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China's Agrifood System
Structure and Transformation, 2012–2023

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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Abstract

This study analyzes the historical performance, evolutionary trends, and future opportunities and challenges of China's agrifood system (AFS) from 2012 to 2023. By constructing multi-year social accounting matrices (SAMs), the study quantifies the economic scale and structural characteristics of the AFS, as well as its historical contribution to broader economic transformation and growth. Utilizing the China Agrifood System Model, the study evaluates the effectiveness of productivity enhancements across different value chains in promoting multidimensional development goals, such as GDP growth, job creation, and poverty eradication. The findings indicate that the transformation of the AFS is a core component of China's economic transformation. Although the AFS's share of the national economy has declined during industrialization, its contribution to inclusive economic transformation remains substantial. This continued importance is closely linked to profound structural shifts within the sector, as value creation has increasingly moved from primary production toward downstream segments such as processing, trade, and food services. General equilibrium simulations indicate that some agricultural sectors, including maize, vegetables, and fisheries, generate strong multiplier effects on non-agricultural employment, helping to absorb labor and alleviate transition pressures. The study concludes that continuously optimizing the internal structure of the AFS and strengthening integrated value chain synergies are critical pathways for addressing future resource and environmental constraints while achieving sustainable and inclusive development.

Keywords: Agrifood system transformation, computable general equilibrium, economic growth, job

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1 Introduction

The concept of the agrifood system (AFS) has emerged against the backdrop of food security, nutritional health, environmental sustainability, and global governance. Traditional agricultural economics has long focused on the production sector and yield enhancement, yet this approach is inadequate for addressing the “double burden of malnutrition,” that is, the coexistence of hunger, undernutrition, and obesity (WHO, 2023). At the same time, high-input production models have resulted in land degradation, water scarcity, and rising greenhouse gas emissions (IPCC, 2019), intensifying environmental and climate concerns. With globalization and the extension of value chains, food systems have evolved into complex networks spanning production, processing, transportation, consumption, and waste management, and are increasingly constrained by trade rules and standards (FAO, 2022). Since the early 21st century, organizations such as the Food and Agriculture Organization of the United Nations (FAO) have advocated for a “food systems approach,” emphasizing the need for cross-sectoral and cross-objective governance to strike a balance between economic efficiency, social equity, and ecological sustainability (FAO, 2023).

As the AFS concept has deepened, characterization of these systems has shifted from a focus on single production segments to full-chain systems, and from single-sector analysis to multisector coordination. These changes pose new challenges for accounting and assessment methods. At the same time, to comprehensively evaluate the impacts of AFS on the environment, nutritional health, and food security, systematic analytical approaches are required to quantify the complex relational networks that link food production and consumption (Halpern et al., 2019; Farmery et al., 2021). In recent years, scholars in China and abroad have made substantial methodological progress, primarily in three areas.

First, input–output analysis (IOA) details the flows of goods and services among sectors through intermediate inputs, thereby capturing interdependencies among different food production activities. IOA also reveals complex interactions among economic, social, and environmental factors, making it highly valuable for research on healthy and sustainable food systems (Boylan et al., 2020).

Second, life-cycle assessment (LCA) focuses on assessing the potential environmental and

social impacts of AFS—for example, the implications of dietary shifts for greenhouse gas emissions and land use (Lu et al., 2020). LCA typically constructs the full life-cycle from production to consumption and waste disposal, collecting quantitative data on all inputs (e.g., energy, raw materials, production factors) and outputs (e.g., carbon emissions, waste). These data are then converted into indicators reflecting economic, social, or environmental impacts (Cucurachi, 2019).

Third, true-cost accounting (TCA) applies cost–benefit theory to systematically measure the external costs and benefits of AFS to provide decision-support for governments and other stakeholders (Baker et al., 2020). TCA is grounded in the notion that market mechanisms fail to reflect the full costs of food production and consumption, leading to neglected “externalities,” primarily environmental, social, and health-related impacts (Hendriks et al., 2023). By integrating economic accounting and impact assessment, TCA serves diverse actors: governments may incorporate TCA into national accounts and gross domestic product (GDP) calculations, and consumers can better understand environmental externalities embedded in food products and adjust dietary behaviors accordingly (von Braun et al., 2023).

These three approaches encompass most quantitative research on AFS, each with its own emphasis. IOA focuses on describing production relationships among sectors and depicts the internal network structure from a macro perspective. LCA excels in micro-level dissection of value chains for food items or categories, building a complex system from each life-cycle stage. TCA emphasizes non-economic factors related to AFS and internalizes them into product prices. The three approaches are not mutually exclusive; rather, they are increasingly integrated into comprehensive methodological systems (Boylan et al., 2020). However, these methodologies exhibit several limitations: first, the absence of value-added accounting across different segments of the agrifood value chain may lead to an underestimation of the system’s contribution to macroeconomic development. Second, they often overlook the impact of the agrifood system on external factors—such as poverty reduction, coordinated urban–rural development, and global trade—within the contemporary context of global sustainable development and its implications for developing nations. Third, while these approaches are predominantly applied to global-scale cost–benefit analyses, their application to detailed single-country assessments remains limited. This, to some extent, neglects the specific role and

influence of individual nations in the evolution of agrifood systems, warranting more in-depth investigative research.

Despite these advances, cross-country applications remain limited, and the role of national systems in shaping agrifood development is often overlooked. China's AFS plays a pivotal role globally, underpinning food security and sustainable development. With only 9% of the world's arable land and 6% of its freshwater resources, China sustains nearly 20% of the global population. Grain output stands above 650 million tons, ensuring staple food self-sufficiency (National Bureau of Statistics of China, 2023), and China has long ranked first worldwide in agricultural value added (World Bank, 2022). Technological progress accounts for over 62% of China's agricultural growth, with improved varieties covering 96% of major crops and a mechanization rate exceeding 73% (Zheng, 2023). Significant advances have also been made in green production—such as reducing chemical inputs and utilizing crop residues (FAO, 2020). Internationally, China is both a major demand center in global agricultural markets and a strong promoter of South–South cooperation. Through trade openness, technical assistance, and multilateral engagement, China supports agricultural productivity growth in developing countries (OECD/FAO, 2023). Thus, China's AFS not only underpins national food security but also contributes significantly to global governance and innovation.

Given the central role of China's AFS, several studies have attempted to conduct integrated and systemic assessments using comprehensive modeling approaches, yet notable limitations remain. One group of studies employs partial equilibrium models, which can effectively depict supply–demand dynamics for specific commodities or isolated markets but struggle to capture the downstream linkages along agricultural value chains. For example, research on soybean trade often focuses on shocks to a single commodity without identifying the systemic responses in processing, feed, or substitute product markets (Zhang et al., 2021). Another strand of research incorporates entire grain value chains but continues to concentrate primarily on staple crops, overlooking the structural relationships and factor-substitution mechanisms among the many sectors embedded within the broader AFS (Cao et al., 2024). In addition, although some international integrated modeling frameworks can accommodate multidimensional objectives, their granularity remains limited when applied to the Chinese context (Wang et al., 2025), making it difficult to adequately represent the interactions between agriculture and non-

agriculture sectors.

China's AFS is large in scale and highly complex, and therefore its accounting and assessment involve a series of fundamental issues. First, measuring output and value added: a central task is accurately defining value added across agriculture, food processing, distribution, and food service within frameworks such as input–output tables and SAMs. Second, evaluating contributions to labor and employment: comprehensive assessment is needed to capture employment quantity, job quality, and income distribution in agriculture and related industries, and to illuminate the role of the AFS in poverty reduction and urban–rural integration. Third, identifying globalization and trade dependence: given China's deep integration into global markets, a key challenge is distinguishing import-dependent and export-competitive industries in an integrated accounting framework.

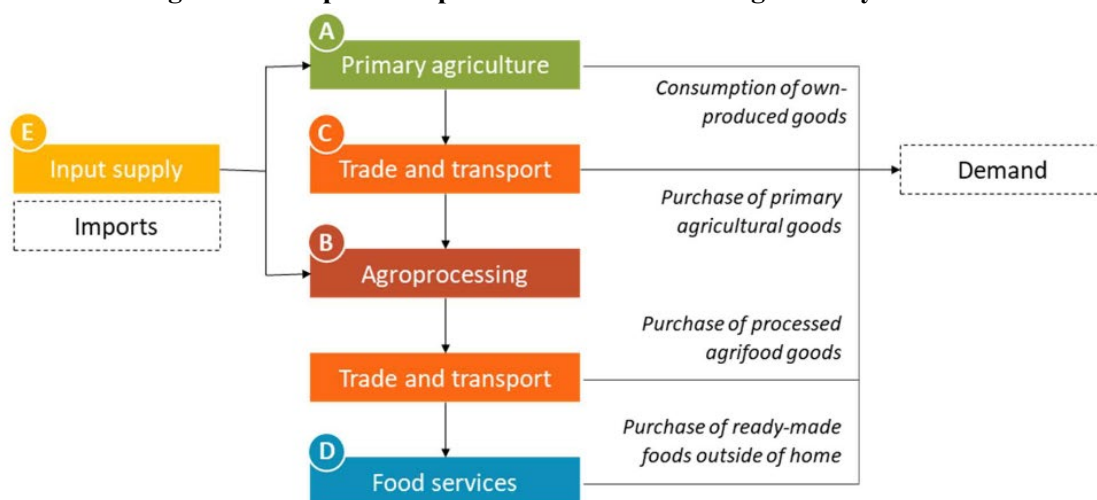
This report proposes a comprehensive research framework and analytical solutions to address these methodological challenges. Its research design and contributions are as follows: first, the report achieves a systematic update and integration of data coverage. Building upon IOA, it comprehensively and meticulously calculates the economic benefits of China's agrifood system from 2012 to 2023, examining both the macroeconomic sector perspective and the industrial chain segment perspective. This work not only extends the temporal coverage but also improves the consistency of cross-sectoral and cross-segment data, providing a solid data foundation for accurately assessing the role of the agrifood system within the economy; second, at the methodological level, the report significantly extends the traditional IOA framework by embedding it into a SAM with an explicit trade module. This allows the model to systematically capture the complex linkages among domestic production, consumption, and international trade, thereby improving the rigor and accuracy of economic impact assessments; third, the report develops an analytical framework for evaluating the potential economic contributions of the AFS (or the broader agricultural value chain). Based on comparative statics and multiplier analysis, the framework can quantitatively simulate changes in key economic outcomes—such as GDP growth, employment generation, and income distribution—under policy interventions or external shocks, offering a scientific tool for policy design and impact forecasting.

2 Methods for Agrifood System Analysis

2.1 Definition of the concept of agrifood system

The AFS is a complex network comprising multiple economic agents connected through production, consumption, agricultural product management, and employment (Tagtow et al., 2011). Its evolution accompanies national economic development. In its early stages, the system is rooted in subsistence agriculture; as agricultural productivity rises, surplus production enters the market, increasing input demand for agro-processing industries and expanding nonfarm employment opportunities. Growing agricultural output also stimulates demand for diversified products, generating additional activities in processing, packaging, transport, trade, and other nonfarm sectors. In the early phases of economic development, agriculture functions as the primary engine of rural and even national growth. Urbanization, the expansion of nonfarm economic activities, and rising non-agricultural incomes subsequently become key drivers of AFS transformation, as consumer demand for processed agricultural products creates strong linkages between rural producers and urban markets (Dorosh and Thurlow, 2013). In this study, we adopt the conceptual framework developed by the International Food Policy Research Institute (IFPRI).

Figure 1 A simple conceptual framework of the agrifood system



Source: Thurlow et al. (2023).

Figure 1 illustrates a simplified conceptual framework of the agrifood system (AFS), consisting of five components labeled A to E. Primary agriculture (A) comprises all supply and

demand activities related to crop production, livestock, fisheries, and forestry. Agro-processing (B) forms part of the manufacturing sector and includes subsectors that process agricultural raw materials into food and nonfood products. Trade and transport services (C) include transport, wholesale, and retail services linking farms, firms, and final points of sale. Food services (D) refers to prepared meals provided in restaurants, snack bars, and hotels. Input supply (E) represents domestically produced intermediate inputs used directly in agriculture and agro-processing, such as fertilizer, feed, machinery services, and financial services.

2.2 Computational approach

This report conducts two main types of analysis: first, descriptive statistics, including key economic indicators such as sectoral GDP and employment, with results disaggregated for each component of the AFS; second, assessment of the potential economic impacts of agricultural value chains on overall economic development.

To support both dimensions, we construct a set of SAMs for China in 2012, 2015, 2018, 2020, and 2023 by integrating national input - output tables, customs trade data, and central government fiscal statistics. The SAM records intermediate input flows, value-added components, and final demand categories, including household consumption, government consumption, capital formation, and exports.

GDP is calculated using the income approach, defined as the sum of labor compensation, net production taxes, depreciation of fixed assets, and operating surplus. Employment estimation proceeds in two steps: preliminary employment is calculated by dividing labor compensation by sectoral average wages, followed by calibration using official employment totals for agriculture, industry, and services from the China Labor Statistical Yearbook. For example, employment in agricultural subsectors is calibrated using the following procedure:

$$L_i^1 = \frac{W_i}{\omega_i} \quad (2.1)$$

$$L_i^2 = \frac{L_{agri}}{\sum_{i \in agri} L_i^1} \cdot L_i^1 \quad (2.2)$$

Where L_i^1 is the preliminary estimate for subsector I, W_i is labor compensation, ω_i is average wages, L_i^2 is the calibrated estimate, L_{agri} is total agricultural employment, $\sum_{i \in agri} L_i^1$ is the total agricultural employment estimated by the first step.

To identify AFS components within the SAM framework, we categorize 88 production sectors into 22 primary agricultural sectors, 17 agro-processing sectors, 7 trade and transport sectors, and 1 food service sector. GDP and employment for each of these sectors are computed directly from the SAM, whereas GDP and employment for input supply are estimated as the share of value added attributable to inputs used by the AFS.

To assess the potential economic impacts of agricultural value chains, this report constructs the China Agrifood System Assessment Model (CAFSAM), a computable general equilibrium (CGE) model built on the logic of IFPRI's Rural Investment and Policy Analysis (RIAPA) model. CAFSAM preserves the SAM-based analytical structure of RIAPA and emphasizes the dynamic interlinkages across agriculture, non-agriculture, household groups, labor markets, and income distribution (Aragie et al., 2022). By incorporating China's multisector and multifactor input–output structure, CAFSAM provides a more detailed representation of agro-processing, distribution, and food service segments compared with the standard RIAPA model, enabling more accurate characterization of internal AFS structures and their interactions with the broader economy.

Similar to the RIAPA model, the CAFSAM can simultaneously assess the direct and indirect effects of agricultural policies, technological change, or external shocks on both the AFS and the macroeconomy. Compared with partial equilibrium models, its core advantage lies in integrating CGE analysis with sector-based microsimulation methods. This combined framework not only allows for estimating the impacts of changes in agricultural productivity on macro-level variables such as GDP, employment, and trade but also enables tracing the structural effects of policy changes on income distribution and consumption patterns (Dorosh et al., 2023). This report applies a comparative static setting in which increased total factor productivity (TFP) in primary agriculture serves as the policy scenario, while unchanged TFP represents the baseline scenario. Differences between scenarios indicate the potential contribution of agricultural value chains to economic growth and structural transformation. This approach is consistent with the analytical logic of RIAPA, whereby policy simulations reveal multi-layered feedback effects of agricultural investment and institutional change across the economic system, thereby offering a quantitative foundation for policy design and sustainable development planning.

Building on multiplier analysis, the report defines a value-chain multiplier as the change in an aggregate economic indicator generated by a one-unit increase in the GDP (value added) of a specific agricultural value chain. In other words, the multiplier measures the broader economywide effect associated with an additional unit of value added created in a given value chain. For example, if an increase of RMB 1 in the GDP of the maize value chain leads to an increase of RMB K in total GDP, then K represents the GDP multiplier of that value chain. Formally:

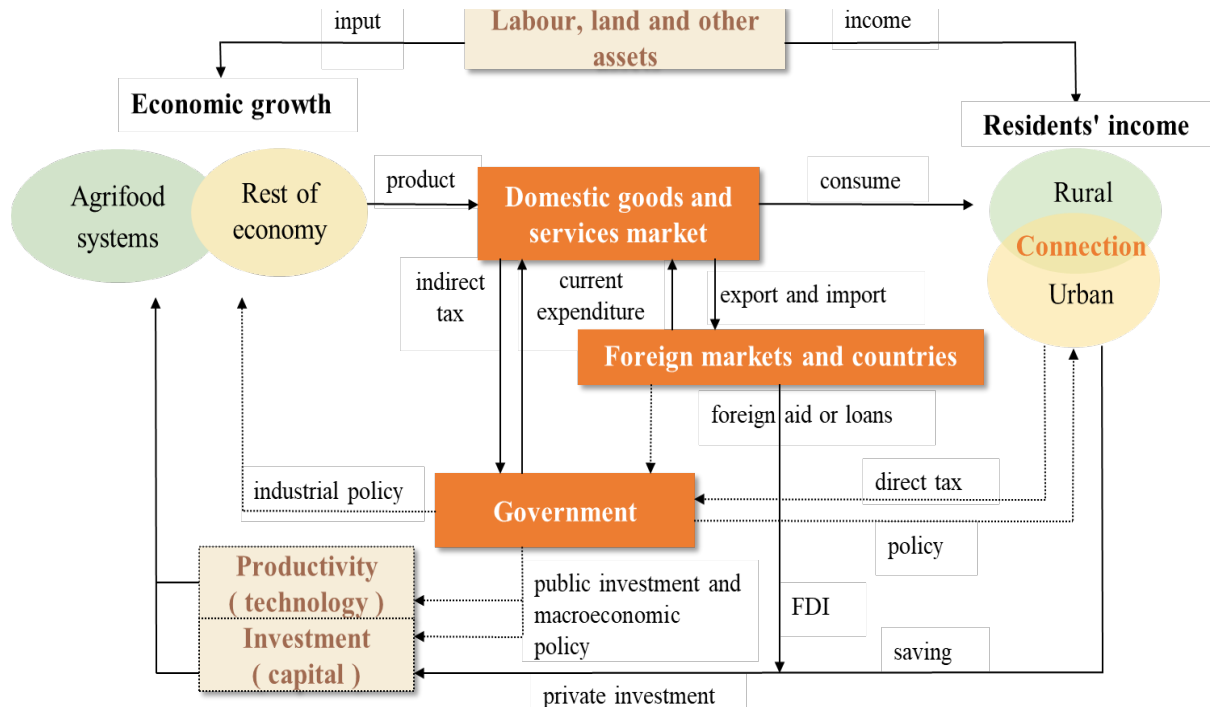
$$K_i = \frac{\Delta \text{MacroIndex}}{\Delta \text{GDP}_i} \quad (2.3)$$

Where K_i denotes the multiplier for value chain i , ΔGDP_i is the change in value added for that chain, and $\Delta \text{MacroIndex}$ is the corresponding change in macroeconomic outcomes, measured as the difference between the policy and baseline scenarios:

$$\Delta \text{MacroIndex} = \text{MacroIndex (simulation)} - \text{MacroIndex (baseline)} \quad (2.4)$$

$$\Delta \text{GDP}_i = \text{GDP}_i \text{ (simulation)} - \text{GDP}_i \text{ (baseline)} \quad (2.5)$$

Figure 2 Model Framework of CAFSAM



3 Structural Analysis of China’s Agrifood System

3.1 Economic structure of China’s agrifood system

3.1.1 Trends in the economic structure of the agrifood system

Using the input–output tables for 2012, 2015, 2018, 2020, and 2023, combined with China Customs trade statistics and central government fiscal data, this report constructs corresponding SAMs and calculates the economic structure of China’s AFS, as shown in Table 1. Table 1 presents two key macroeconomic indicators—GDP and employment—as well as the share of these indicators across different components of the economy. The GDP estimates are based on the input–output tables, whereas employment figures are drawn from the China Labour Statistical Yearbook. The entire economy is divided into the AFS and the non-agrifood system. The AFS is further disaggregated into five subsectors: primary agriculture (A), agro-processing (B), trade and transport services (C), food services (D), and input supply (E). For clarity, subsectors B to E are collectively classified as the off-farm AFS, while manufacturing and services constitute the non-agrifood system. For a better comparative perspective on the evolution of the AFS, this study extends its scope to include the rest of economy, specifically the manufacturing and service sectors.

1) Overall economic scale and employment

From 2012 to 2023, China’s total economic scale expanded significantly. GDP increased from RMB 55.29 trillion (approximately US\$8.76 trillion) in 2012 to RMB 130.04 trillion (US\$18.45 trillion) in 2023, a nominal increase of 135.2 percent. Although this comparison is based on current prices, and therefore reflects both real growth and price changes, the increase remains substantial even after accounting for cumulative inflation of about 25.2 percent over the same period. This trend underscores China’s growing importance in the global economy. Employment remained relatively stable despite slight fluctuations, declining only from 767 million workers in 2012 to 740 million in 2023, suggesting that labor market stability was maintained even amid rapid economic expansion.

2) Changes in the agrifood system

In 2023, the AFS generated RMB 19.49 trillion (US\$2.8 trillion) in GDP and employed 222 million workers, confirming its central role in China’s macroeconomy. In particular, its

relatively large employment share suggests that the sector functions as a key buffer for labor absorption during structural transformation, helping to support employment stability as workers transition across sectors. However, Table 1 shows that the AFS's share of GDP declined from 20.6 percent in 2012 to 15.0 percent in 2023 (a drop of 5.6 percentage points), while its share of employment fell from 43.6 percent to 30.0 percent (down 13.6 percentage points). This indicates a declining relative importance of the AFS in the economy, but it also reflects structural upgrading and transformation within the system. Compared with other studies (Zhang & Diao, 2020; Zhou et al., 2022), the GDP share of the AFS calculated in this report is higher because it includes not only food-related primary and processing sectors but also nonfood sectors such as forestry and textiles. In the textile industry, this paper only considers the portion that is produced using traditional agricultural raw materials such as natural yarn. While this broader definition captures the full economic contribution of the AFS, it may yield estimates that differ from narrower definitions used in other research. This approach provides a more comprehensive perspective on the AFS's role during China's economic transition.

Although downstream agrifood activities now account for a larger share of economic output, primary agriculture remains a major source of employment and a key pillar of food security. In 2023, primary agriculture contributed RMB 9.52 trillion (US\$1.35 trillion) to GDP and provided 169 million jobs. While its share of national GDP was only 7.3 percent, it still accounted for 22.8 percent of total employment, highlighting the sector's disproportionately important role in labor absorption relative to its economic output. Between 2012 and 2023, agriculture's GDP share declined from 9.6 to 7.3 percent, while employment fell from 258 million workers to 169 million workers (−34.5 percent), with the employment share decreasing from 33.6 to 22.8 percent. These trends indicate rising agricultural productivity, which allowed the release of labor into other sectors. This is outcome consistent with China's agricultural modernization (Huang & Rozelle, 2018) and with FAO findings that agriculture's economic share declines globally even as modernization accelerates (FAO, 2020).

3) Changes in off-farm agrifood sectors

The off-farm agrifood sectors—that is, the linkages connecting production and consumption—expanded from RMB 6.11 trillion (US\$0.97 trillion) in 2012 to RMB 9.97 trillion (US\$1.41 trillion) in 2023, although the off-farm share of GDP declined from 11.0 to

7.7 percent. Employment decreased from 77 million to 53 million workers, with the employment share stabilizing at around 9 percent.

Within these subsectors, agro-processing occupies a central position, with GDP rising from RMB 3.19 trillion (US\$0.51 trillion) to RMB 5.13 trillion (US\$0.73 trillion) and consistently representing more than half of off-farm agrifood GDP, underscoring its importance in driving agro-industrialization. Trade and transport services expanded from RMB 1.15 trillion (US\$0.18 trillion) to RMB 1.88 trillion (US\$0.27 trillion), maintaining a stable GDP share of 2.0 percent, and employment increased from 14 million to 17 million workers, reflecting improved food distribution efficiency, consistent with global studies on the role of modern supply chains (Reardon & Timmer, 2012).

In contrast, the GDP of the food service sector has been more volatile. After peaking at RMB 1.67 trillion (US\$0.25 trillion) in 2018, it fell to RMB 1.12 trillion (US\$0.16 trillion) in 2020 before rebounding to RMB 1.93 trillion (US\$ 0.27 trillion) in 2023. Its share of the total economy declined from 2.4 to 1.5 percent, while employment dropped from 18 million to 9 million people. This change may be influenced by shifts in consumption patterns or the short-term impact of the pandemic.

Following a 2015 peak of RMB 1.19 trillion (US\$0.19 trillion), the input supply sector's GDP contracted to RMB 1.02 trillion (US\$0.14 trillion) in 2023, with its economic share falling from 1.8 to 0.8 percent and employment stabilizing at 2 million.

4) Expansion of the non-agrifood economy

Outside the AFS, the rest of the economy experienced continuous expansion. Its GDP increased from RMB 43.89 trillion (US\$6.95 trillion) in 2012 to RMB 110.54 trillion (US\$15.69 trillion) in 2023, and its GDP share grew from 79.4 to 85.0 percent. Employment rose from 433 million to 518 million workers (from 56.4 to 70.0 percent of total employment). Manufacturing GDP increased from RMB 17.54 trillion (US\$2.78 trillion) to RMB 30.44 trillion (US\$4.32 trillion), although its GDP share fell from 31.7 to 23.4 percent, and employment declined from 127 million to 114 million workers—signaling an upgrade toward high-tech and high-value-added manufacturing. Meanwhile, services surged: GDP rose from RMB 26.35 trillion (US\$4.18 trillion) to RMB 80.16 trillion (US\$11.38 trillion), and its economic share grew from 47.7 to 61.6 percent. Service-sector employment expanded from

305 million to 404 million workers, increasing its employment share from 39.8 to 54.6 percent. These trends reinforce the observation that services have become the primary driver of China's economic growth and employment (OECD, 2021).

Overall, while the agrifood system's share of the national economy has declined, its internal structure is undergoing optimization and transformation. The recent "downsizing for efficiency" in primary agriculture aligns with modernization trends, whereas the expansion of nonfarm AFS sectors—particularly the rise of agro-processing—has become a pivotal driver of agricultural industrialization. Additionally, fluctuations in food services may reflect shifting consumption patterns or short-term pandemic disruptions. Ultimately, the continuous expansion of non-AFS sectors, especially services, underscores China's economic transition toward higher value-added domains.

Table 1 Summary of the economic structure of China's agrifood system

Year		Sector of economy		Total economy	(1) Agrifood system	(1.1) Primary agriculture (A)	(1.2) Off-farm AFS	(1.2.1) Processing (B)	(1.2.2) Trade and transport (C)	(1.2.3) Food services (D)	(1.2.4) Input supply (E)	(2) Rest of economy	(2.1) Total manufacturing	(2.2) Total services
2012	GDP	Value RMB trillion	55.29	11.41	5.30	6.11	3.19	1.15	0.75	1.01	43.89	17.54	26.35	
		Share %	100	20.6	9.6	11.0	5.8	2.1	1.4	1.8	79.4	31.7	47.7	
	Employment	Workers Ten million	76.7	33.45	25.77	7.68	4.26	1.39	1.82	0.22	43.25	12.74	30.51	
		Share %	100	43.6	33.6	10	5.6	1.8	2.4	0.3	56.4	16.6	39.8	
2015	GDP	Value RMB trillion	69.65	13.27	6.36	6.91	3.50	0.97	1.25	1.19	56.38	19.31	37.08	
		Share %	100	19.1	9.1	9.9	5.0	1.4	1.8	1.7	80.9	27.7	53.2	
	Employment	Workers Ten million	76.32	29.47	21.42	8.05	4.41	1.86	1.53	0.25	46.85	11.73	35.12	
		Share %	100	38.6	28.1	10.5	5.8	2.4	2.0	0.3	61.4	15.4	46.0	
2018	GDP	Value RMB trillion	94.18	15.62	6.89	8.73	3.98	2.00	1.67	1.08	78.56	25.22	53.34	
		Share %	100	16.6	7.3	9.3	4.2	2.1	1.8	1.1	83.4	26.8	56.6	
	Employment	Workers Ten million	77.59	27.12	20.26	6.87	3.39	1.94	1.34	0.21	50.46	10.81	39.65	
		Share %	100	35	26.1	8.9	4.4	2.5	1.7	0.3	65.0	13.9	51.1	
2020	GDP	Value	101.64	17.62	8.22	9.40	4.76	2.58	1.12	0.94	84.02	23.51	60.51	

Year		Sector of economy		Total economy	(1) Agrifood system	(1.1) Primary agriculture (A)	(1.2) Off-farm AFS	(1.2.1) Processing (B)	(1.2.2) Trade and transport (C)	(1.2.3) Food services (D)	(1.2.4) Input supply (E)	(2) Rest of economy	(2.1) Total manufacturing	(2.2) Total services
		RMB trillion												
		Share %	100	17.3	8.1	9.3	4.7	2.5	1.1	0.9	82.7	23.1	59.5	
	Employment	Workers Ten million	75.06	24.45	17.72	6.74	3.29	1.97	1.31	0.16	50.61	10.34	40.27	
		Share %	100	32.6	23.6	9.0	4.4	2.6	1.7	0.2	67.4	13.8	53.7	
2023	GDP	Value RMB trillion	130.04	19.49	9.52	9.97	5.13	1.88	1.93	1.02	110.54	30.44	80.16	
		Share %	100	15.0	7.3	7.7	3.9	1.4	1.5	0.8	85.0	23.4	61.6	
	Employment	Workers Ten million	74.04	22.22	16.88	5.34	2.60	1.70	0.65	0.39	51.82	11.39	40.44	
		Share %	100	30.0	22.8	7.2	3.5	2.3	0.9	0.5	70.0	15.4	54.6	

5) Trends in agrifood system GDP shares

To analyze the transformation of the agrifood system, this report builds upon accounting methodologies from literature such as Zhang and Diao (2020), the *2022 China and Global Food Policy Report*, and the *China Agricultural Sector Development Report 2019*. The accounting framework encompasses both food and nonfood industries; specifically, it excludes synthetic-based textile sectors (e.g., chemical fibers) while incorporating natural fiber-based segments (e.g., cotton and yarn). This study extends the analysis to include the years 2020 and 2023, examining AFS transformation through longitudinal trends in GDP shares.

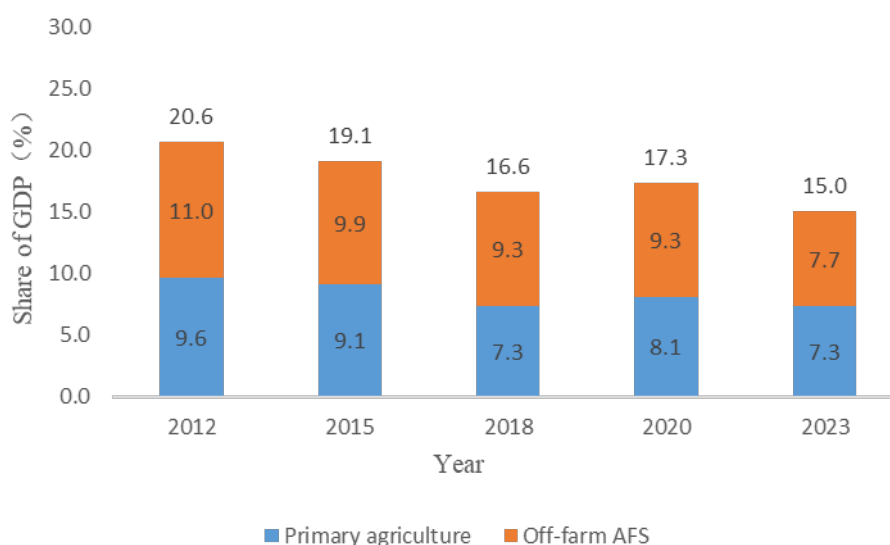
Compared to previous studies, this report yields higher estimates due to its broader scope. Zhang and Diao (2020), using the 2017 input–output table, estimated the AFS GDP share at 16.0 percent and the employment share at 33.0 percent; these are lower than our findings as they excluded nonfood processing (textiles and wood products). Similarly, the *2022 China and Global Food Policy Report* estimated the 2018 AFS GDP share at 15.1 percent and labor share at 31.2 percent, with the lower figures again attributed to the exclusion of nonfood industries, despite consistent results for primary agriculture. In contrast, the *China Agricultural Sector Development Report 2019* estimated the 2017 AFS value-added at 23.3 percent of GDP and employment at 36.7 percent. The higher shares mainly reflected the report's broader definition of the agrifood system, which included sectors such as apparel and leather products, and furniture manufacturing. These sectors are excluded from our study because their growing reliance on synthetic and chemical-based inputs has weakened their linkages with the agrifood system.

Table 1 and Figure 3 summarize the GDP shares of primary agriculture and non-agricultural sectors within the AFS. While the overall AFS GDP share exhibits a distinct downward trend, an anomaly occurred in 2020, when the share slightly exceeded 2018 levels. This was driven by a rise in primary agriculture's share during the 2018–2020 period, likely due to the COVID-19 shock, which reduced urban labor demand and non-agricultural output, prompting migrant workers to return to farming (Zhang et al., 2020; IOM, 2022).

Furthermore, while the AFS GDP share remained stable from 2012 to 2015, it declined sharply between 2015 and 2018, primarily driven by the rapid growth of non-AFS sectors. This shift reflects China's structural transformation—particularly the expansion of services and

high-tech manufacturing—which absorbed significant labor and capital, thereby diminishing the AFS’s relative economic weight (OECD, 2021). While consistent with global trends of declining relative importance for the AFS, our findings uniquely reveal the pandemic's short-term impact on GDP shares, particularly in primary agriculture, providing a novel perspective on AFS dynamics during economic crises (FAO, 2020).

Figure 3 Trends in the economic structure of China’s agrifood system



6) *Analysis of labor productivity*

To better evaluate economic efficiency, this report employs labor productivity—defined as the ratio of GDP to the size of the workforce—as a key metric. With 2012 as the base period, from 2012 to 2023, total economic labor productivity in China rose from 72,100 to 140,300 RMB/person, representing cumulative growth of 94.6% (average annual increase of 6.24%) and reflecting a significant improvement in overall efficiency.

Within the agrifood system (AFS), labor productivity increased by 103.1%, rising from 34,502 to 70,081 RMB/person—slightly outpacing the national growth rate. This surge was mainly driven by primary agriculture, where productivity jumped from 20,567 to 45,064 RMB/person, a 119.1% increase that underscores the transformative impact of agricultural modernization (Huang & Rozelle, 2018). Nevertheless, the AFS’s total labor productivity remains lower than that of its nonfarm components and of other economic sectors, showing the agriculture sector as a persistent bottleneck for efficiency gains.

Specifically, while the off-farm AFS sector started from a higher baseline (83,801

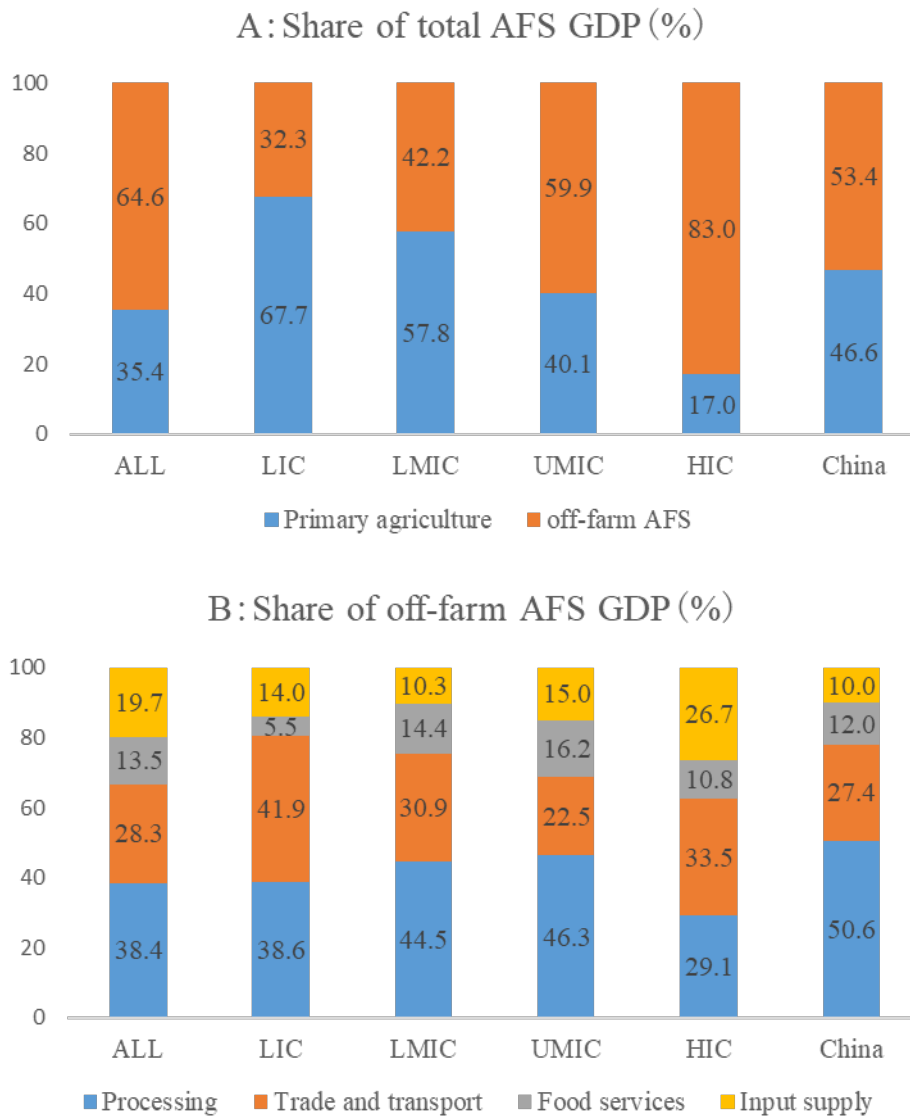
RMB/person in 2012), its growth (78.1%) trailed the AFS average. Other economic sectors saw productivity rise from 100,055 to 170,406 RMB/person (up 69.5%), largely fueled by the service sector, which achieved a 85.7% increase from 85,267 to 158,371 RMB/person by 2023.

3.1.2 International comparison of agrifood system structure: Evidence from 2020

Using China's 2020 agrifood structure and comparable 2021 data from other countries, this report compares the structural composition of agriculture and off-farm agrifood sectors internationally (Figure 4). Panel A divides the AFS into agriculture and off-farm components. Across countries, agricultural GDP shares decline with economic development, while off-farm agrifood shares increase—consistent with structural transformation theory (Wang et al., 2021). China's structure resembles that of upper-middle-income countries (UMIC), though its agricultural share is higher, reflecting unique features of its modernization pathway.

Further disaggregating the off-farm sectors into input supply, processing, trade and distribution, and food services, Panel B shows that in low- and middle-income countries, agro-processing grows rapidly and accounts for an increasing share of agrifood GDP, whereas trade and food services also expand but at a slower pace. As economies transition into high-income status, the focus shifts from industrialization to services, with processing shares stabilizing or declining while trade and services increase. China, which is classified by the World Bank as a UMIC, exhibits a GDP structure across the four segments that broadly resembles the average pattern observed among UMICs. However, its agro-processing share (27.4%) is substantially higher than the typical UMIC levels, reflecting rapid agro-industrialization. In contrast, the shares of food services and transport services are below global UMIC averages, likely due to the impact of COVID-19, which disproportionately affected the service-intensive components of food systems (FAO, 2020). China's AFS transformation thus exhibits both global regularities and distinct national characteristics.

Figure 4 International comparison of agrifood systems (China 2020; Other 2021)



Source: The data are derived from the working paper by Thurlow et al. (2025) and China’s 2020 Social Accounting Matrix. Other countries are classified into low-income countries (LIC), lower-middle-income countries (LMIC), upper-middle-income countries (UMIC), and high-income countries (HIC).

3.2 Food supply and household demand structures within the agrifood system

3.2.1 Food supply

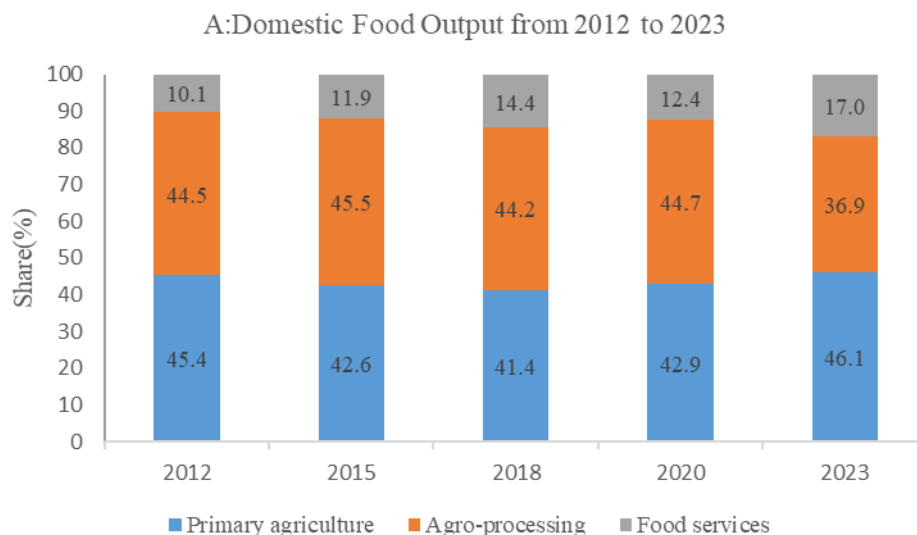
To compare the structural dynamics of agriculture and food within the AFS, this report calculates the output values and proportions of agricultural and food production, analyzing their annual trajectories. Overall, the combined output of these sectors exhibits a growth trend. Specifically, food supply increased until 2018 but declined between 2018 and 2023—a pattern that mirrors global food supply evolution while being shaped by China’s unique agricultural

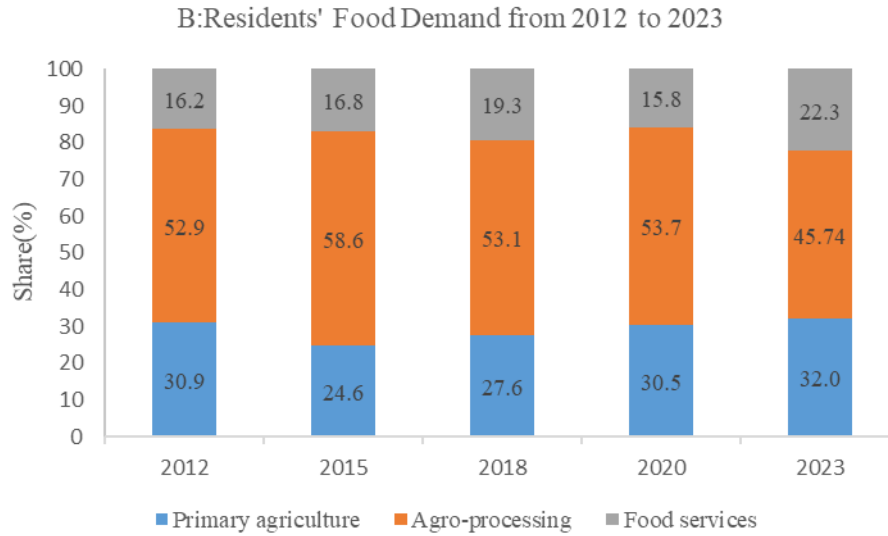
policies and market dynamics.

Figure 5 illustrates the comparison between China’s food output structure and consumer demand patterns for 2012, 2015, 2018, 2020, and 2023. Both output and demand are measured in food value units based on the SAMs. To isolate supply-demand discrepancies, nonfood sectors (e.g., transport services, intermediate inputs, and non-edible primary or processed products) were excluded. Final food consumption is categorized into three types: (1) fresh products (e.g., vegetables, fruits, aquatic products); (2) processed foods (e.g., milled grains, sugar, and meat products); and (3) catering services (out-of-home consumption) (Zhou et al., 2022).

On the supply side (Panel A), fresh and processed foods maintain comparable proportions. The share of processed food remained stable between 44.2% and 45.5% from 2012 to 2020, before dropping to 36.9% in 2023. Conversely, the share of fresh products declined from 45.4% to 41.4% (2012–2018) but rebounded to 46.1% by 2023. Catering services saw an upward trend from 10.1% to 14.4% between 2012 and 2018, dipped to 12.4% in 2020 due to pandemic-related disruptions, and surged to 17.0% by 2023.

Figure 5 Food supply and demand structure by year





3.2.2 Household food demand

In terms of consumer food demand, processed foods maintain a dominant position, although the proportions of various categories exhibit fluctuations. Figure 5-Panel B, indicates that the demand share for processed foods peaked at 58.6% in 2015 before stabilizing between 53% and 54%. Conversely, the demand share for fresh products reached a minimum of 24.6% in 2015, followed by a gradual ascent to 32.0% by 2023. Notably, the demand for catering services peaked at 19.3% in 2018 but retracted to 15.8% in 2020, then rebounded to 22.3% in 2023.

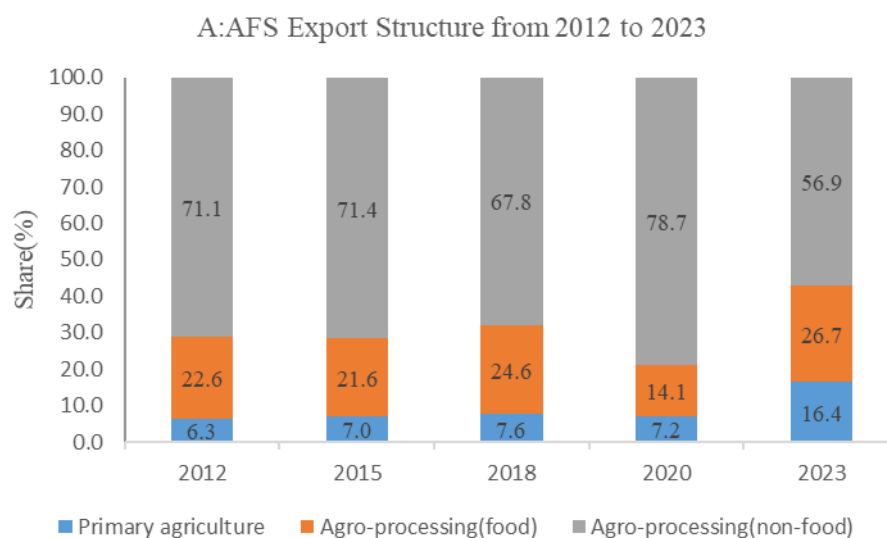
Comparative analysis highlights a significant structural mismatch between China’s food supply and demand: while fresh and processed foods hold nearly equal shares on the supply side, consumer demand for processed foods markedly exceeds that for fresh products. This discrepancy is driven by two primary factors. First, the upgrading of food supply chains has enhanced the standardization and supply efficiency of processed products, thereby encroaching upon the space for direct consumption of primary agricultural products and increasing the proportion of food entering processing channels. Second, a generational shift in consumption has positioned younger households as the primary consumer force; these cohorts exhibit a strong preference for time-saving, convenience-oriented, and “cooking-free” processed options (Liu & Begho, 2024).

3.3 Trade structure of the agrifood system

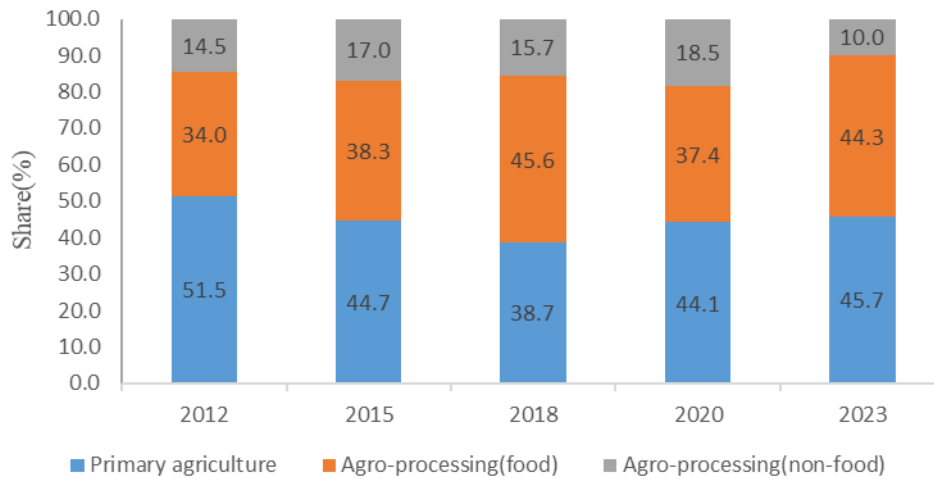
3.3.1 Exports

Figure 6 illustrates the international trade structure of the AFS for 2012, 2015, 2018, 2020, and 2023, categorized into primary agricultural products, processed foods, and nonfood processed products. This classification aligns with the previously discussed food production and demand structures but focuses specifically on trade dynamics. Regarding exports, nonfood processed products constitute the dominant share, though their proportion declined steadily from 71.1% in 2012 to 56.9% in 2023. Meanwhile, the export share of primary agricultural products rose from 4.4% to 10.4%. The share of processed food exports peaked at 20.8% in 2020 before receding to 17.0% in 2023. These changes profoundly reflect the development of China's agricultural trade. Since joining the WTO in 2001, China's agricultural opening has been at the forefront globally, and China is now among the countries with the lowest agricultural tariff levels and the highest degree of trade liberalization (Ye, 2020), leading to a rapid increase in primary agricultural exports. Concurrently, exports of labor-intensive agricultural products such as aquatic products, vegetables, and fruits have grown significantly (AGFEP, 2021), serving as a key factor driving the transformation of the export structure within the food system.

Figure 6 Trade structure of the agrifood system



B:AFS Import Structure from 2012 to 2023



3.3.2 Imports

In terms of imports, the shares of primary agricultural products, processed foods, and nonfood processed products are relatively balanced. The import share of primary agricultural products dropped from 51.5% to 38.7%, and then rose to 45.7% between 2012 and 2023. Conversely, the share of processed food imports rose from 34.0% to 44.3%, though it experienced a slight contraction to 37.4% in 2020. The import share of nonfood processed products initially increased to 18.5% before receding to 10.0%. This shift correlates with the supply-demand structure depicted in Figure 5, where imports of processed foods have increased to meet the rising food demand among Chinese residents. This indicates that domestically produced food in China—encompassing both primary and processed products—is largely consumed by its residents, while a certain volume of food imports remains necessary to satisfy demand.

This finding aligns with existing literature but uniquely highlights shifts in import composition. Specifically, the rising prominence of processed food imports likely reflects an increasing domestic demand for high-quality and diversified food options among Chinese consumers.

3.4 Economic structure of agricultural value chains

To assess the development characteristics of different agrifood value chains in China, this report disaggregates the 22 primary agricultural subsectors (based on the 2017 National

Industrial Classification) and traces each subsector through the five stages of the AFS. At the aggregate level, trade plays a relatively limited role in China’s AFS, with exports accounting for only a small share of output and imports accounting for a small share of domestic demand, indicating a largely self-sufficient agrifood structure. However, considerable heterogeneity exists across value chains. Some chains display export or import intensities that are substantially higher than the AFS average. Accordingly, value chains with export-to-output ratios above the AFS average (4.9%) are classified as “exportable”, whereas those with import-to-demand ratios above the average (5.5%) are classified as importable. All other chains are categorized as “less tradable.” Table 2 reports the GDP composition of each value chain and the trade ratios underlying this classification.

Table 2 Economic structure of agricultural value chains by trade orientation, 2023

	Share of GDP (%)			Exports/ output (%)	Imports/ Demand (%)
	AFS	Primary agriculture	Off-farm AFS		
Total				4.9	5.5
Exportable	42.9	39.9	45.4	8.9	4.2
Maize	11.5	7.0	15.2	9.3	5.7
Cane sugar	0.8	0.7	0.9	7.8	4.1
Beet sugar	0.1	0.0	0.1	8.5	4.2
Vegetable	17.8	19.4	16.5	8.5	3.1
Tobacco	1.7	1.2	2.1	9.8	4.4
Other crops	2.1	0.7	3.3	11.5	4.7
Fish	9.0	10.9	7.4	8.2	4.0
Importable	15.6	9.3	20.9	9.5	13.6
Other grains	0.8	0.3	1.1	13.3	15.6
Soybean	5.5	1.5	8.8	11.0	20.3
Cotton	1.7	1.1	2.2	8.5	8.3
Beef	1.6	1.2	1.9	7.5	17.4
Forestry	6.0	5.1	6.7	8.5	6.5
Less tradable	41.5	50.8	33.7	6.1	4.2
Rice	5.2	6.0	4.6	6.7	3.6
Wheat	3.6	3.1	3.9	7.2	5.5
Groundnut	1.4	1.7	1.1	5.8	3.0
Rape seed	1.5	2.1	1.0	5.5	2.7
Fruit	11.7	18.7	5.9	5.1	5.2
Pork	8.8	10.1	7.7	5.8	4.1
Mutton	2.3	3.5	1.4	5.1	4.2
Poultry	3.0	2.4	3.4	7.0	4.1

	Share of GDP (%)			Exports/ output (%)	Imports/ Demand (%)
	AFS	Primary agriculture	Off-farm AFS		
Eggs	2.4	1.7	3.0	6.7	3.2
Milk	1.6	1.6	1.6	6.3	3.2

Note: Each row in the table represents the GDP share and trade structure of an agricultural industry chain within the agrifood system (AFS). For example, the total GDP of all links in the corn industry chain accounts for 11.5% of the AFS GDP, with the GDP of the corn primary agriculture sector accounts for 7.0% of the primary sector's GDP in the AFS, and the GDP of other non-agricultural corn sectors accounts for 15.2% of the non-agricultural sector's GDP in the AFS. Considering both primary corn agricultural products and corn processed products, the export-output ratio of the corn industry chain is 8.9%, and the import-consumption ratio is 4.2%.

3.4.1 Export-oriented agricultural value chains

The export-oriented group comprises seven value chains: corn, sugarcane, sugar beet, vegetables, flue-cured tobacco, other crops, and fisheries. This group accounts for 42.9% of the total AFS GDP, with its primary agriculture and nonfarm sectors contributing 39.9% and 45.4% to their respective sectoral totals. The corn, vegetable, and fishery chains are the primary drivers, contributing 11.5%, 17.8%, and 9.0% of the aggregate AFS GDP, respectively. Notably, the corn value chain accounts for a substantial share within the nonfarm sector, aligning with its characteristics as a high-value-added product. Conversely, the vegetable and fishery chains maintain higher GDP shares in primary agriculture, reflecting China's large-scale production and the predominance of fresh consumption in these sectors.

3.4.2 Import-oriented agricultural value chains

The import-oriented group includes five value chains: other grains (sorghum, barley, millet, etc.), legumes (primarily soybeans), cotton, beef, and forestry. This group accounts for 15.6% of the total AFS GDP, while its primary agriculture and nonfarm sectors contribute 9.3% and 20.9% to their respective totals. The gap of about 11% between these two segments indicates that while raw materials are largely imported, processing and other nonfarm activities are conducted domestically. The export-to-output ratios for other grains and legumes (soybeans) are significantly higher than the national average (7.8%), suggesting a notable volume of processed exports. Within this group, legumes and forestry yield the highest GDP contribution, with total shares of 5.5% and 6.0%, respectively. Most chains in this group exhibit higher GDP shares in nonfarm sectors than in primary agriculture, consistent with an industry model centered on secondary processing and reproduction.

3.4.3 *Less-tradable agricultural value chains*

The less-tradable group encompasses 10 value chains, accounting for 41.5% of the total AFS GDP. Its primary agriculture and nonfarm sectors contribute 50.8% and 33.7% to their respective totals. The high GDP share of the primary agriculture sector underscores the large scale of domestic cultivation and breeding, as well as high domestic demand, indicating a high degree of self-sufficiency and industrial completeness in these chains. Within this group, rice (5.2%), fruits (11.7%), and pork (8.8%) represent the most significant shares, reflecting their status as mature industrial chains in China.

3.5 Summary

This study identifies three pivotal shifts within China's AFS: first, the COVID-19 pandemic exposed the vulnerability of contact-intensive catering—as consumption failed to rebound alongside supply—while simultaneously revealing the “reservoir” function of primary agriculture in absorbing displaced labor, a resilience echoing global trends where basic production secures social stability (Laborde et al., 2021). Second, a structural surge in processed food demand is being driven by an intergenerational shift toward convenience-oriented consumption among younger cohorts, which now serves as a primary catalyst for downstream modernization and supply chain refinement (Sheng et al., 2021). Finally, China's AFS trade is undergoing a qualitative transition, evidenced by the rising import share of processed foods relative to primary commodities, reflecting a macro-level shift from volume-based security to high-value, quality-driven consumption among the expanding middle-income population (Yang and Dong, 2019).

4 Structural Transformation of China’s Agrifood System and Its Driving Factors

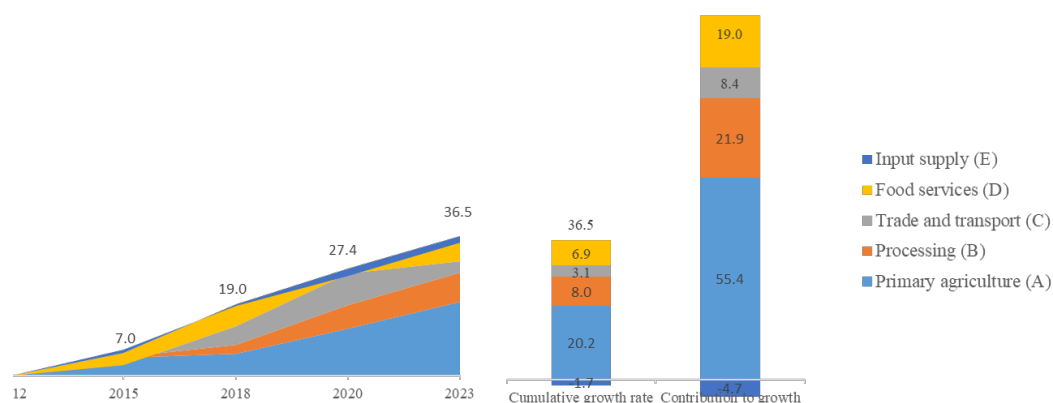
This section analyzes the growth structure of China’s AFS from the perspectives of GDP and labor productivity and identifies the drivers of AFS transformation through the lens of industrial chains segments.

4.1 GDP growth structure of the agrifood system

4.1.1 Growth dynamics across agrifood system segments

Figure 7 provides a structural decomposition of AFS GDP growth across five distinct sectors. Between 2012 and 2023, China’s AFS GDP grew by 36.5%. The area chart on the left illustrates the cumulative growth rates of each sector, revealing a general trend of rapid initial growth followed by a deceleration, with slight variations across specific sectors. For instance, the agro-processing sector followed a fast-slow-fast trajectory, while the primary agriculture sector maintained a consistent growth rate. The bar chart on the right summarizes the contribution rates of these five sectors to total AFS GDP growth. Aggregated data show that primary agriculture was the fastest-growing sector, with a growth magnitude of 20.2% and a contribution rate of 55.4%, highlighting its pivotal role as the strategic cornerstone of food security. Conversely, the input supply sector saw negative growth of -1.7% ; it exhibited significant growth until 2015, and shifted into negative growth after 2018.

Figure 7 GDP Growth Structure of the Agrifood System by Segment

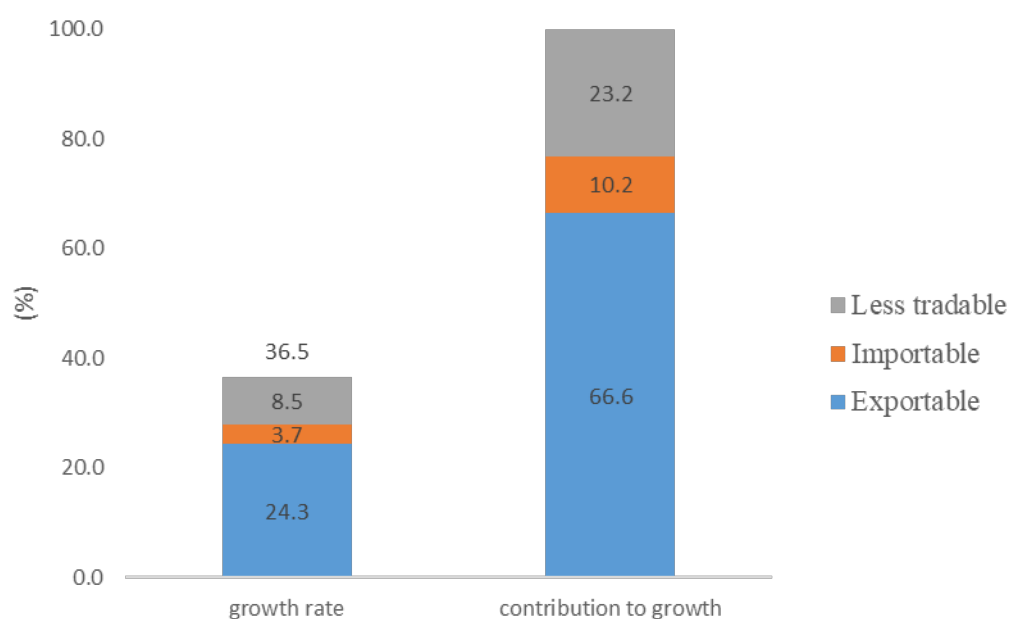


4.1.2 Growth patterns by trade-oriented industrial groups

Figure 8 presents the GDP growth rates of the industrial groups classified by trade

orientation (as defined in Chapter 3) between 2012 and 2023, and their contribution to total AFS GDP growth. Among the three industrial groups, the exportable group grew the fastest, with a growth rate of 24.3% and a contribution of 66.6%. This is primarily due to the continuous increase in China’s trade liberalization from 2012 to 2020 (Ye, 2020), which provided ample development space for agricultural industries with export advantages. Additionally, China’s rapidly developing transportation infrastructure has contributed significantly to the growth of these industries (Khan et al., 2025).

Figure 8 GDP growth structure of the agrifood system by industrial group



4.1.3 Growth patterns by trade-oriented industrial chain segments

Complementing Figures 7 and 8, Table 3 presents the GDP growth of 22 agricultural value chains from 2012 to 2023, expressed as compound annual growth rates (CAGR). Each value chain encompasses primary agriculture, nonfarm AFS sectors, and other related segments.

The export-oriented group averaged 3.9% growth in primary agriculture; notably, vegetables maintained a high growth rate of 5.7%, while sugar beets contracted by –2.8%. In agro-processing, the export group averaged 5.8%, with vegetables and other crops exceeding 12%, though sugarcane processing shrank by –2.3%. Trade and transport grew by an average of 6.3%, with vegetables and other crops both exceeding 13%, reflecting their high logistical dependence. Catering services led with a 10.1% average growth, spearheaded by vegetables

(22.8%) and other crops (16.9%). Conversely, input supply growth decreased by 1.7%, with vegetables showing a -2.6% decline, likely as a result of fertilizer and pesticide reduction policies. Overall, export-oriented products show robust growth in circulation and consumption but remain weak in inputs, necessitating technical and capital investments to bridge these gaps.

The import-oriented group grew by an average of 1.2% in primary agriculture; legumes and forestry saw positive growth of 4.9% and 4.1%, respectively, while cotton experienced a significant contraction of -8.0%. Agro-processing averaged 2.7% growth, with moderate gains in beef and legumes, while cotton processing declined by -8.9% annually. Trade and transport averaged 1.8%, with other grains, legumes, and forestry all exceeding 3%, highlighting a heavy reliance on circulation. Catering services recorded the highest average growth at 6.8%, while cotton remained negative across all segments. Input supply showed near-zero growth, with negative values for cotton, legumes, and beef, reflecting a lack of momentum in upstream sectors like machinery and materials. This suggests that while import-dependent products remain vibrant in circulation, their growth in processing and consumption is slowing. The persistent decline across the cotton value chain may be linked to national food security policy prioritizations.

The less-tradable group averaged approximately 3.1% growth in primary agriculture. Peanuts, rapeseed, fruits, mutton, and poultry all maintained growth above 3%, whereas rice, wheat, pork, eggs, and milk grew more slowly. The average rate of decline rate of agro-processing in this group was 0.6%; while wheat, and some livestock products remained positive, rice, peanuts, rapeseed, and fruits saw negative growth ranging from -2.1% to -5.4%. Trade and transport averaged -0.4% growth. Catering services averaged 2.9% growth, led by poultry (nearly 6.5%). Input supply overall contracted by -2.9%, with significant declines in peanuts, pork, and mutton. These results indicate that less-tradable products perform best in primary production and catering but face stark divergence in processing and inputs, with varieties like peanuts and rapeseed facing pressures from high costs and insufficient value chain integration.

Table 3 Average annual GDP growth rate of China's agricultural value chains, 2012–2023

	Average annual GDP growth rate (%)						
	Total AFS	Primary agriculture	Off-farm AFS				
			Total	Agro-processing	Trade and transport	Food service	Input supply
Total	2.7	3.2	2.3	2.1	2.5	6.7	-2.3
Exportable	4.8	3.9	5.5	5.8	6.3	10.1	-1.7
Maize	3.9	1.9	4.9	4.9	4.9	8.2	-0.2
Cane sugar	-0.8	-0.3	-1.1	-2.3	-1.9	2.8	0.9
Beet sugar	-0.8	-2.8	-0.2	-0.9	-0.6	3.4	-0.3
Vegetable	6.9	5.7	8.3	12.1	13.1	22.8	-2.6
Tobacco	4.3	0.3	7.1	7.2	7.4	11.4	-0.8
Other crops	8.0	-2.2	12.1	13.3	13.3	16.9	-0.6
Fish	2.7	3.8	1.5	-1.5	0.8	5.6	0.1
Importable	1.8	1.2	2.0	1.4	1.8	6.8	-1.9
Other grains	9.6	1.9	12.8	13.3	13.3	16.0	2.1
Soybean	4.4	4.9	4.3	3.1	3.9	10.5	-4.0
Cotton	-7.8	-8.0	-7.7	-8.9	-8.7	-4.2	-3.5
Beef	2.4	2.0	2.6	2.3	2.5	4.8	-4.4
Forestry	4.9	4.1	5.5	5.8	5.7	8.9	0.4
Less tradable	1.4	3.1	-0.4	-0.6	-0.4	2.9	-2.9
Rice	-0.7	0.4	-1.9	-2.2	-2.2	0.9	-2.3
Wheat	1.2	0.6	1.7	1.8	1.8	4.9	-1.2
Groundnut	-0.2	4.0	-4.0	-5.4	-4.5	2.3	-6.9
Rape seed	1.3	2.9	-1.2	-2.1	-1.6	4.0	-3.5
Fruit	3.0	8.0	-3.8	-5.0	-4.7	0.1	-3.0
Pork	-0.3	-0.3	-0.2	-0.5	-0.3	1.9	-5.5
Mutton	2.9	3.0	2.6	2.3	2.5	4.8	-4.7
Poultry	4.3	4.3	4.2	4.0	4.2	6.5	-1.5
Eggs	2.5	2.3	2.7	2.5	2.6	4.9	-2.8
Milk	3.0	2.7	3.3	3.0	3.2	5.5	-2.4

Note: Values represent the average annual GDP growth rate of each value chain (group) in each corresponding segment. For example, the maize value chain grew at an annual rate of 3.9% across all segments of the agrifood system (AFS) from 2012 to 2023, including 1.9% in primary agriculture and 4.9% in off-farm AFS, with 4.9% in the processing segment.

4.2 Growth structure of labor productivity across agrifood system sectors

The analysis of labor productivity growth follows McMillan, Rodrik, and Verduzco-Gallo (2017). Labor productivity improvements typically occur through two channels: (1) “within-sector” productivity growth, and (2) “between-sector” (or “structural change”) labor reallocation, where labor moves from lower-productivity to higher-productivity sectors, which are the components of labor productivity growth. The core formula is:

$$\Delta P_t = \sum_{i=1}^n \theta_{i,t} \Delta P_{i,t} + \sum_{i=1}^n P_{i,t} \Delta \theta_{i,t}$$

where P_t and $P_{i,t}$ denote economywide and sector-specific labor productivity at time t ; $\theta_{i,t}$ is the employment share of sector i , Δ denotes changes between $t-k$ and t . The first term captures within-sector technical or efficiency changes; the second captures between-sector effects arising from labor reallocation. When employment shifts toward higher-productivity sectors, this term is positive.

Figure 9 presents the average annual labor productivity growth rates for 2012 – 2023, with 2015, 2018, and 2020 included as intermediate nodes to observe changes across subperiods. Labor productivity grew by an annual average of 6.24% between 2012 and 2023, with 5.19% in 2012 – 2015, 7.92% in 2015 – 2018, 2.89% in 2018 – 2020, and 7.91% in 2020 – 2023.

4.2.1 *Within-sector component*

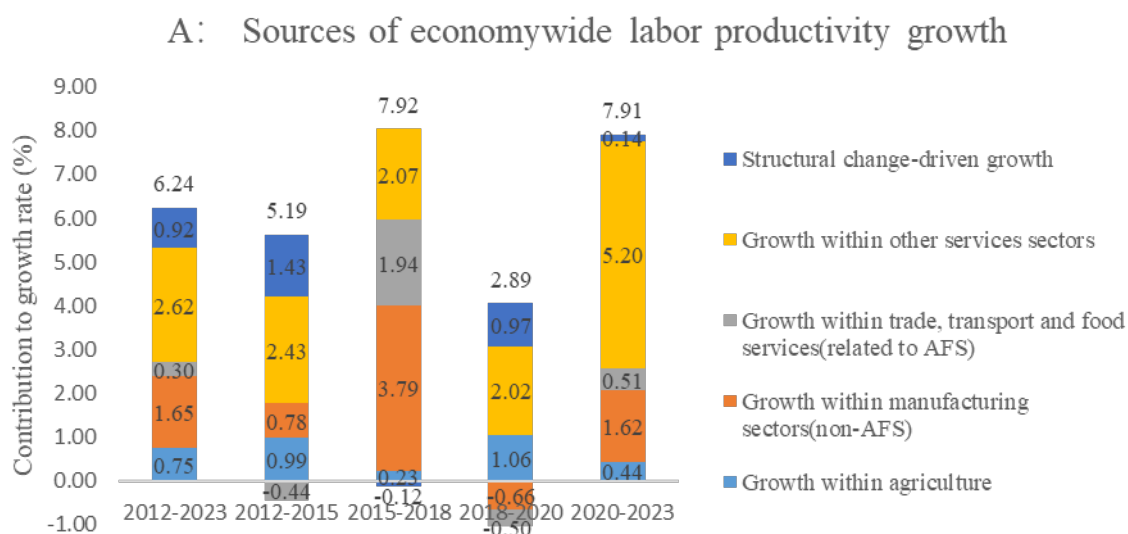
Both Panels A and B of Figure 9 divide the aggregate Chinese economy into intrasectoral and intersectoral components, though they offer differing interpretations of labor productivity growth due to their distinct categorization methods. In Panel A, intrasectoral encompasses four subsectors: agriculture, manufacturing, trade/transport/catering, and other services. Among these, manufacturing and other services exhibited faster productivity growth than other sectors. Specifically, other services showed stable and accelerating growth, while manufacturing experienced an explosive surge between 2015 and 2018, with a growth magnitude of 3.79%. Excluding the 2015–2018 period, primary agriculture maintained a relatively stable growth rate of approximately 1.0%. In contrast, trade, transport, and catering services encountered negative growth during 2018–2020, coinciding with a significant slowdown in manufacturing, likely as a result of the COVID-19 shock. In the 2020–2023 period, productivity growth was most prominent in the service sector.

In Panel B, the intrasectoral component is narrowed down to three subsectors: primary agriculture, nonfarm AFS sectors, and other sectors. Labor productivity in non-AFS sectors outpaced the rest, peaking at a growth rate of 6.19% during 2020–2023. While primary agriculture mirrored the trends in Panel A, the nonfarm AFS sector saw accelerating growth until peaking at 1.62% in 2015–2018, then decelerating to 0.20% during the 2018–2020 pandemic period, and rebounding to 0.83% by 2020–2023.

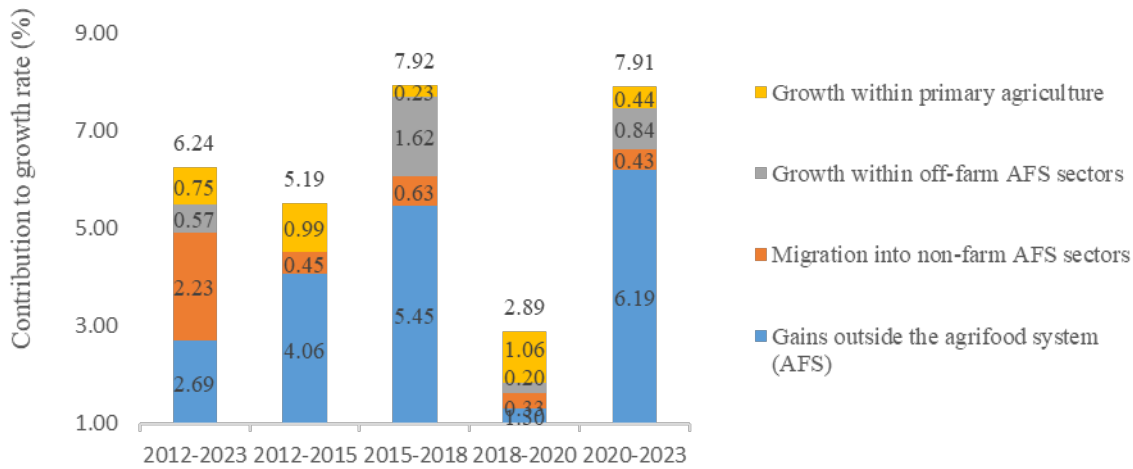
4.2.2 Between-sector component

In Panel A of Figure 9, intersectoral dynamics explain the structural growth of aggregate labor productivity. This structural growth peaked at 1.43% during 2012–2015 but turned negative (–0.12%) in 2015–2018. Coupled with the intrasectoral findings, this suggests that the explosive productivity gains in 2015–2018 were driven not by large-scale labor reallocation, but rather by efficiency improvements stemming from technological progress or institutional reforms within sectors. In Panel B, intersectoral dynamics represent productivity gains specifically induced by labor migration within the AFS. This growth rate has remained stable at around 0.5%. A comparison between the intersectoral trends in Panels A and B indicates that structural labor shifts within the AFS serve as the core driver of the structural productivity growth observed in the aggregate economy.

Figure 9 Structure of labor productivity growth in China, 2012 - 2023



B: Contribution of agrifood system



4.3 Summary

In conclusion, the development of China’s AFS from 2012 to 2023 is characterized by three pivotal dynamics. First, AFS GDP growth was primarily anchored by the primary agriculture sector—a strategic stabilizer for food security—while simultaneously transitioning from a factor-input-driven model to a green-efficiency-oriented model following the implementation of fertilizer and pesticide reduction policies. Second, the system exhibits significant industrial heterogeneity: while downstream catering services saw robust expansion across all value chains, structural bottlenecks persist due to a “strong middle, weak ends” pattern, where upstream input efficiency and midstream processing capabilities lag behind vibrant consumption demand. Finally, aggregate labor productivity growth was predominantly fueled by intrasectoral technological innovation rather than large-scale reallocation; nonetheless, the internal migration of labor from primary agriculture to nonfarm sectors remains the core driver of structural dividends. This confirms that while the pace of labor transfer has moderated, the AFS continues to play a fundamental role in optimizing national resource allocation and driving China’s dual-economy transition.

5 Assessing Growth Outcomes Using CAFSAM Model

As a globally significant agricultural producer, China's AFS serves not only as the fundamental cornerstone for ensuring national food security and meeting dietary requirements but also as a vital pillar of the national economy. The structural transformation of this system—facilitated by the profound optimization and upgrading of all segments along the agricultural value chain—provides critical support for achieving core economic objectives, including high-quality development, common prosperity, and the green transition.

From a social development perspective, the AFS functions as a unique “employment reservoir,” providing stable livelihoods for a vast population, including smallholder farmers, agro-processing workers, and related service practitioners. Consequently, advancing the AFS toward a more inclusive, efficient, and resilient value chain has become a strategic lever for empowering key workforces and driving sustainable poverty reduction.

5.1 Contribution of agricultural value chains to China's development outcomes

Development economics posits that the advancement and structural evolution of the agriculture sector constitute a pivotal mechanism for achieving overall economic structural transformation (Goddard et al., 1993). To quantitatively analyze this mechanism, this report employs the CAFSAM model to estimate the stimulative effects of various Chinese agricultural value chains on diverse economic outcomes under a growth scenario driven by total factor productivity (TFP). As a holistic measure of aggregate productivity, TFP reflects the integrated efficiency of all production factors—including labor, capital, and technology—within an economic system. Consequently, TFP is influenced by a multitude of factors, such as the introduction of new technologies (Li, 2016) and institutional changes (Yan & Wang, 2004). By selecting TFP growth as the exogenous shock in this report, it serves as an intermediary variable to elucidate the potential impacts of multidimensional factor variations on the AFS.

This report utilizes China's 2020 SAM for simulation analysis, integrated with micro-data from the 2019 China Household Finance Survey (CHFS) to ensure maximum temporal consistency across both macro and micro dimensions. The selection of the 2019 micro-sample is justified by two primary considerations: first, data accessibility, as CHFS datasets for 2021 and 2023 have not yet been publicly released; second, data robustness, as the full-scale outbreak

of COVID-19 in 2020 introduced significant outliers into micro-survey data from subsequent years, which could potentially compromise the precision and validity of the simulation results.

Under the RIAPA microsimulation module, the SAM is further disaggregated by household types and labor structures. By adopting the top-down approach proposed by Debowicz (2012), this report links the macro-level model with a microsimulation module. This integrated structure allows for a comprehensive assessment of how agricultural TFP growth influences diverse economic development outcomes. Drawing upon the *FAO Strategic Framework 2022–31*,¹ this report analyzes the potential influence of all agricultural value chains across key developmental dimensions:

- 1) *Contribution to economic growth*: defined as the growth multiplier, measuring the change in total GDP induced by a one-unit change in the GDP of a specific agricultural value chain.
- 2) *Contribution to employment*: defined as the employment multiplier, measuring the change in total employment associated with a one-unit change in value chain GDP.
- 3) *Contribution to poverty reduction*: defined as the poverty-growth elasticity, measuring the percentage change in national poverty associated with a 1% change in value chain GDP.

The simulations raise TFP exogenously for each targeted value chain and compare the resulting development outcomes. Although the productivity shock is applied only to the primary agricultural segment of a given chain, spillover effects emerge in downstream non-agricultural components as well as in other agricultural value chains outside the AFS. The RIAPA model captures these spillovers and reveals how productivity growth reverberates through AFS and the broader economy. Structural differences also exist across value chains: some operate as suppliers or consumers of intermediate inputs, while others have differentiated links to urban or rural households owing to distinct consumption patterns.

Accordingly, we expect heterogeneous impacts across value chains. Some value chains may generate negative or limited effects; in certain cases, trade-offs may arise due to cross-chain competition for resources. RIAPA helps disentangle these complex interactions and thus

¹ FAO, *Strategic Framework 2022–31*, <http://www.fao.org/3/ne577zh/ne577zh.pdf>

informs policymakers or social organizations in prioritizing value chains according to their preferred development outcomes.

Figure 10 Potential impact of the agricultural industry chain on development outcomes

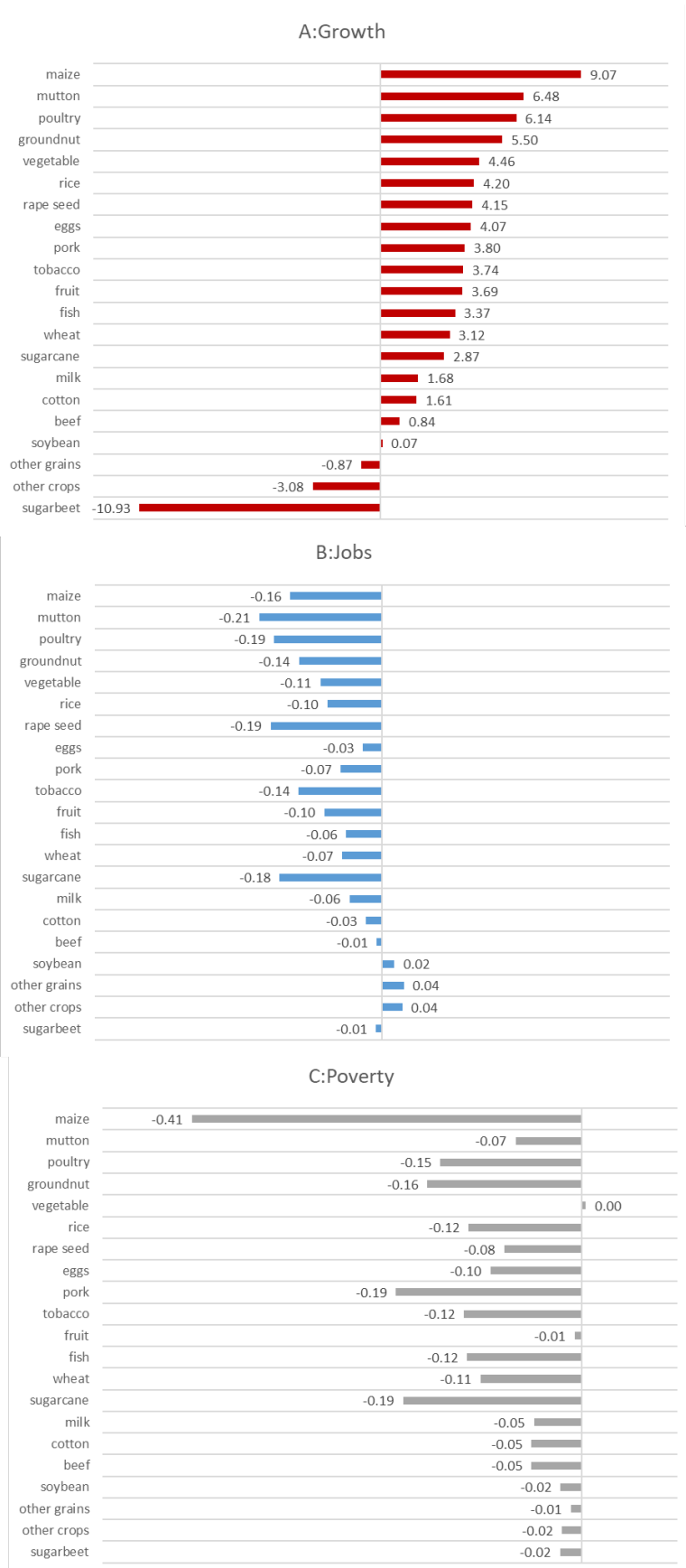


Figure 10 presents the scores of each value chain on the three development indicators. Panel A shows GDP responses (in RMB 100 million) when the agricultural GDP of the targeted chain increases by RMB 100 million; Panel B reports changes in total employment (10,000 persons) under the same GDP increase; and Panel C shows changes in the national poverty rate when the agricultural GDP of the targeted chain increases by 1%. Growth and employment effects are produced from the SAM macro module, while poverty effects are derived from the micro-simulation module, which maps households across income groups and rural-urban categories to the model's household groups.

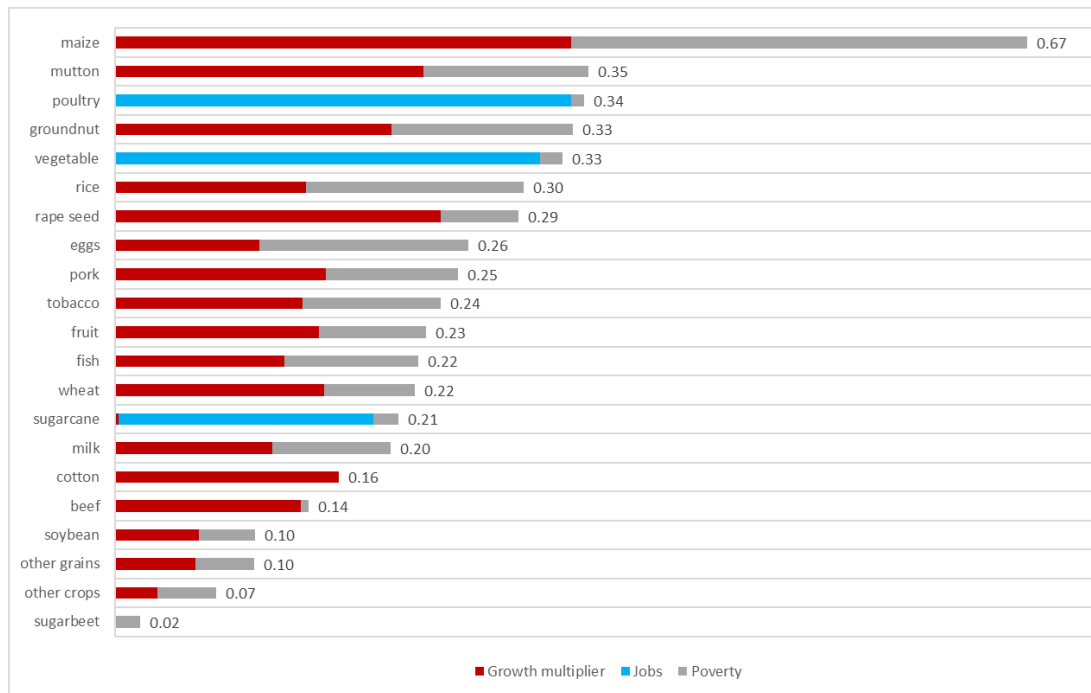
Figure 10 is ordered by contribution to aggregate economic growth. For example, for the maize value chain, the growth and employment scores are 9.07 and -0.16 , respectively. This implies that an increase of RMB 100 million in maize GDP stimulates an additional RMB 907 million in total GDP while reducing employment by approximately 1,600 persons. In addition, a 1% increase in maize GDP reduces the national poverty rate by 0.41 percentage points.

To facilitate clear comparison, this report constructs a composite scoring index across development indicators. Since each indicator has different units, scores are standardized to ensure comparability while retaining rankings within their category. The most effective value chain receives a score of 1 and the least effective a score of 0. If a value chain yields a negative poverty effect, a negative or zero employment effect, or a growth multiplier below 1, its score for that indicator is set to 0. Other standardized values fall between 0 and 1, proportional to the original scores. These standardized scores are then aggregated into a composite score for each chain.

In computing composite scores, this report assigns equal weights to economic growth, employment, and poverty reduction. In practice, policymakers may prioritize certain indicators. For example, during China's 2012 – 2020 poverty-eradication campaign, poverty reduction may have been weighted more heavily than growth or employment.

Figure 11 shows composite scores under equal weighting, with each bar indicating the relative contribution of each indicator. Consistent with Figure 10, the maize value chain ranks highest, driven by its strong contributions to GDP growth and poverty reduction.

Figure 11 Composite scores of value chains under equal weights



5.2 Potential impacts on non-agricultural sectors within the agrifood system

Non-agricultural sectors within the AFS are closely linked to primary agriculture and constitute major transmission channels through which agriculture affects macroeconomic outcomes. This section therefore evaluates how primary agricultural sectors influence non-agricultural AFS sectors under counterfactual scenarios, focusing on downstream output dynamics, employment changes, and the skill bias of job creation. The results reveal highly heterogeneous multiplier effects driven by upstream productivity growth, along with substantial structural reallocation of labor along the value chain. Owing to space limitations, only selected simulation results are reported.

5.2.1 Relative changes in GDP of non-agricultural agrifood system sectors

Table 4 reports percentage changes in non-agricultural AFS GDP under scenarios where the GDP of an agriculture subsector increases by 1%. In Scenario 1, driven by higher TFP in rice production, a 1% increase in rice sector GDP expands GDP in grain milling by 0.6%. The indicator reflects output elasticities along agricultural value chains.

Table 4 Changes in GDP of non-agricultural AFS sectors (%)

Primary agriculture Off-farm AFS	Rice	Maize	Soybean	Fruit	Vegetable	Pork	Fish
	SIM1	SIM2	SIM3	SIM4	SIM5	SIM6	SIM7
Grain milling products	0.6	1.5	0.0	0.2	0.2	0.2	0.1
Feed products	0.1	1.0	0.0	0.2	0.4	0.7	0.5
Vegetable oil products	0.1	0.3	0.1	0.3	0.3	0.2	0.1
Sugar and sugar products	0.2	0.6	0.0	0.6	0.5	0.3	0.2
Meat products	0.1	0.7	0.0	0.1	0.3	1.1	0.1
Aquatic products processing	0.3	1.2	0.0	0.3	0.6	0.3	3.9
Other agricultural by-products processing	0.2	0.4	0.0	1.8	0.2	0.1	0.1
Convenience foods	0.1	0.3	0.0	0.1	0.1	0.0	0.0
Dairy products	0.1	0.5	0.0	0.1	0.2	0.8	0.1
Fermented products	0.2	0.6	0.0	0.6	1.1	0.2	0.2
Other foods	0.1	0.4	0.0	0.3	0.5	0.2	0.1
Alcohol and liquor	0.2	1.4	0.0	0.1	0.2	0.1	0.1
Beverages	0.0	0.0	0.0	0.1	0.2	0.0	0.0
Refined tea	0.1	0.1	0.0	0.1	0.1	0.0	0.0
Tobacco products	0.1	0.1	0.0	0.1	0.1	0.1	0.1
Textiles	0.5	1.2	0.1	0.5	0.8	0.5	0.3
Wood processing	0.2	0.4	0.0	0.2	0.3	0.1	0.1
Food services	0.0	0.1	0.0	0.0	0.1	0.0	0.1

The results show pronounced heterogeneity. The largest multiplier occurs in the fishery value chain: a 1% increase in fishery GDP raises GDP in aquatic product processing by 3.9%. This exceptionally high elasticity reflects the sector's strong dependence on upstream raw material supply. Improvements in fishery TFP reduce harvesting or farming costs and boost raw material availability; given the perishability and strict quality requirements of aquatic products, upstream efficiency directly and significantly stimulates downstream processing expansion.

Horticultural value chains also show strong spillover effects. A 1% increase in vegetable GDP raises output in “vegetable, fruit, nut, and other agricultural by-product processing” by 1.8%. High-value horticulture demands sophisticated packaging, preservation, and deep processing to meet shifting consumer preferences, particularly in rapidly urbanizing contexts where demand is rising for diversified and ready-to-eat food. Efficiency improvements in

primary production thus unlock downstream value-added potential (Barrett et al., 2019).

Among major staples, the maize value chain exhibits strong scale effects. A 1% GDP increase in maize stimulates 1.5% growth in grain milling and 1.0% growth in feed processing, reflecting the central role of maize as a raw material in feed, starch, and deep-processing industries. Upstream productivity improvement significantly enhances GDP in livestock-related value chains.

5.2.2 Changes in employment

Table 5 reports changes in total employment in non-agricultural processing sectors under counterfactual scenarios. The indicator measures the number of jobs created (10,000 persons) in AFS processing sectors per RMB 100 million increase in agricultural GDP. For example, a RMB 100 million GDP increase in the rice value chain generates 500 low-skilled and 300 high-skilled jobs in AFS processing industries.

Table 5 Changes in employment in non-agricultural agrifood system processing sectors (10,000 persons)

Employments of off-farm AFS Primary agriculture	Low-skilled jobs	High-skilled jobs
	Rice	0.05
Maize	0.17	0.07
Soybean	-0.02	-0.03
Fruit	0.04	0.02
Vegetable	0.04	0.02
Pork	0.05	0.03
Fish	0.04	0.02

Overall, TFP growth in most primary agriculture subsectors yields net positive employment creation in downstream processing. The maize value chain is the largest contributor, generating 2,400 new jobs per RMB 100 million GDP increase (1,700 low-skilled and 700 high-skilled). Rice, vegetables, fruits, and fisheries also show strong employment effects (600–700 jobs per RMB 100 million), supporting the structural transformation narrative

in which labor moves from low-productivity primary agriculture to higher-productivity downstream processing and service segments (Yi et al., 2025).

Regarding skill composition, low-skilled job creation exceeds high-skilled job creation in most chains. For maize, the low-skill to high-skill job ratio reaches 2.43:1, indicating that downstream expansion—logistics, sorting, packaging, basic processing—remains labor-intensive in the short term. This absorption of low-skilled workers plays a key role in mitigating labor displacement caused by productivity gains in primary agriculture.

The pork value chain, in contrast, shows a relatively higher share of high-skilled job creation (ratio 1.67:1), reflecting greater technological intensity in modern meat processing, including automated slaughtering lines, quality control, and cold-chain logistics.

An exception arises in the soybean value chain, in which TFP growth leads to net employment losses (−0.05 jobs per RMB 100 million), with greater losses in high-skilled positions. As soybeans are deeply embedded in global value chains and exposed to intense international competition, domestic productivity gains may not offset pressures from global automation or import competition. Literature suggests that global value chains exert heterogeneous labor-market impacts, and in highly globalized sectors, technological upgrading may coincide with employment reduction (Lim, 2021; Carneiro et al., 2024).

5.3 Summary

This section quantitatively evaluates the macroeconomic effects of structural transformation in China’s agricultural value chains driven by TFP growth, focusing on economic growth, employment, and poverty reduction, supplemented by analyses of non-agricultural AFS GDP and employment. Key findings include:

Trade-offs among growth, employment, and poverty reduction: Agricultural value chains exhibit heterogeneous impacts. Although the maize chain drives the highest growth and poverty reduction, TFP improvement in maize results in net employment losses. This illustrates that efficiency gains in primary agriculture may displace labor, requiring policymakers to balance productivity improvements with employment stability.

Heterogeneous output multipliers: Productivity growth in primary agriculture triggers strong but uneven downstream GDP effects. The fishery chain yields the highest elasticity,

followed by vegetables, revealing high value-added potential under urbanizing food demand.

A new narrative of structural transformation: Most agricultural value chains generate net positive employment in downstream processing, supporting labor reallocation toward higher-productivity segments. The maize chain is the strongest performer, adding 2,400 jobs per RMB 100 million in additional GDP.

Low-skill job creation as a social buffer: In most chains, low-skilled job creation far exceeds high-skilled job creation. This labor-absorbing capacity of downstream expansion serves as an important mechanism to cushion labor released from primary agriculture due to productivity gains.

6 Conclusions and Policy Implications

China's AFS achieved a high-efficiency transformation between 2012 and 2023, contributing significantly to national economic development and global food security. Based on the analytical findings of this report, the following major conclusions and corresponding policy implications are drawn.

6.1 Main conclusions: Structural divergence and trade-offs of transformation

The structural transformation of China's AFS is characterized by a core duality: a shrinking GDP share coupled with rising productivity. Although the AFS's relative weight in the national economy has declined, its labor productivity growth slightly outpaced aggregate economic growth, reflecting the outcomes of de-laboring and efficiency enhancement as labor shifted from low-efficiency to high-efficiency sectors. The primary drivers of AFS GDP growth are the export-oriented industrial groups and the consistent output from primary agriculture. Nevertheless, the transformation faces three critical challenges and trade-offs:

(1) *Structural weaknesses are evident at both ends of the value chain.* Significant bottlenecks exist at both the upstream and downstream ends of the value chain. The upstream input supply sector has seen widespread negative growth due to efficiency constraints and the "Double Reduction" policy for fertilizers and pesticides. Meanwhile, downstream catering services were severely impacted by the COVID-19 pandemic. Within midstream processing, growth is polarized; processing for key varieties (e.g., peanuts and fruits) has contracted. This reflects a structural contradiction of strong circulation in the middle, weak supply and services at the ends.

(2) *Demand upgrading is reshaping the system.* Consumption patterns have shifted from a focus on quantity to quality and convenience, with consumer demand for processed foods far exceeding that for fresh products. This demand surge, combined with the insufficient competitiveness of domestic processing, has led to a significant rise in the share of processed food imports, intensifying competitive pressure on the domestic industry.

(3) *A complex trade-off occurs between efficiency gains and employment stability.* Simulation results reveal a macro-level trade-off between TFP and labor demand. While TFP-driven agricultural growth strongly promotes economic expansion and poverty alleviation (with

the corn value chain showing the highest poverty reduction elasticity), it simultaneously causes net job losses at the macro level. For instance, every 100 million RMB increase in GDP within the corn value chain corresponds to a reduction in labor demand of approximately 1,600 people. This indicates that the labor-substitution effect triggered by agricultural modernization must be buffered by the employment absorption capacity of downstream sectors.

6.2 Policy implications: Balancing development objectives and structural optimization

In light of the above challenges and trade-offs, future AFS policymaking should prioritize addressing weaknesses, promoting upgrading, and stabilizing employment, thereby fostering coordinated progress in efficiency, resilience, and social stability.

(1) *Implement a supply-side strategy of green technological substitution.* In response to the negative growth in the input supply sector, policy focus should shift from merely reducing input volumes to enhancing input quality. By increasing investment in green technology, biotechnology, and intelligent agricultural machinery, China can achieve high-quality substitution of agricultural inputs. This will consolidate the efficiency gains of primary agriculture while ensuring environmental sustainability.

(2) *Accelerate fine-grained upgrading of midstream processing industries.* It is essential to leverage financial and technical support to drive the domestic agro-processing industry toward standardization, refinement, and branding. This transformation is necessary to effectively meet the rising domestic demand for high-quality processed foods. Priority should be given to supporting processing segments with high output-driven elasticity, while targeted measures should be implemented to reverse the decline in specific crop processing sectors and bolster their market competitiveness.

(3) *Establish structural mechanisms to buffer employment shocks.* To mitigate the labor-substitution risks triggered by TFP growth, policy must treat labor-intensive segments in downstream nonfarm sectors—such as logistics, packaging, and primary processing—as strategic anchors for social stability. Priority should be given to value chains with a strong capacity for absorbing low-skilled labor. Additionally, scaling up vocational training for the rural workforce is crucial to ensuring that displaced agricultural labor can smoothly transition

into relatively higher-productivity downstream segments, thereby achieving synchronized structural transformation and inclusive social growth.

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Appendix

The China Agrifood System Assessment Model (CAFSAM) used in this report was developed on the basis of the Rural Investment and Policy Analysis (RIAPA) model of the

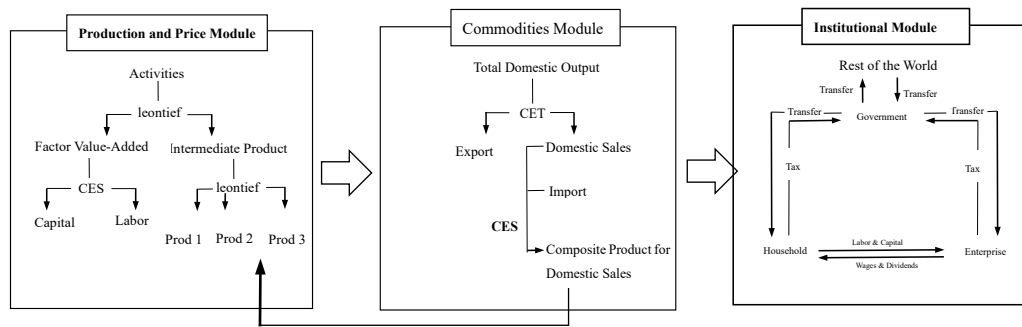
International Food Policy Research Institute (IFPRI), and incorporates China’s agricultural production and consumption characteristics. It constitutes a comprehensive analytical framework for examining China’s agrifood system (AFS). The model describes the market behavior and supply and demand relationships of producers and consumers for all commodities in China (including agricultural and non-agricultural products), and reflects the interactions among producers, processors, and consumers. It captures the complex interconnections and mutual influences among production, consumption, and trade involving agricultural and non-agricultural products, including competitive and complementary relationships across commodities, as well as upstream – downstream linkages within value chains. The model focuses on food system – related industries, covering 39 agricultural and processed products such as rice, wheat, maize, other grains, soybeans, peanuts, and rapeseed (Table A-1). It also includes nonfood agricultural and processed products—such as cotton, tobacco, forestry, and textiles—to enable measurement of the broad AFS (including both food and nonfood sectors).

Table A-1 Categories of agricultural products and processed goods covered in the model

Category(Count)	Commodities
Crops (14)	Rice, wheat, maize, other grains, soybeans, peanuts, rapeseed, cotton, sugarcane, sugar beet, fruits, vegetables, tobacco, other crops
Livestock (6)	Pork, beef, mutton, poultry, eggs, dairy
Aquatic products (1)	Fisheries
Forestry products (1)	Forestry
Processed goods (17)	Grain milling products, feed products, vegetable oil products, sugar and sugar products, meat products, aquatic products processing, other agricultural by-products processing, convenience foods, dairy products, fermented products, other foods, alcohol and liquor, beverages, refined tea, tobacco products, textiles, wood processing, and educational supplies

The model used in this report consists of four major components: the production and price module, the commodity module, the institutional (agent) module, and the macroeconomic closure module. The overall structure is illustrated in Figure A-1.

Figure A-1 Model structure diagram

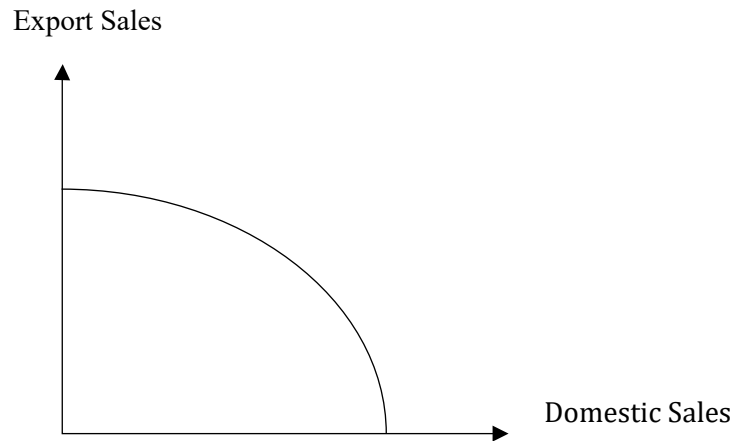


The production and price module describes production activities composed of value added generated by primary production factors and the use of intermediate inputs, together with the corresponding prices of these factors and inputs. The model includes 88 production subsectors grouped into three major industries: (1) agriculture, forestry, animal husbandry, and fisheries, comprising 23 subsectors covering all agricultural branches and related services; (2) industry, comprising 41 subsectors that span manufacturing, mining, construction, and related activities; and (3) services, with 24 subsectors including transportation, warehousing, finance, food services, and others. Production in each subsector involves both intermediate inputs and factor inputs; the two are not substitutable. Intermediate inputs consist of multiple commodities, while factor inputs include labor and capital, and land is added as an additional factor for agriculture. To represent multi-factor production, the model uses a nested production-function structure. At the first level, a Leontief function governs the combination of intermediate inputs and primary factors. At the second level, the model specifies two functions: one that allows substitution among production factors and another that describes complementarity among multiple intermediate inputs.

The commodities module describes how domestically produced goods are allocated between domestic demand and exports, and how domestic and imported goods are jointly selected by households and the government. In the first process, producers maximize profits by allocating output between domestic and export markets according to the relative levels of domestic and international prices, a relationship analogous to a production possibility frontier and represented using a constant elasticity of transformation (CET) function. In the second process, consumers maximize utility by choosing between domestically produced and imported varieties of the same commodity, which are assumed to be imperfect substitutes. This

relationship is modeled using a CET function, based on the well-known Armington assumption. In addition, the model applies the small-country assumption in the trade domain, meaning that China's imports and exports do not affect international market prices.

Figure A-2 Relationship between domestic sales and export sales



The institutional module defines the income-and-expenditure behaviors of the main economic agents, including households, firms, the government, and the rest of the world. Households are divided into urban and rural groups; their income comes primarily from labor remuneration and partially from domestic and foreign transfers, and their expenditures include consumption of market goods and the payment of taxes. Firms receive income mainly from capital earnings and allocate expenditures to taxes and transfers. Government revenues derive from taxes on households and firms and from import and export tariffs, while government expenditures include the purchase of goods and various transfer payments. The rest of the world is modeled as an aggregated foreign sector whose activities include trade, foreign savings, and cross-border transfers.

The macro-closure module is essential for ensuring that the model reaches a feasible solution, consisting of a set of macroeconomic constraints that are specified on the basis of the research questions and the structure of the economy. In general, computable general equilibrium (CGE) models include equilibrium conditions for commodity markets, factor markets, savings-investment balances, government budgets, and balance of payments. In commodity markets, equilibrium requires total supply to equal total demand, where demand includes household and government consumption, intermediate input use, fixed investment, changes in inventories, and

trade-related demand. Market equilibrium is achieved through endogenous adjustments in domestic – international price relationships and production-side relative prices, which in turn influence the incomes and consumption patterns of economic agents. Factor-market equilibrium involves balancing the total demand for labor and capital across sectors with the fixed total supply of each factor. The model assumes full employment in the labor market, with labor supply exogenously given and wages adjusting endogenously to clear the market. In the capital market, sectoral capital stocks are assumed fixed, and capital returns adjust to equilibrate capital supply and demand.

While commodity- and factor-market equilibria are common across CGE models, the macro-closure rules governing government budgets, the balance of payments, and savings-investment balances must be specified in accordance with economic theory and national conditions. In this study, three assumptions are made to reflect China’s current institutional context. First, government expenditure and tax rates are held constant, and government savings adjust endogenously to maintain fiscal balance. Second, the exchange rate is assumed to be flexible, foreign savings are set exogenously, and the total supply of composite goods, together with foreign factor transfers, must equal export revenues, foreign transfers, and foreign savings. Third, the national savings rate is treated as exogenous, and aggregate savings of all agents must equal total investment, including fixed capital formation and inventory changes.

To analyze the impacts of macroeconomic fluctuations on micro-level agents, such as household income and consumption structures, the CAFSAM model incorporates a microsimulation module. Following the top-down macro-micro linkage approach proposed by Debowicz (2012), the module first maps surveyed household samples from micro-datasets to their corresponding household representative groups in the macro-model based on income levels and residential locations (urban or rural). Similarly, individual family members are assigned to specific labor factor categories based on their industry of employment and skill levels.

Under this framework, household real income and labor real wages are assumed to change proportionally with the income and factor returns of their respective groups in the macro-model. This allows for the integration of macro-level income and wage variations into the microsimulation module. To account for intra-group income heterogeneity—acknowledging

that income changes are not uniform across all households within the same group—the module employs econometric methods to estimate household income variances driven by micro-level determinants, such as household characteristics, regional factors, and employment profiles.

Taking the poverty rate as an illustration: an exogenous macroeconomic shock drives the CAFSAM model toward a new equilibrium, resulting in endogenous changes in group-level income and labor factor prices. By feeding these adjusted indicators back into the microsimulation module, the total income for each household sample is estimated, enabling the recalculation of the national poverty rate.

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