final demand for food filters through to different parts of the agrifood system, such as farmers, processors, and retailers, based on input-output linkages. Yi et al. (2021) apply a similar approach using multi-regional input-output tables produced by Eora (Lenzen et al. 2012, 2013) to estimate the off-farm value added embodied within food expenditures in 61 countries. They find that almost three quarters of that value added occurs outside of primary agriculture, which is consistent with our 72.3 percent estimate for the same countries. Yi et al. (2024) extend the approach to 112 countries and estimate that share at 71.6 percent. They further incorporate ILO employment data to analyze how employment and compensation have evolved over two decades. Based on this, they estimate that, in 2021, the global agrifood value chain contributed $10.18 trillion in nominal value added, which is slightly lower than our estimate of $11.73 trillion of the broader global agrifood system (Yi et al. 2024).

Corong et al. (2024) also develop a global multiplier model to estimate agrifood system employment, with three important distinctions. First, they use the Global Trade Analysis Project (GTAP) database rather than MRIOs; second, they model the impact of an exogenous increase in final demand across all agrifood products, not only food products; and third, rather than only focusing on "backward linkages" (i.e., the resources required to produce an extra unit of final demand), they also consider the "forward linkages" from the agrifood system to the rest of the economy. This means they include the value-added and employment generated in nonfood sectors that rely on agrifood products as intermediate inputs in their estimate of the size of the agrifood system (e.g., to produce commodities such as biofuels, clothing, or leather products).

Adding forward linkages increases their estimate of the global agrifood system from 11.0 to 16.3 percent of global GDP, which is higher than our own estimate of 12.8 percent.

Model-based approaches that consider backward linkages estimate the total resources required to supply a unit of final demand. Whereas our approach includes the value-added in (say) the fertilizer blending sector that supplies inputs to the agricultural sector, a multiplier approach would, additionally, include value-addition in the mining sector that supplies the raw material to fertilizer blending firms, as well as the value-addition in the sector that produces the equipment used by the mining company, and so on, even if there are no direct links between mining and equipment sectors and agriculture. When forward linkages are also included, the scope of influence of the agrifood system becomes even larger. Our objective is different, namely, to directly measure value-added and employment in sectors we consider to be part of the agrifood system. Modeling approaches—especially ones with a global focus—face data challenges. Eora data, for instance, are extrapolated from a small sample of countries (see Lenzen et al. 2013), while GTAP data often deviates from official sectoral GDP estimates during cross-country data reconciliation (see Aguiar et al. 2019). A strength of our analysis is that it makes use of countries' own national accounts data, to the extent possible.

In summary, despite methodological and data differences, most studies discussed here provide similar insights to our own regarding the underlying structure of the global food system, including the importance of value addition beyond the farm.

6. Conclusion

This study introduces two indicators that measure the size and structure of national agrifood systems. We define the agrifood system as consisting of all actors involved in the complex supply chains linking food production, processing, distribution, and consumption. As such, our indicators extend beyond traditional indicators that focus on primary agriculture by also including off-farm components of broader agrifood systems, such as food industries (including those that supply inputs to agriculture or agro-processing), food trade and transport, and food service sectors. AgGDP+ captures the total value-added across the on- and off-farm sectors of the agrifood system, while AgEMP+ reflects the employment generated across its various components. Leveraging national accounts data and a statistical imputation approach, we produce consistent estimates of AgGDP+ and AgEMP+ for 217 countries over the 2000–2021 period. The resulting *Agri-Food System Dashboard* (IFPRI, 2025a), which is publicly available and will be regularly updated, allows policymakers and researchers to monitor transformation, prioritize investments, and better understand the evolving role of agrifood systems in national economies or at regional or global scales.

Our analysis of levels and changes in AgGDP+ and AgEMP+ underscores the importance of looking beyond primary agricultural production to understand the broader scope of agrifood systems. Globally, primary agriculture accounts for one-third of GDP in the agrifood system (i.e., AgGDP+), with the remaining two-thirds generated in the off-farm components of the agrifood system. Over time, the transformation of the agrifood system aligns with well-established narratives of structural transformation of economies: as countries develop, the share of primary agriculture in GDP declines, while the off-farm components of the agrifood system—alongside the non-agriculture sectors of the broader economy—become relatively more important. Similarly, the gradual expansion of off-farm employment is a key feature of economic transformation, especially in low and middle-income countries, even though employment shifts tend to lag compositional changes in GDP.

The quality of our agrifood system indicators—and those of others involved in similar endeavors—are subject to the quality of the underlying data. Firstly, while the sue of countries' own national accounts data is a strength of our analysis, it is also true that our estimates are sensitive to the quality that data, and especially the quality of inter-industry supply-and-use data or commodity-specific trade and transport margins required to disaggregate various non-agriculture sectors into their food and nonfood components. Data quality is a greater concern in low-income countries where statistical agencies often face funding or capacity constraints that prevent them from regularly updating or improving the quality of their national accounts. Secondly, our employment estimates draw on the ILO modelled data. While the use of modelled estimates reduces noise, it may also unintentionally introduce bias in the estimates. The limitations of this particular dataset are also well-documented, including the fact that employment numbers do not reflect full-time equivalent jobs, disregard secondary jobs, or may under- or overestimate seasonal employment.

The relevance of the AgGDP+ and AgEMP+ indicators has already been demonstrated through several applications. At IFPRI, for instance, the indicators have been incorporated into the Rural Investment and Agricultural Policy Analysis (RIAPA) modeling framework (IFPRI, 2025b), which allows RIAPA modelers to simulate the impacts of government policies, investments, or external shocks on agrifood system outcomes (e.g., Aragie et al., 2024; Arndt et al., 2023). An analysis of AgGDP+ and AgEMP+ levels and trends also features strongly in IFPRI's agrifood system diagnostics, a series that examines historical and future drivers of agrifood system growth and transformation in numerous countries (e.g., Diao et al., 2024b; Diao et al., 2023).

Additionally, IFPRI's new Agricultural Transformation Index (ATI) (Diao et al., 2024a) includes value addition in the off-farm component of the agrifood system as a share of AgGDP+ as one of its four components—alongside measures of staple crop productivity, crop diversification, and agricultural labor productivity—to monitor agricultural and agrifood system transformation over time at global, regional, and national scales. We anticipate that others using the *Agri-Food System Dashboard* (IFPRI 2025a) will develop useful applications of their own.

References

ADB. 2017. *Compendium of Supply and Use Tables for Selected Economies in Asia and the Pacific*. Manila, Philippines: Asian Development Bank.

Aguiar, A., M. Chepeliev, E.L. Corong, R. McDougall, D. van der Mensbrugghe. 2019. The GTAP Data Base: Version 10. *Journal of Global Economic Analysis* 4(1): 1-27.

Aragie, E., Benfica, R., Pauw, K., Randriamamonjy, J., and Thurlow, J. 2024. Assessing investment priorities for inclusive agricultural transformation in Tanzania, *Development Policy Review* e 12812.

Arndt, C., Diao, X., Dorosh, P., Pauw, K., and Thurlow, J. 2023. "The Ukraine War's Impacts on Global Poverty and Food Insecurity", *Global Food Security*, 36(2023):100680.

Barrett, C.B., T. Reardon, J. Swinnen, D. Zilberman. 2022. Agri-food Value Chain Revolutions in Low- and Middle-Income Countries. *Journal of Economic Literature* 60(4): 1316-1377.

BEA. 2022. *GDP for U.S. Territories*. Suitland MD: Bureau of Economic Analysis, U.S. Department of Commerce. < https://www.bea.gov/data/gdp - last accessed 01-31-2022>

Canning, P., A. Weersink, J. Kelly. 2016. Farm Share of the Food Dollar: An IO Approach for the United States and Canada. *Agricultural Economics* 47: 505-512.

Christiaensen, L., L. Demery, J. Kuhl. 2011. The (Evolving) Role of Agriculture in Poverty Reduction: An Empirical Perspective. *Journal of Development Economics* 96(2): 239-254.

Christiaensen, L., Z. Rutledge, J.E. Taylor. 2021. Viewpoint: The Future of Work in Agri-Food. *Food Policy* 99: Article 101963.

Corong, E., Gautam, M., Martin, W., & Vos, R. 2024. *Measuring employment and job quality in agrifood systems: A comprehensive approach*. CGIAR Initiative on Rethinking Food Markets. https://cgspace.cgiar.org/bitstreams/0492c315-0e03-4c08-8b10-7f79cbc29e3a/download

Davis, B., E. Mane, L.Y. Gurbuzer, G. Caivano, N. Piedrahita, K. Schneider, N. Azhar, M. Benali, N. Chaudhary, R. Rivera, R. Ambikapathi, P. Winters. 2023. *Estimating Global and Country-Level Employment in Agrifood Systems*. FAO Statistics Working Paper Series No. 23-34. Rome, Italy: Food and Agriculture Organization.

Diao, X., P. Hazell, J. Thurlow. 2010. The Role of Agriculture in African Development. *World Development* 38(10): 1375-1383.

Diao, X., Pauw, K., Smart, J., and Thurlow, J. 2023. Kenya's Agri-Food System: Overview and Drivers of Transformation, Ch. 2 in Breisinger, C., Keenan, M., Mbuthia, J., and Njuki, J.

(eds.), *Food Systems Transformation in Kenya: Lessons from the Past and Policy Options for the Future*, Washington DC: IFPRI.

Diao, X., Jones, E., Pauw, K., Thurlow, J., and Xu, W. 2024a. The Agricultural Transformation Index. *Discussion Paper* 02275 (September 2024), IFPRI.

Diao, X., Masias, I., Pauw, K., Thurlow, J., and Boughton, D. 2024b. The agrifood system: structure and contribution to development goals. Ch. 2 in Boughton, D., Belton, B., Lambrecht, I., and Minten, B. (eds.), *Myanmar's agrifood system: Historical development, recent shocks, future opportunities*, Washington DC: IFPRI.

Diao, X., McMillan, M., Pauw, K., and Thurlow, J. 2025. "Agrifood Systems: Transformation, Structural Change, and Development", Ch. 3 in Swinnen, J. and Barret, C. (eds.), *2025 Global Food Policy Report: Policy Research for Evolving Food Systems*, Washington D.C.: International Food Policy Research Institute (IFPRI).

Dorosh, P., J. Thurlow. 2018. Beyond Agriculture Versus Non-Agriculture: Decomposing Sectoral Growth-Poverty Linkages in Five African Countries. *World Development* 109: 440-451.

Fanzo, J., Haddad, L., McLaren, R., Marshall, Q., Davis, C., Herforth, A., Kapuria, A., 2020. The food systems dashboard is a new tool to inform better food policy. Nat. Food 1 (5), 243–246. https://doi.org/10.1038/s43016-020-0077-y

GLOPAN (Global Panel on Agriculture and Food Systems for Nutrition) 2020. *Future food systems: for people, our planet, and prosperity*. London, UK.

Gollin, D., D. Lagakos, M.E. Waugh. 2014. The Agricultural Productivity Gap. *Quarterly Journal of Economics* 129(2): 939-993.

Hasnain, S., J. Ingram, M. Zurek. 2020. *Mapping the UK Food System: A Report for the UKRI Transforming UK Food Systems Program*. Oxford, U.K.: Environmental Change Institute, University of Oxford.

ICLS. 2013. *Resolution I: Resolution Concerning Statistics of Work, Employment, and Labor Underutilization*. Geneve, Switzerland: International Conferences of Labor Statisticians.

IFPRI. 2025a. *Agri-Food System Dashboard*. Washington, D.C.: International Food Policy Research Institute. Available from Agri-food System Dashboard | Tableau Public

IFPRI. 2025b. *Rural Investment and Agricultural Policy Analysis (RIAPA) model*. Washington, D.C.: International Food Policy Research Institute. Available from https://www.ifpri.org/project/riapa-model/

ILO. 2023. *ILO Modeled Estimates, November 2020*. Geneve, Switzerland: Department of Statistics, International Labor Organization. < https://ilostat.ilo.org/data - last accessed 01-31-2022>

ILO. 2024. *ILO Modeled Estimates: Methodological Overview*. Geneve, Switzerland: Department of Statistics, International Labor Organization.

Ingram, J., and Thornton, P. 2022. "What Does Transforming Food Systems Actually Mean?", *Nature Food*, 3(2022):881–882. https://doi.org/10.1038/s43016-022-00620-w

Jerven, M. 2013. *Poor Numbers: How We Are Misled by African Development Statistics and What to Do About It*. Ithaca, N.Y.: Cornell University Press.

Klasen, S. 2019. What Explains Uneven Female Labor Force Participation Levels and Trends in Developing Countries? *World Bank Research Observer* 34(2): 161-197.

Lenzen M, Kanemoto K; Moran D, and Geschke A. 2012. Mapping the structure of the world economy. Environmental Science & Technology 46(15) pp 8374–8381. DOI: 10.1021/es300171x

Lenzen, M., D. Moran, K. Kanemoto, A. Geschke. 2013. Building Eora: A Global Multi-Regional Input-Output Database at High Country and Sector Resolution. *Economic Systems Research* 25(1): 20-49.

McMillan, M., D. Rodrik, I. Verduzco-Gallo. 2014. Globalization, Structural Change, and Productivity Growth, with an Update on Africa. *World Development* 63(11): 11-32.

Moneta, A., A. Chai. 2014. The Evolution of Engel Curves and Its Implications for Structural Change Theory. *Cambridge Journal of Economics* 38(4): 895–923.

OECD. 2021. Input-Output Tables 2021 Edition. Paris, France: Organization for Economic Cooperation and Development. < https://www.oecd.org/sti/ind/input-outputtables.htm - last accessed 01-31-2022>

OECD. 2023. Supply and Use Tables Database. Paris, France: Organization for Economic Cooperation and Development. <https://www.oecd.org/sdd/na/supply-and-use-tables-database.htm - last accessed 01-31-2022>

Timmer, P.C. 1988. Chapter 8: The Agricultural Transformation. In Chenery, H. and T.N. Srinivasan (eds.) *Handbook of Development Economics Volume 1*. Amsterdam, Netherlands: North Holland.

Tibshirani, R. 1996. Regression Shrinkage and Selection Via the Lasso. *Journal of the Royal Statistical Society: Series B* (Methodological) 58(1): 267-288.

UNDESA. 2008. *International Standard Industrial Classification of All Economic Activities Revision 4*. Statistical Papers, Series M No. 4 Revision 4. New York, NY: Department of Economics Affairs, United Nations.

UNDESA. 2015. *Central Product Classification (CPC) Version 2.1*. Statistical Papers, Series M No. 77 Version 2.1. New York, NY: Department of Economics Affairs, United Nations.

UNDESA. 2018. *Handbook on Supply and Use Tables and Input-Output Tables with Extensions and Applications*. Studies in Methods, Series F No. 74 Revision 1. New York, NY: Department of Economics Affairs, United Nations.

UNDESA. 2022. *World Population Prospects 2022*. New York, NY: Population Division, Department of Economics Affairs, United Nations.

UNDESA. 2023. *National Accounts Statistics: Main Aggregates and Detailed Tables, 2020*. New York, NY: Department of Economics Affairs, United Nations.

Vogel, S. J. 1994. Structural Changes in Agriculture: Production Linkages and Agricultural Demand-Led Industrialization. *Oxford Economic Papers* 46(1): 136-156.

Von Braun, J., K. Afsana, L.O. Fresco, M. Hassan, M. Torero. 2021. Food System Concepts and Definitions for Science and Political Action. *Nature Food* 2: 748-750.

World Bank. 2017. *Future of Food: Shaping the Food System to Deliver Jobs*. Washington DC, USA. Available from: The Future of Food: Shaping the Food System to Deliver Jobs

World Bank. 2023. *World Development Indicators*. Washington D.C. <https://databank.worldbank.org/source/world-development-indicators - last accessed 01-12-2023>

Yi, J. E-M. Meemken, V. Mazariegos-Anastassiou, J. Liu, E. Kim, M.I. Gómez, P. Canning, C.B. Barrett. 2021. Post-Farmgate Food Value Chains Make Up Most of Consumer Food Expenditures Globally. *Nature Food* 2: 417-425.

Yi, Jing; Jiang, Shiyun; Tran, Dianna; Gómez, Miguel I.; Canning, Patrick; Bloem, Jeffrey R.; and Barrett, Christopher B. 2024. How agri-food value chain employment and compensation evolve with structural transformation. IFPRI Discussion Paper 2311. Washington, DC: International Food Policy Research Institute. https://hdl.handle.net/10568/168646

Appendix: Formal Definition of Agri-Food System GDP and Employment

For most countries, supply-use tables (SUT) are used to measure agrifood systems. These national accounting frameworks reconcile total supply and demand for every sector and product in an economy.[10] Table A1 shows a SUT as a condensed data matrix with supplies reported down the columns and uses across the rows. Domestic sectors i pay for products j used as intermediate inputs N_{ji}. Sectoral value added V_i is the difference between the value of gross output O_i and total intermediate input costs and net taxes on production T_i^s. Sectors can produce more than one type of product and so domestic product supply is represented by the submatrix Z_{ij}.[11] Indirect taxes are applied to imports M_j and domestic products. Transaction costs R_j are the trade and transport margins applied to domestic and imported goods. In addition to intermediate demand, other uses of products include private and public consumption and investment demand—collectively known as total absorption A_j—and exports X_j. The total value of margin receipts R_j on each product are paid to the trade and transport sectors in the vector P_j. Overall, total supply S_j must equal total demand D_j in a reconciled SUT. In countries where SUTs are unavailable, we use input-output tables (IOT), which collapse the distinction between sectors and products. Table A2 identifies which of the 122 countries in our dataset have SUTs (106) or IOTs (16).

Table A1. Simplified Supply-Use Table

	Sectors i	Products j	Margins	Absorption	Exports	Total
Sectors i		Z_{ij}				O_i
Products j	N_{ji}		P_j	A_j	X_j	$D_j = S_j$
Margins		R_j				
Factors	V_i					
Taxes	T_i^s	T_i^p				
Imports		M_j				
Total	O_i	$S_j = D_j$				

Source: Authors' representation.

[10] See UNDESA (2018) for further information on SUTs and national accounts. Most SUTs adopt standard sector and product classification systems – see UNDESA (2008) for the International Standard Industrial Classification (ISIC), and UNDESA (2015) for the Central Product Classification (CPC).
[11] Input-output tables (IOT) and some SUTs have a one-to-one mapping between sectors and products. Where possible, the IOTs used in our analysis are structured around industries, not products, and use purchaser prices.

Agrifood system GDP ($AgGDP^{+}$) has six components:

$$AgGDP^{+} = AGR + PRC + FSV + HOT + INP + TRD$$

Primary agriculture AGR is the sum of the value added generated by the production of all crops, animals, forestry, and fishing:

$$AGR = \sum_{i} V_i \qquad i \in I^A$$

where $i \in I$ is the set of all sectors (also referred to as i' and i''), and I^A ($\subset I$) is a subset of sectors containing agricultural activities (i.e., ISIC divisions D1-D3). Total value-added in each sector V_i is drawn directly from the SUT when measuring agrifood system GDP.

Agro-processing PRC is the total value added generated by the processing of food and agricultural products:

$$PRC = \sum_{i} V_i \qquad i \in I^P$$

where I^P ($\subset I$) is a subset of sectors containing agro-processing activities, including foods, beverages, and tobacco (ISIC D10-D12). It is possible to include other types of agro-processing, such as cotton into yarn (ISIC class C1311) or timber into wood (ISIC C1610). These additions are not included here, because many countries' SUTs do not include such detailed subsectors.

Food services FSV is total value-added in the food and beverage services sector:

$$FSV = \sum_{i} V_i \qquad i \in I^F$$

where I^F ($\subset I$) is a subset of sectors containing food and beverage service activities (ISIC D56).

Hotel services HOT is the food and agriculture-related portion of total value-added in the accommodation services sector (e.g., hotel restaurants). This cannot be directly drawn from the SUT. Instead, it is estimated based on the share of food and agricultural products in total intermediate input demand N_{ji} of the accommodation sector. The formula is shown below:

$$HOT = \left(\sum_{j'i} N_{j'i} \Big/ \sum_{ji} N_{ji} \right) \cdot \sum_{i} V_i \qquad i \in I^H, \; j \in J, \; j' \in J^{AP}$$

where $j \in J$ is the set of all products (also referred to as j' and j''), I^H ($\subset I$) is a subset of sectors containing accommodation activities (ISIC D55), and J^{AP} ($\subset J$) is a subset of products containing primary and processed food and agricultural goods (CPC D01-D04 and D21-25). The assumption is that agrifood inputs reasonably approximate the value of food services embedded in the supply of accommodation services, and that value added is the same per unit of intermediate input. Since hotel restaurants, for example, also demand nonfood intermediate inputs, our definition may underestimate this component's contribution to the agrifood system.

Agrifood inputs INP is the value added generated by the domestic production of the nonfood and nonagricultural intermediate inputs used in the production of food and agricultural products. Trade and transport intermediate inputs are excluded from INP because they are captured in the next component. The formula is shown below:

$$INP = \sum_{i'} \sum_{ij} \left(\frac{N_{ji'}}{D_j} \cdot z_{ij} \cdot V_i \right) \qquad i \in I,\ \ i' \in I^{AP},\ \ j \in J^N$$

where I^{AP} ($\subset I$) is a subset of sectors containing agricultural and agro-processing activities, i.e., $I^{AP} = I^A \cup I^P$ (ISIC D1-D3 and D10-D12), and J^N ($\subset J$) is a subset of products that excludes the outputs of other components of the agrifood system, i.e., $J^N = J - J^{AP} - J^T - J^F - J^H$ (CPC D11-18, D26-D54, and D71-D99). Since products may be produced by more than one sector, it is necessary to convert demand for intermediate products into demand for sector output. This conversion is governed by the term z_{ij}, which is the share of domestic output of product j supplied by sector i, i.e., $z_{ij} = Z_{ij} / \sum_{i'} Z_{i'j}$ and $\sum_i z_{ij} = 1$.

Trade and transport TRD is the portion of total value added in the trade and transport services sectors generated via the transaction cost margins applied to the transporting and wholesale and retail trading of food and agricultural products:

$$TRD = \sum_{ij} \left(\frac{T_j}{D_j} \cdot z_{ij} \cdot V_i \right) \qquad T_j = \sum_{j'} \left(R_{j'} \cdot p_j \right) + \sum_{i'} N_{i'j} \qquad i \in I,\ \ j \in J^T,\ \ j' \in J^{AP},\ \ i' \in I^{AP}$$

where J^T ($\subset J$) is the subset of products related to trade and transport services (CPC D61-D62 and D64-D69). This component is measured in two steps: First, we estimate T_j, which is the total value of transaction cost margins on food and agriculture-related products, plus the total value of trade and transport intermediate inputs used in the food and agriculture sectors. This is converted into a share of total demand for trade and transport services D_j, some of which may be imported. Second, margins on products generate demand for different types of trade and transport services, and so we calculate p_j, which is the value share of each type of trade and transport service in the total value of trade and transport margins, i.e., $p_j = P_j / \sum_{j'} P_{j'}$ and $\sum_j p_j = 1$. Multiplied together, these two terms (T_j / D_j and z_{ij}) provide an estimate of the portion of total value added in each trade and transport subsector that this associated with food and agricultural products. This is then multiplied by the total value added in the trade and transport sectors V_i.

Summed together, the above six components comprise our definition of the agrifood system, whose total GDP can be estimated directly from an SUT or IOT. Agrifood system employment ($AgEMP^+$) has the same six components and is measured using the same equations above. The only change is the meaning of V_i, which is total sectoral value-added when measuring

AgGDP+, but is redefined as the total number of workers employed in each sector per unit of sectoral GDP when measuring AgEMP+. Similarly, V_i is redefined as the number of male or female workers per unit of GDP when disaggregating agrifood system employment by gender.

Table A2. Country Agrifood System Shares of GDP and Employment (2021)

	Share of total (%)					Share of total (%)			
	GDP		Employment			GDP		Employment	
	AGR	AFS	AG	AFS		AGR	AFS	AG	AFS
Afghanistan (AFG)	35.0	48.5	48.0	58.3	Costa Rica (CRI)	4.8	17.5	17.1	32.1
Albania (ALB)	20.3	28.8	34.6	45.2	Cote d'Ivoire (CIV)	21.9	40.6	45.0	67.0
Algeria (DZA)	12.6	27.7	10.3	31.2	Croatia (HRV)	3.5	15.6	6.8	20.1
Am. Samoa (ASM)	5.4	15.1	n/a	n/a	Cuba (CUB)	2.0	10.0	17.7	27.6
Andorra (AND)	0.6	9.8	n/a	n/a	Curacao (CUW)	0.2	11.0	n/a	n/a
Angola (AGO)	11.5	24.4	58.7	66.3	Cyprus (CYP)	1.9	8.7	2.8	12.4
Antigua and B. (ATG)	2.6	13.3	n/a	n/a	Czech R. (CZE)	2.0	8.1	2.5	10.0
Argentina (ARG)	7.2	19.9	7.7	20.3	Denmark (DNK)	1.0	6.3	2.0	7.9
Armenia (ARM)	12.5	24.2	30.3	39.8	Djibouti (DJI)	1.4	14.5	1.2	14.0
Aruba (ABW)	0.0	12.5	n/a	n/a	Dominica (DMA)	20.3	31.3	n/a	n/a
Australia (AUS)	3.4	9.9	2.4	13.7	Dominican R. (DOM)	6.1	21.9	8.3	26.4
Austria (AUT)	1.4	7.9	3.7	10.6	Ecuador (ECU)	10.0	27.5	32.2	52.4
Azerbaijan (AZE)	6.4	15.7	34.2	44.2	Egypt (EGY)	12.0	23.8	19.8	30.8
Bahamas (BHS)	0.5	12.4	3.2	19.5	El Salvador (SLV)	5.5	22.8	15.2	40.2
Bahrain (BHR)	0.3	6.4	1.0	12.5	Eq. Guinea (GNQ)	2.6	13.7	55.5	62.5
Bangladesh (BGD)	12.1	22.6	37.1	47.1	Eritrea (ERI)	17.3	28.8	62.4	73.6
Barbados (BRB)	1.7	14.6	2.8	19.1	Estonia (EST)	2.3	8.9	2.7	10.2
Belarus (BLR)	7.8	17.0	8.1	19.2	Eswatini (SWZ)	9.0	27.5	12.4	28.1
Belgium (BEL)	0.7	7.4	0.9	8.6	Ethiopia (ETH)	39.2	51.7	63.7	72.3
Belize (BLZ)	8.9	21.8	21.2	38.6	Faroe Is. (FRO)	n/a	n/a	n/a	n/a
Benin (BEN)	31.4	50.0	28.1	57.7	Fiji (FJI)	17.0	33.0	28.9	42.0
Bermuda (BMU)	0.2	4.7	n/a	n/a	Finland (FIN)	2.6	7.5	4.1	10.1
Bhutan (BTN)	17.8	23.3	56.0	63.1	France (FRA)	1.9	8.6	2.5	10.6
Bolivia (BOL)	14.4	30.6	29.2	51.4	Fr. Polynesia (PYF)	3.3	13.1	2.1	15.7
Bosnia and H. (BIH)	6.0	18.5	11.3	22.7	Gabon (GAB)	6.5	13.4	29.0	39.7
Botswana (BWA)	1.8	5.4	23.1	29.1	Gambia (GMB)	24.1	44.6	48.5	58.7
Brazil (BRA)	8.1	18.2	9.7	24.0	Georgia (GEO)	7.0	20.9	40.4	48.8
Brit. Virgin Is. (VGB)	0.1	6.3	n/a	n/a	Germany (DEU)	0.9	6.0	1.3	6.7
Brunei (BRN)	1.2	5.9	1.3	7.5	Ghana (GHA)	21.0	34.4	39.5	52.6
Bulgaria (BGR)	5.0	14.5	6.3	16.6	Gibraltar (GIB)	n/a	n/a	n/a	n/a
Burkina Faso (BFA)	19.1	32.8	73.3	81.9	Greece (GRC)	4.4	15.5	11.4	24.2
Burundi (BDI)	37.5	50.6	85.9	93.2	Greenland (GRL)	18.7	18.9	n/a	n/a
Cabo Verde (CPV)	5.1	15.4	11.0	29.6	Grenada (GRD)	6.0	17.3	n/a	n/a
Cambodia (KHM)	24.5	34.5	38.9	49.6	Guam (GUM)	0.0	4.2	0.2	8.6
Cameroon (CMR)	18.6	39.8	42.6	62.5	Guatemala (GTM)	10.0	33.1	29.2	51.5
Canada (CAN)	1.9	8.4	1.3	11.0	Guinea (GIN)	28.1	41.6	59.2	73.9
Cayman Is. (CYM)	0.4	7.0	n/a	n/a	Guinea-Bissau (GNB)	32.4	51.4	50.3	60.9
C.A. Republic (CAF)	33.3	51.4	68.5	79.6	Guyana (GUY)	14.2	20.9	13.1	25.0
Chad (TCD)	46.5	58.5	68.9	79.1	Haiti (HTI)	21.1	40.6	45.6	59.8
Channel Is. (CHI)	n/a	n/a	n/a	n/a	Honduras (HND)	11.7	32.5	24.8	45.5
Chile (CHL)	3.7	15.0	6.6	21.9	Hong Kong (HKG)	0.1	5.0	0.2	8.0
China (CHN)	7.6	18.1	24.4	36.9	Hungary (HUN)	4.0	11.4	4.4	14.2
Colombia (COL)	8.2	19.4	15.9	31.4	Iceland (ISL)	5.1	16.4	4.0	16.6
Comoros (COM)	38.7	55.9	35.0	47.0	India (IND)	18.6	27.7	44.0	53.9
Congo, D.R. (COD)	20.4	40.2	55.3	73.2	Indonesia (IDN)	13.8	30.1	29.0	46.3
Congo, R. (COG)	8.7	19.7	36.3	51.0	Iran (IRN)	13.0	18.2	16.3	22.2

Table A2 (continued). Country Agrifood System Shares of GDP and Employment (2021)

	Share of total (%)					Share of total (%)			
	GDP		Employment			GDP		Employment	
	AGR	AFS	AG	AFS		AGR	AFS	AG	AFS
Iraq (IRQ)	4.0	10.9	19.8	31.7	Nepal (NPL)	24.9	39.9	62.3	76.4
Ireland (IRL)	1.1	7.9	4.5	11.0	Netherlands (NLD)	1.7	8.8	2.3	10.4
Isle of Man (IMN)	n/a	n/a	n/a	n/a	New Caledonia (NCL)	2.1	11.3	3.6	10.6
Israel (ISR)	1.2	7.7	0.9	8.5	New Zealand (NZL)	6.2	18.9	6.1	18.7
Italy (ITA)	2.2	9.8	4.1	12.8	Nicaragua (NIC)	17.4	32.5	28.7	45.7
Jamaica (JAM)	9.5	24.0	15.5	30.1	Niger (NER)	38.7	50.1	70.7	78.4
Japan (JPN)	1.0	10.0	3.2	14.1	Nigeria (NGA)	23.7	37.7	35.2	51.8
Jordan (JOR)	5.8	22.7	3.2	17.5	N. Macedonia (MKD)	9.0	20.8	10.8	24.4
Kazakhstan (KAZ)	5.4	14.5	15.0	24.1	N. Mariana Is. (MNP)	n/a	n/a	n/a	n/a
Kenya (KEN)	23.9	34.0	33.0	47.4	Norway (NOR)	1.8	4.6	2.3	7.1
Kiribati (KIR)	23.1	30.9	n/a	n/a	Oman (OMN)	2.1	9.2	4.1	15.5
Korea, PDR. (PRK)	23.8	32.9	43.5	57.8	Pakistan (PAK)	24.2	35.9	37.5	50.6
Korea, R. (KOR)	2.0	9.6	5.3	16.2	Palau (PLW)	4.3	17.2	n/a	n/a
Kosovo (XKX)	8.6	23.2	n/a	n/a	Panama (PAN)	2.7	11.9	15.7	27.8
Kuwait (KWT)	0.4	7.0	2.0	11.1	Papua N.G. (PNG)	20.2	28.3	17.2	39.0
Kyrgyz R. (KGZ)	15.3	26.4	16.6	28.3	Paraguay (PRY)	11.2	31.3	19.7	35.7
Laos (LAO)	18.1	27.6	58.1	67.5	Peru (PER)	7.6	19.9	27.9	41.4
Latvia (LVA)	4.7	12.9	6.8	15.5	Philippines (PHL)	10.1	28.6	24.3	38.3
Lebanon (LBN)	4.1	21.3	3.8	19.5	Poland (POL)	2.6	11.8	8.4	17.4
Lesotho (LSO)	4.8	11.0	30.0	40.4	Portugal (PRT)	2.5	12.4	5.2	16.1
Liberia (LBR)	73.9	82.3	40.6	59.2	Puerto Rico (PRI)	0.7	15.6	1.2	10.9
Libya (LBY)	3.6	8.1	16.3	29.9	Qatar (QAT)	0.3	3.9	1.2	6.7
Liechtenstein (LIE)	0.1	7.9	n/a	n/a	Romania (ROU)	4.8	16.1	18.6	31.2
Lithuania (LTU)	3.7	14.8	5.3	15.3	Russia (RUS)	4.2	12.7	5.8	15.1
Luxembourg (LUX)	0.2	5.7	1.1	8.5	Rwanda (RWA)	26.1	35.0	54.7	59.4
Macao (MAC)	0.0	5.3	1.3	13.8	Samoa (WSM)	10.2	27.3	24.1	38.9
Madagascar (MDG)	25.4	39.8	73.9	82.6	San Marino (SMR)	0.0	7.1	n/a	n/a
Malawi (MWI)	28.3	48.0	61.9	75.5	Sao Tome and P. (STP)	12.7	31.1	18.0	38.5
Malaysia (MYS)	9.7	21.1	9.6	23.6	Saudi Arabia (SAU)	2.4	10.1	2.7	10.9
Maldives (MDV)	6.1	20.7	10.5	22.3	Senegal (SEN)	17.1	34.7	21.6	44.8
Mali (MLI)	38.2	47.5	67.7	74.9	Serbia (SRB)	7.8	18.9	13.9	26.1
Malta (MLT)	1.0	6.1	0.9	9.9	Seychelles (SYC)	3.4	13.1	n/a	n/a
Marshall Is. (MHL)	23.2	31.2	n/a	n/a	Sierra Leone (SLE)	60.0	73.5	42.7	61.4
Mauritania (MRT)	20.2	30.2	29.5	44.0	Singapore (SGP)	0.0	5.3	0.3	6.9
Mauritius (MUS)	3.7	14.8	5.1	18.4	St. Maarten (D) (SXM)	0.0	9.7	n/a	n/a
Mexico (MEX)	4.1	16.3	12.3	25.8	Slovak R. (SVK)	2.0	7.2	2.5	9.4
Micronesia (FSM)	23.9	32.9	n/a	n/a	Slovenia (SVN)	1.9	7.0	4.1	9.6
Moldova (MDA)	12.1	25.3	37.6	47.4	Solomon Is. (SLB)	33.6	46.2	38.0	47.1
Monaco (MCO)	0.0	7.2	n/a	n/a	Somalia (SOM)	60.2	77.3	26.3	34.6
Mongolia (MNG)	14.7	26.6	24.3	39.2	South Africa (ZAF)	2.7	11.4	21.3	29.8
Montenegro (MNE)	7.8	20.2	7.4	22.5	South Sudan (SSD)	4.0	16.1	62.1	70.8
Morocco (MAR)	13.4	25.3	34.6	47.5	Spain (ESP)	2.9	11.4	4.1	13.8
Mozambique (MOZ)	30.7	41.7	70.3	76.3	Sri Lanka (LKA)	9.6	24.5	25.7	42.0
Myanmar (MMR)	25.3	38.4	42.8	57.2	St. Kitts, Nevis (KNA)	1.6	10.5	n/a	n/a
Namibia (NAM)	10.1	23.2	22.1	33.0	St. Lucia (LCA)	2.2	20.5	10.5	28.2
Nauru (NRU)	2.4	15.6	n/a	n/a	St. Martin (Fr.) (MAF)	n/a	n/a	n/a	n/a

Table A2 (continued). Country Agrifood System Shares of GDP and Employment (2021)

	Share of total (%)					Share of total (%)			
	GDP		Employment			GDP		Employment	
	AGR	AFS	AG	AFS		AGR	AFS	AG	AFS
St. V. and G. (VCT)	7.7	20.1	10.3	26.1	Turks and C. (TCA)	0.5	12.6	n/a	n/a
Sudan (SDN)	19.7	31.0	40.6	50.1	Tuvalu (TUV)	9.1	14.9	n/a	n/a
Suriname (SUR)	9.4	25.1	7.9	19.5	Uganda (UGA)	25.2	40.7	62.9	72.1
Sweden (SWE)	1.5	5.7	2.0	6.1	Ukraine (UKR)	12.4	25.0	14.7	27.8
Switzerland (CHE)	0.6	7.9	2.2	9.8	U.A.E. (ARE)	0.9	7.8	1.7	10.2
Syria (SYR)	20.6	34.2	12.5	28.0	United Kingdom (GBR)	0.8	5.9	1.0	7.7
Tajikistan (TJK)	26.8	39.4	42.6	52.0	United States (USA)	0.9	6.8	1.7	10.4
Tanzania (TZA)	28.4	37.2	64.3	75.0	Uruguay (URY)	7.5	21.0	8.4	22.9
Thailand (THA)	8.5	21.3	31.6	43.9	Uzbekistan (UZB)	26.1	33.4	23.9	32.4
Timor-Leste (TLS)	15.8	24.8	41.6	57.2	Vanuatu (VUT)	23.5	37.4	48.0	60.0
Togo (TGO)	21.1	33.1	30.9	52.5	Venezuela (VEN)	5.4	24.8	13.1	26.1
Tonga (TON)	19.9	32.6	30.4	37.8	Vietnam (VNM)	13.8	29.4	29.0	44.4
Trinidad and T. (TTO)	1.0	15.8	3.0	15.8	Virgin Is. (US) (VIR)	0.0	6.8	1.8	12.1
Tunisia (TUN)	10.9	23.6	13.9	27.1	West Bank, Gaza (PSE)	8.3	25.4	6.7	21.4
Turkey (TUR)	6.2	17.8	17.1	29.2	Yemen (YEM)	19.5	44.5	28.1	52.7
Turkmenistan (TKM)	11.1	18.5	22.3	31.0	Zambia (ZMB)	3.0	13.0	58.7	65.4
Turks and C. (TCA)	0.5	12.6	n/a	n/a	Zimbabwe (ZWE)	9.4	27.2	61.6	69.5

Source: IFPRI Agrifood System Database.
Notes: AGR is primary agriculture; AFS is the agrifood system (i.e., $AgGDP^+$ and $AgEMP^+$); and n/a means that the GNI, GDP and/or employment data was not available for this country.

Supplementary Materials

Table S1. Off-Farm Agrifood System (AFS) GDP Shares

	Off-farm AFS GDP as a share of total GDP		
	(1)	(2)	(3)
Log GNI per capita ($, Atlas method)	-2.000 ***	22.077	-
	(0.232)	(13.532)	
Squared log GNI per capita ($100)	-	-266.617 *	-
		(159.449)	
Cubed log GNI per capita ($1000)	-	100.305	-3.000 ***
		(61.767)	(1.005)
Urban population share (%)	-	0.007	-
		(0.022)	
Arable land per rural person (hectares)	-	0.082	-
		(0.145)	
Share of total GDP value added (%)			
Agriculture	-	0.028	-
		(0.062)	
Manufacturing	-	0.153 ***	0.144 ***
		(0.041)	(0.044)
Construction	-	-0.125	-
		(0.087)	
Trade services	-	0.329 ***	0.287 ***
		(0.059)	(0.052)
Transport services	-	0.098	-
		(0.103)	
Other services	-	0.029	-
		(0.043)	
Share of total GDP expenditures (%)			
Private consumption	-	0.074	0.069 **
		(0.103)	(0.028)
Government consumption	-	-0.066	-0.067
		(0.117)	(0.077)
Gross fixed capital formation	-	0.015	-
		(0.106)	
Exports	-	0.011	-0.022 **
		(0.098)	(0.010)
Imports	-	-0.036	-
		(0.098)	
Regional dummies			
East Asia and Pacific	-	1.815	-
		(1.778)	
Europe and Central Asia	-	1.857	-
		(1.445)	
Latin America and Caribbean	-	3.229 *	-
		(1.759)	
Middle East and North Africa	-	3.627 *	-
		(1.915)	

Table S1 (continued). Off-Farm Agrifood System (AFS) GDP Shares

	Off-farm AFS GDP as a share of total GDP		
	(1)	(2)	(3)
Regional dummies (continued)			
North America	-	-	-
South Asia	-	0.674	-
		(1.791)	
Sub-Saharan Africa	-	0.846	-
		(1.443)	
Latitude (degrees)	-	-0.047	-
		(0.029)	
Squared latitude (degrees)	-	-0.851	-0.782 ***
		(0.988)	(0.285)
Cubed latitude (degrees)	-	0.021	-
		(0.018)	
Data source dummy (1 SUT, 0 IOT)	-	3.964 ***	4.046 ***
		(0.665)	(0.609)
Constant	27.483 ***	-61.674	1.728
	(2.194)	(39.952)	(2.744)
Observations	1389	1389	1389
R-squared	0.319	0.710	0.663
Adjusted R-squared	0.319	0.704	0.661

Source: Authors' calculations sample country agri-food system GDP estimates (see Table A2); GDP data from BEA (2022) and UNSD (2022); and GNI data from World Bank (2023).
Notes: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.10).

Table S2. Off-Farm Agrifood System (AFS) Employment Shares

	Off-farm AFS employment as a share of total employment					
	(1)		(2)		(3)	
Log GNI per capita ($, Atlas method)	-1.038	***	22.909	**	-	
	(0.268)		(11.224)			
Squared log GNI per capita ($100)	-		-297.687	**	-	
			(139.531)			
Cubed log GNI per capita ($1000)	-		117.856	**	-6.239	***
			(56.775)		(0.821)	
Urban population share (%)	-		0.013		-	
			(0.020)			
Arable land per rural person (hectares)	-		0.278	**	-	
			(0.137)			
Sector shares of total employment (%)						
Agriculture	-		0.376	***	-	
			(0.122)			
Mining	-		0.047		-0.332	**
			(0.211)		(0.147)	
Manufacturing	-		0.529	***	-	
			(0.138)			
Construction	-		0.280		-	
			(0.181)			
Utilities	-		0.405		-	
			(0.327)			
Trade services	-		0.863	***	0.448	***
			(0.130)		(0.071)	
Transport services	-		0.438	*	-	
			(0.250)			
Accommodation and food services	-		1.184	***	0.623	***
			(0.190)		(0.118)	
Financial services	-		0.494	**	-	
			(0.213)			
Public administration	-		0.455	***	0.044	
			(0.134)		(0.086)	
Education	-		0.496	**	-	
			(0.197)			
Health and social work	-		0.468	***	-	
			(0.160)			
Other services	-		0.436	***	-	
			(0.157)			
Regional dummies						
East Asia and Pacific	-		1.098		-	
			(1.201)			
Europe and Central Asia	-		0.873		0.072	
			(0.820)		(0.535)	
Latin America and Caribbean	-		1.986		1.215	
			(1.248)		(0.827)	
Middle East and North Africa	-		2.093		1.093	
			(1.292)		(1.071)	
North America	-		-		-	

Table S2 (continued). Off-Farm Agrifood System (AFS) Employment Shares

	Off-farm AFS employment as a share of total employment					
	(1)		(2)		(3)	
Regional dummies (continued)						
South Asia	-		2.480	*	-	
			(1.408)			
Sub-Saharan Africa	-		1.093		-	
			(1.456)			
Latitude (degrees)	-		-0.007		-	
			(0.023)			
Squared latitude (degrees)	-		0.447		-	
			(0.963)			
Cubed latitude (degrees)	-		-0.004		-	
			(0.015)			
Data source dummy (1 SUT, 0 IOT)	-		5.539	***	5.022	***
			(0.531)		(0.442)	
Constant	19.071	***	-97.764	***	1.557	
	(2.522)		(31.226)		(1.145)	
Observations	1389		1389		1389	
R-squared	0.093		0.772		0.723	
Adjusted R-squared	0.0928		0.767		0.721	

Source: Authors' calculations sample country agri-food system employment estimates (see Table A2); employment data from ILO (2023); and GNI data from World Bank (2023).
Notes: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.10).

Table S3. Female Share of Off-Farm Agrifood System (AFS) Employment

	Female share of total off-farm AFS employment (1)		(2)		(3)	
Log GNI per capita ($, Atlas method)	-1.128		-11.002		-	
	(0.738)		(10.500)			
Squared log GNI per capita ($100)	-		125.025		-	
			(132.861)			
Cubed log GNI per capita ($1000)	-		-44.422		3.608	*
			(54.953)		(1.852)	
Urban population share (%)	-		-0.010		-0.009	
			(0.022)		(0.019)	
Arable land per rural person (hectares)	-		-0.082		-0.086	
			(0.112)		(0.112)	
Female share of total employment (%)	-		-0.113			
			(0.081)			
Female share of total off-farm employment (%)	-		0.729	***	0.674	***
			(0.137)		(0.120)	
Sector shares of total employment (%)						
Agriculture	-		-0.209		-	
			(0.167)			
Mining	-		-0.475	**	-0.346	**
			(0.233)		(0.167)	
Manufacturing	-		-0.057		0.162	***
			(0.158)		(0.060)	
Construction	-		0.159		0.343	***
			(0.185)		(0.116)	
Utilities	-		-0.230		-0.190	
			(0.414)		(0.376)	
Trade services	-		-0.235		-0.033	
			(0.174)		(0.051)	
Transport services	-		-0.474	*	-0.177	
			(0.254)		(0.146)	
Accommodation and food services	-		-0.126		0.082	
			(0.189)		(0.125)	
Financial services	-		-0.075		0.091	
			(0.193)		(0.118)	
Public administration	-		0.269	*	0.458	***
			(0.157)		(0.089)	
Education	-		-0.354		-0.102	
			(0.228)		(0.163)	
Health and social work	-		-0.350		-0.164	
			(0.227)		(0.113)	
Other services	-		-0.376	**	-0.162	*
			(0.172)		(0.095)	
Female share of sector employment (%)						
Agriculture	-		0.094	**	0.060	*
			(0.040)		(0.032)	
Mining	-		-0.029		-0.027	
			(0.021)		(0.020)	
Manufacturing	-		0.187	***	0.188	***
			(0.034)		(0.031)	

Table S3 (continued). Female Share of Off-Farm Agrifood System (AFS) Employment

	Female share of total off-farm AFS employment				
	(1)	(2)		(3)	
Female share of sector employment (continued)					
Construction	-	-0.039		-	
		(0.041)			
Utilities	-	0.027		0.024	
		(0.025)		(0.028)	
Trade services	-	0.285	***	0.288	***
		(0.040)		(0.038)	
Transport services	-	-0.094	*	-0.110	**
		(0.051)		(0.051)	
Accommodation and food services	-	0.160	***	0.155	***
		(0.027)		(0.027)	
Financial services	-	0.023		0.021	
		(0.027)		(0.027)	
Real estate and business services	-	-0.020		-0.024	
		(0.041)		(0.042)	
Public administration	-	-0.076	***	-0.072	***
		(0.026)		(0.025)	
Education	-	-0.070	**	-0.067	**
		(0.029)		(0.027)	
Health and social work	-	0.064	*	0.062	*
		(0.038)		(0.037)	
Other services	-	-0.127	***	-0.129	***
		(0.031)		(0.031)	
Regional dummies					
East Asia and Pacific	-	-3.183	*	0.285	
		(1.689)		(1.059)	
Europe and Central Asia	-	-6.293	***	-2.524	
		(1.028)		(1.706)	
Latin America and Caribbean	-	-1.549		1.809	
		(1.604)		(1.111)	
Middle East and North Africa	-	-5.088	***	-1.602	
		(1.458)		(1.776)	
North America	-	-		3.570	**
				(1.663)	
South Asia	-	0.662		3.550	**
		(2.046)		(1.715)	
Sub-Saharan Africa	-	-3.395	**	-	
		(1.681)			
Latitude	-	-0.012		-0.011	
		(0.025)		(0.024)	
Squared latitude	-	-1.557	**	-1.462	*
		(0.765)		(0.781)	
Cubed latitude	-	0.028	**	0.023	*
		(0.012)		(0.012)	
Data source (1 is SUT, 0 is IOT)	-	1.739	***	1.868	***
		(0.577)		(0.556)	

Table S3 (continued). Female Share of Off-Farm Agrifood System (AFS) Employment

	Female share of total off-farm AFS employment					
	(1)		(2)		(3)	
Constant	53.351	***	49.409		-7.781	***
	(7.034)		(33.839)		(2.700)	
Observations	1389		1389		1389	
R-squared	0.014		0.973		0.972	
Adjusted R-squared	0.0136		0.972		0.971	

Source: Authors' calculations sample country agrifood system employment estimates (see Table A2); employment data from ILO (2023); and GNI data from World Bank (2023).
Notes: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.10).

Table S4. Imputation and Extrapolation Data Points

CODE	Type	Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
ALB	SUT	Official	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	E
ARG	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
AUS	SUT	OECD	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	E
AUT	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
AZE	IOT	Official	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E
BEL	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
BEN	SUT	Official	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E	E	E	E	E	E	E	E
BFA	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	A	A	E	E
BGD	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	A	A	A	A	A	A	A	A	A	E
BGR	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
BOL	SUT	Official	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	E	E	E	E	E	E	E
BRA	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
BRN	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
BTN	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
BWA	SUT	IFPRI	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E
CAN	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
CHE	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
CHL	SUT	OECD	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	E
CHN	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
CIV	SUT	Official	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E	E	E	E
CMR	SUT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E
COD	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	A	A	A	A	A	A	A	E	E
COL	SUT	OECD	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	E	A
CPV	SUT	OECD	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	E
CRI	SUT	OECD	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	E
CYP	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
CZE	SUT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
DEU	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
DNK	SUT	OECD	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E
DOM	SUT	Official	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E	E	E	E
DZA	IOT	Official	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E
ECU	SUT	Official	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E
EGY	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E
ESP	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
EST	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
ETH	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	A	A	A	A	A	A	A	A	E
FIN	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
FJI	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
FRA	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
GBR	SUT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E

CODE	Type	Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GEO	SUT	OECD	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A
GHA	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	A	A	A	A	A	A	A	A	E
GRC	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
GTM	SUT	Official	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A
HKG	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
HND	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	E
HRV	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
HTI	SUT	Official	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E
HUN	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
IDN	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
IND	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
IRL	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
IRN	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E
IRQ	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E	E
ISL	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
ISR	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
ITA	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
JAM	SUT	Official	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E
JOR	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E
JPN	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
KAZ	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
KEN	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A
KGZ	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
KHM	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
KOR	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
KWT	IOT	Official	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E	E	E
LAO	IOT	ADB	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
LCA	SUT	Official	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E
LKA	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
LSO	SUT	IFPRI	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E
LTU	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
LUX	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
LVA	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
MAR	SUT	OECD	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A
MDG	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	A	A	A	A	A	A	A	E	E
MDV	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
MEX	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
MKD	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
MLI	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	A	A	A	A	A	A	A	A	E
MLT	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
MMR	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
MNG	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

CODE	Type	Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
MOZ	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E	A	A	A	A	E	E
MUS	SUT	Official	E	E	A	A	A	A	E	A	E	E	E	E	E	A	E	E	E	E	A	E	E	E
MWI	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	A	A	A	A	E
MYS	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
NAM	SUT	IFPRI	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E
NER	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	A	A	A	A	A	A	E
NGA	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A
NIC	IOT	Official	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
NLD	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
NOR	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
NPL	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	A	A	A	A	A	A	A	E	E
NZL	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
PAK	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
PAN	SUT	Official	E	E	E	E	E	E	E	A	A	A	A	A	A	E	E	E	E	A	A	A	E	E
PER	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
PHL	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
PNG	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E
POL	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
PRT	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A
PRY	SUT	Official	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	E	E	E	E	E	E	E
ROU	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
RUS	IOT	OECD	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
RWA	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A
SAU	IOT	OECD	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
SDN	SUT	IFPRI	M	M	M	M	M	M	M	M	M	M	M	M	E	E	E	E	E	E	E	A	E	E
SEN	SUT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E
SGP	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
SLV	SUT	Official	E	E	E	E	E	A	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	E
SRB	SUT	OECD	M	M	M	M	M	M	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
SVK	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	E	E
SVN	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
SWE	SUT	OECD	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	E
SWZ	SUT	IFPRI	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E
TGO	SUT	Official	E	E	E	E	E	E	E	E	E	A	E	A	A	A	A	A	A	A	A	A	E	E
THA	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
TJK	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E	E	E	A	E
TUN	IOT	OECD	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
TUR	IOT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	E	E	E
TZA	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	E	E	A	A	A	A	A	A	A	A
UGA	SUT	IFPRI	E	E	E	E	E	E	E	E	E	A	E	E	A	A	A	A	A	A	A	A	E	E
UKR	IOT	Official	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E
URY	IOT	Official	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E

CODE	Type	Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
USA	SUT	OECD	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
UZB	SUT	Official	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	E	E	E
VEN	IOT	Official	A	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
VNM	IOT	ADB	A	E	E	E	E	E	E	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
YEM	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	E	E
ZAF	SUT	OECD	E	E	E	E	E	E	E	E	E	E	E	E	E	A	A	A	A	A	A	A	E	E
ZMB	SUT	IFPRI	E	E	E	E	E	E	E	E	E	E	A	E	E	E	E	A	A	A	A	A	A	A
ABW	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
AFG	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
AGO	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
AND	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
ARE	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
ARM	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
ASM	SUT	-	M	M	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
ATG	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
BDI	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
BHR	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
BHS	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
BIH	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
BLR	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
BLZ	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
BMU	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
BRB	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
CAF	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
CHI	SUT	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
COG	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
COM	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
CUB	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
CUW	SUT	-	M	M	M	M	M	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
CYM	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
DJI	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
DMA	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
ERI	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
FRO	SUT	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
FSM	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
GAB	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
GIB	SUT	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
GIN	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
GMB	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
GNB	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
GNQ	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
GRD	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

CODE	Type	Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GRL	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
GUM	SUT	-	M	M	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
GUY	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
IMN	SUT	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
KIR	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
KNA	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
LBN	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
LBR	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
LBY	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
LIE	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
MAC	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
MAF	SUT	-	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
MCO	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
MDA	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
MHL	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
MNE	SUT	-	M	M	M	M	M	M	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
MNP	SUT	-	M	M	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	M
MRT	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
NCL	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
NRU	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
OMN	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
PLW	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
PRI	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
PRK	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
PSE	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
PYF	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
QAT	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SLB	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SLE	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SMR	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SOM	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SSD	SUT	-	M	M	M	M	M	M	M	M	M	M	M	M	I	I	I	I	I	I	I	I	I	I
STP	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SUR	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SXM	SUT	-	M	M	M	M	M	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SYC	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
SYR	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
TCA	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
TCD	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
TKM	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
TLS	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
TON	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

CODE	Type	Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TTO	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
TUV	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
VCT	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
VGB	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
VIR	SUT	-	M	M	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
VUT	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
WSM	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
XKX	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
ZWE	SUT	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

Source: Authors' summary.

Notes: E stands for Extrapolation, I is for Imputation, A for Actual and M stands for Missing data.

ALL IFPRI DISCUSSION PAPERS

All discussion papers are available **here**

They can be downloaded free of charge

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
www.ifpri.org

IFPRI HEADQUARTERS
1201 Eye Street, NW
Washington, DC 20005 USA
Tel.: +1-202-862-5600
Fax: +1-202-862-5606
Email: ifpri@cgiar.org