

Article

Unlocking Common Prosperity Through Global Value Chain Embedding: Evidence from China on Urban–Rural Inequality and Sustainable Development

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Abstract

In the context of globalization, balancing economic growth with social equity is a critical challenge for achieving sustainable development. While Global Value Chains (GVCs) have become a defining feature of the contemporary economy, their specific impact on the urban–rural income gap—a key indicator of common prosperity—remains under-explored. This study empirically investigates the impact of GVC embedding on urban–rural common prosperity in China using panel data from 30 provinces spanning the period 2011–2022. Adopting a dual perspective of “efficiency” (income growth) and “equity” (income distribution), this study constructs a mediation model to analyze the transmission mechanisms. Research indicates that embedding in global value chains not only enhances the income-generating capacity of urban and rural residents but also effectively narrows the urban–rural income gap. Furthermore, its positive contribution to urban–rural common prosperity is both long-term and sustainable. This effect of GVC embedding on urban–rural common prosperity remains significant after conducting various robustness tests. Mechanism analyses reveal that GVC embedding achieves these outcomes by promoting agricultural industrial upgrading, fostering agricultural technological innovation, and stimulating rural entrepreneurial vitality. Notably, heterogeneity tests indicate that these positive effects are more pronounced in eastern, coastal, and economically developed regions, whereas the impact is less evident in central, western, and inland areas. This study holds important policy implications for promoting the development of China’s open economy to a higher level in the era of economic globalization, as well as for realizing urban–rural common prosperity and balanced, sustainable development.

Keywords: global value chain embedding; agricultural technological innovation; rural entrepreneurial vitality; industrial upgrading; urban–rural income gap



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1. Introduction

The urban–rural income gap represents a critical challenge for global socioeconomic development, with far-reaching implications for social stability and human well-being [1]. Addressing this gap is fundamental to the realization of several United Nations Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty) and SDG 10 (Reduced Inequalities). Over recent decades, many developing economies have pursued rapid economic growth at the expense of addressing income disparities, resulting in structural

imbalances such as uneven urban–rural development. These imbalances have intensified income inequality between urban and rural populations [2]. Increasing urban and rural per capita disposable income, narrowing the urban–rural income gap, and actively promoting sustainable and balanced urban–rural development not only reduce social inequality and foster development but also safeguard national security and social stability.

As the world’s largest developing country, China faces particularly severe urban–rural income disparities [3]. Its long-standing dual economic structure has further widened this divide. In 2023, the ratio of per capita disposable income between urban and rural residents reached 2.39 (Source: https://www.stats.gov.cn/sj/sjld/202409/t20240920_1956592.html (accessed on 2 January 2026)), indicating a persistently high level of inequality. This disparity remains a significant barrier to China’s pursuit of high-quality economic development and reflects a broader global policy concern. As a representative case of a transitioning economy, China offers an important context for examining the drivers and mechanisms that can foster shared prosperity between urban and rural areas.

Rapid advancements in science and technology, together with declining trade costs, have accelerated the global expansion of the international division of labor within global value chains. Fragmented production networks distributed across countries have become a major driver of global economic growth. Since China initiated its reform and opening-up policy, its embeddedness in international economic exchanges has increased substantially, and trade has gradually emerged as a critical force supporting China’s industrialization [4]. Leveraging population advantages and manufacturing capabilities, China has deepened its embeddedness in GVCs, contributing to rapid economic expansion. As GVC specialization intensifies, China has increasingly shifted resources toward high value-added activities, including research and development, product design, and technological innovation. This shift has enabled the country to move beyond the long-standing “low-end lock-in” and achieve more advanced forms of embeddedness [5], helping to mitigate disparities in factor allocation, resource distribution, and development opportunities between urban and rural regions.

Research by Xu and Zhou [6] indicates that an elevation in Global Value Chain position positively promotes overall productivity. The resulting productivity boost effectively facilitates the circulation of production factors between urban and rural areas, safeguarding the free flow of labor, capital, and technology, thereby narrowing the urban–rural income gap. This finding stands in contrast to the conclusion of Egger et al. [7], who argued that GVC embedding exacerbates wage inequality, reduces overall employment, and widens income disparity. Nonetheless, the effects of GVC embedding vary across countries due to significant differences in economic development, population size, and structural characteristics, resulting in heterogeneous outcomes between developed and developing economies [8]. As the world’s largest developing country, China is currently undergoing a crucial phase of industrial upgrading and transitioning toward high-quality development. Whether deeper GVC embedding can help close China’s urban–rural income gap and foster shared prosperity remains an open empirical question.

Existing research on common prosperity primarily addresses three dimensions. First, scholars focus on its conceptual foundations. As a core requirement of socialism, common prosperity is understood as relative affluence built on the basis of universal well-being. Its connotation centers on two elements: “prosperity,” encompassing both material and spiritual dimensions, and “sharing,” which reflects differentiated forms of distribution [9]. A necessary precondition is the continuous improvement of overall societal affluence, with the equitable sharing of development outcomes representing its essential meaning [10]. Second, a growing literature has constructed and evaluated indices of common prosperity, particularly in the context of the Opinions of the CPC Central Committee and the State

Council on Supporting Zhejiang's High-Quality Development and the Construction of a Demonstration Zone for Common Prosperity [11–13]. Third, studies have explored diverse factors shaping common prosperity, including trade openness [14], industrial restructuring and factor income distribution [15], inequality of opportunity [16], county-level entrepreneurship—especially microenterprises and corporations—and government size [17], as well as redistributive policies [18].

Research on the relationship between GVC embedding and the urban–rural income gap is still in its nascent stage. The existing literature primarily focuses on two aspects: the measurement of GVC embedding and the impact of GVC embedding on income inequality. Regarding measurement, Hummels et al. [19] and Koopman et al. [20] utilized national or world input–output tables to account for GVC embedding at the industry level. Conversely, Upward et al. [21], Zhang et al. [22], Lv et al. [23], and Kee et al. [24] conducted measurements and analyses at the firm level based on large-sample micro-firm data. Furthermore, focusing on Chinese listed companies, Yeerken and Feng [25] empirically identified a significant non-linear inverted U-shaped relationship between corporate GVC embedding and wage inequality.

Regarding the impact of GVC embedding on income disparity, research can be traced back to the H-O-S theory, focusing on international trade and the income gap between workers with different skill levels across industries. Borjas et al. [26] noted that the combined effect of trade and immigration could cause the wage differential between the two types of labor to rise from 5% to 15%. Wood [27] argued that the widening of income inequality within developed countries stems primarily from the substantial import of labor-intensive products, which reduces the demand for low-skilled labor. In contrast, developing countries such as South Korea and Singapore witnessed a narrowing of the income gap between workers of different skill levels after implementing export-oriented trade policies. Based on value chain theory, Li et al. [28] used data from China's service sector and found that China's embeddedness in the GVC division of labor widened the wage gap between high- and low-skilled labor by driving skill-biased technological progress, an effect that was particularly pronounced in technology-intensive industries. A. Reshef [29] also pointed out that international trade contributes to raising the income levels of high-skilled labor in both developed and developing countries. On the other hand, empirical research by Cai et al. [30] shows that for every 1-unit increase in the GVC position index, the Gini coefficient decreases by 6.14%. Similarly, Carpa & Martínez-Zarzoso [31], based on the UNCTAD-Eora database, reached a similar conclusion: a 1-unit increase in the GVC position index reduces the Gini coefficient by 0.152%.

In the context of China, Liu and Yang [32] pointed out that China's industrial development should balance internal regional economic interactions with external global economic relations. Building on this, Shao and Su [33] measured the GVC embedding of Chinese regions at the provincial level and conducted related research, providing an empirical basis for further understanding the impact of GVC embedding on regional income disparities in China.

In summary, the existing literature on GVC embedding tends to focus solely on trade or investment, overlooking their specific positions within the value chain and their impact on urban–rural income inequality. This research gap hinders a comprehensive understanding of the intrinsic link between GVC embedding and income maldistribution. Furthermore, when exploring the income and welfare effects of GVC embedding, current studies often dichotomize the 'efficiency' and 'equity' aspects of common prosperity. They also fail to capture the context of industrial evolution, limiting their policy relevance for guiding high-quality trade development and promoting urban–rural common prosperity under China's 'new development paradigm'. Accordingly, this paper investigates the effects

of GVC embedding on urban–rural common prosperity and its underlying mechanisms from the dual perspectives of ‘efficiency’ and ‘equity,’ aiming to bridge these gaps in the existing literature.

This paper makes two main contributions to the literature. First, it is the first to integrate global value chain embedding and China’s urban–rural common prosperity into a unified analytical framework, examining their relationship in the context of deepening global value chain specialization. By adopting a dual perspective of efficiency and equity, this study provides a more comprehensive assessment of the effects of GVC embedding, thereby enriching and extending the existing research. Second, this paper employs a mediation effect model to empirically test how GVC embedding enhances urban–rural common prosperity through channels such as the upgrading of agricultural industrial structure, agricultural technological innovation, and rural entrepreneurial activity. This analysis provides a theoretical basis for exploring effective paths to advance urban–rural common prosperity and sustainable, balanced development. Furthermore, it offers a reference for developing countries and regions globally to seize development opportunities amidst the continuous deepening of the GVC division of labor.

2. Mechanism Analysis and Research Hypotheses

2.1. *The Direct Impact of Global Value Chain Embedding on Shared Prosperity in Urban and Rural Areas*

Global value chain embedding plays a vital role in raising farmers’ incomes, narrowing the urban–rural income gap, and promoting shared prosperity. China’s current embeddedness in GVCs is predominantly concentrated in midstream production and assembly stages, where firms rely largely on comparatively low labor costs to embed themselves in international production networks. As labor remains a central factor of production within GVCs, deeper embeddedness enables more extensive sharing of economic gains generated through global trade. Consequently, greater GVC embedding can help reduce urban–rural disparities and support the achievement of common prosperity. The embeddedness of global value chains directly enhances per capita income levels [34]. This embeddedness significantly accelerates industrial development and facilitates the large-scale transfer of surplus agricultural labor to the industrial sector. By optimizing resource allocation, it boosts labor productivity in agriculture [35], leading to increased agricultural output and higher incomes for rural residents. Additionally, the expansion of non-agricultural employment opportunities for surplus agricultural labor results in a substantial rise in their income levels as they transition from rural to urban industrial sectors, thereby advancing the realization of common prosperity.

Hypothesis 1 (H1). *The embeddedness of global value chains has a positive impact on achieving urban–rural common prosperity.*

2.2. *The Indirect Impact of Global Value Chain Embedding on Shared Prosperity in Urban and Rural Areas*

As shown in Figure 1, GVC embedding not only exerts a direct impact on urban–rural common prosperity but also influences it through various channels. These processes work to narrow the urban–rural income gap and promote sustainable and balanced urban–rural development. In the mechanism through which global value chain embedding affects urban–rural common prosperity, the upgrading of the agricultural industrial structure serves as a key transmission channel. GVC embedding not only reflects deeper engagement of the agricultural sector with international markets, but also reshapes the sector through multiple pathways. First, embeddedness in GVCs promotes agricultural industrial

upgrading by fostering new productive forces via a “dual-wheel drive” of agricultural industrialization and the expansion of agricultural services. This process optimizes production relations and accelerates structural transformation. Empirical evidence from Wen and Guo [36] further demonstrates that upstream GVC embedding significantly enhances the rationalization and advancement of the agricultural industrial structure. In upstream segments, agricultural enterprises gain access to technological spillovers through engagement in high value-added activities, facilitating a transition from traditional extensive farming to technology-intensive production. Technological innovation and status upgrading reinforce each other, steering the industrial structure toward technology-intensive activities. A higher proportion of skilled labor strengthens bargaining power and contributes to mitigating income inequality [37]. In downstream segments, the accelerated penetration of modern services—such as cold-chain logistics and e-commerce—extends the agricultural value chain and increases overall sectoral value added.

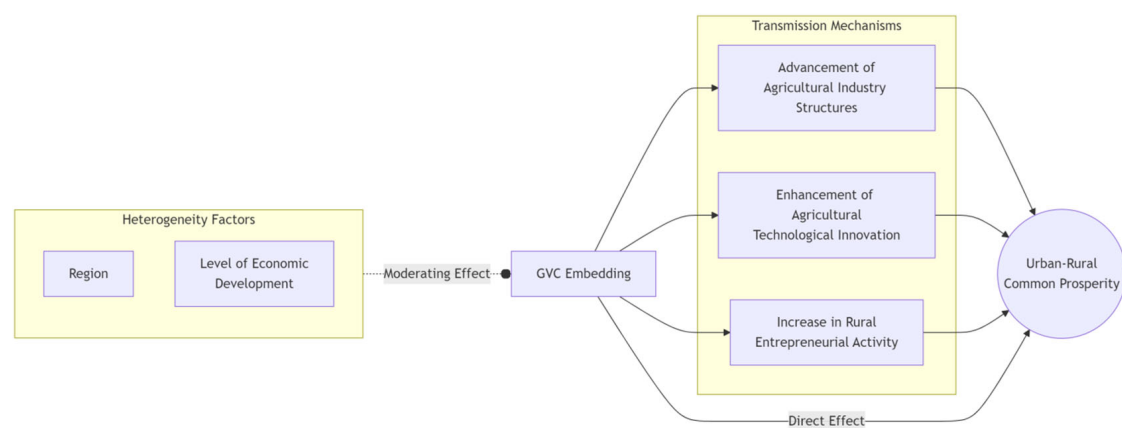


Figure 1. Logic Diagram of the Mechanism of Influence.

Second, the advancement of the agricultural industry structure contributes to urban–rural common prosperity by facilitating resource flows and income redistribution mechanisms, thereby narrowing the development gap between urban and rural areas. On one hand, upgrading the agricultural industry structure increases demand for high-skilled labor in rural areas, attracting urban capital, advanced technologies, and highly skilled talent, which fosters two-way integration of urban and rural resources. On the other hand, the extension of the agricultural value chain boosts rural residents’ participation and income share within the industry, strengthening their position in “functional distribution.” Moreover, the shift toward service-oriented agriculture has spurred new business models, such as rural tourism and rural e-commerce [38], creating significant local employment opportunities that help alleviate the outflow of rural labor and enhance the endogenous development capacity of rural regions, and ultimately contribute to advancing urban–rural common prosperity.

Hypothesis 2 (H2). *The embeddedness of global value chains can drive the advancement of agricultural industry structures, thereby promoting urban–rural common prosperity.*

Global value chain embedding serves as a critical channel for technological spillovers in agriculture, helping to mitigate urban–rural income disparities arising from the inefficient allocation of production factors across regions [39], and thereby promoting urban–rural common prosperity. Specifically, GVC embedding facilitates the formation of cross-regional technology diffusion networks, overcoming geographical limitations and enabling agricultural innovations to spread and be adopted more broadly [40]. Such spatial spillover

effects are particularly advantageous for technologically lagging rural areas, allowing them to achieve “leapfrogging” through the adoption of advanced technologies. Furthermore, agricultural technological innovations—through the deployment of smart equipment and precision farming techniques—enhance land productivity and labor efficiency, release surplus agricultural labor for transfer to non-agricultural sectors, and foster cross-sectoral technological integration. Collectively, these processes drive multi-factor innovation across agricultural and non-agricultural value chains, thereby strengthening urban–rural economic integration.

Finally, agricultural technological innovation provides a range of solutions that cater to agricultural enterprises of varying scales, particularly benefiting small and medium-sized farmers by offering greater inclusivity [41]. Additionally, GVC embedding enables these farmers to access modern market systems, reducing entry barriers through technological innovation and allowing more rural communities to benefit from globalization. This inclusive growth mechanism significantly reduces income inequality within rural areas, thus advancing the realization of urban–rural common prosperity.

Hypothesis 3 (H3). *The embeddedness of global value chains generates a positive feedback mechanism for regional agricultural technological innovation, thereby advancing urban–rural common prosperity.*

Global value chain embedding not only provides rural areas with access to capital, technology, and markets, but also stimulates entrepreneurial activity, generating employment, promoting economic growth, and expanding market channels [42]. As such, GVC embedding constitutes a key mechanism for advancing urban–rural common prosperity. However, in many rural regions, gaps in the value chain and the absence of specialized intermediaries constrain local enterprises’ operations, often forcing them to internalize functions that could otherwise be efficiently outsourced. GVC embedding activates additional factors by continuously exploring new agricultural functions and values through industrial crossover, fusion, and penetration, which in turn attracts highly skilled talent to return to their rural hometowns and start businesses, thus broadening income-generation opportunities for farmers [36]. This emerging rural entrepreneurial ecosystem effectively breaks down barriers to resource integration in rural areas, linking various local resources. The extension of value chains in sectors such as agri-food processing, specialized handicrafts, and rural tourism has enabled a shift from “raw material exports” to “product and service exports.” Leveraging GVC-driven capabilities such as standardization, branding, and e-commerce, these changes have significantly boosted entrepreneurial activity in rural areas.

Enhancing rural entrepreneurial activity not only provides an effective avenue for increasing rural residents’ business income [43], but also mobilizes idle resources, such as land and homesteads, facilitating the reallocation of production factors. This process helps address structural imbalances between urban and rural areas in income, employment opportunities, and factor returns, thereby establishing a sustainable micro-level foundation for achieving common prosperity. Moreover, the “demonstration effect” of such entrepreneurial activity further amplifies knowledge diffusion and human capital accumulation within rural areas, creating a virtuous cycle of “entrepreneurship—income growth—re-entrepreneurship.” This not only accelerates the diversification of rural industrial structures and enhances value chain positioning but also facilitates the gradual integration of urban and rural areas in terms of factor markets, public services, and institutional frameworks, thus becoming a critical mechanism for advancing urban–rural common prosperity.

Hypothesis 4 (H4). *The embeddedness of global value chains fosters urban–rural common prosperity by enhancing entrepreneurial activity in rural areas, thereby generating a positive reinforcing effect.*

2.3. Extended Hypothesis: Heterogeneous Effects of Global Value Chain Embedding on Common Prosperity in Urban and Rural Areas

Within the value chain network system, regional economic development is no longer an isolated endeavor but an integrated entity formed through economic linkage mechanisms. Zhang and Choi [44] note that while green trade fosters further growth in countries with intermediate productivity levels, its excessive pursuit in more developed economies may retard the improvement of production levels, creating a so-called ‘sustainability trap.’ Similarly, given the disparities among Chinese provinces in terms of economic strength, geographic location, and factor endowments, the impact of GVC embedding on urban–rural common prosperity is likely to exhibit heterogeneity.

Firstly, significant urban–rural disparities in resource distribution and access to educational opportunities contribute to differences in labor quality. These gaps limit rural residents’ access to education and skills training, creating a technological divide between rural and urban labor forces. As a result, issues such as the large urban–rural gap, sectoral imbalances, and low returns on education persist [38].

Secondly, regions with higher levels of GVC specialization are typically located in eastern or coastal provinces, which, due to their advanced economic openness, serve as hubs for institutional innovation and sectoral reforms. These areas thus gain a first-mover advantage in GVC embedding [8]. With the accumulation of human capital and technological progress, these regions are increasingly moving from midstream production and assembly to upstream activities such as design and marketing, thus assuming higher-value-added production processes. This transition raises demand for skilled labor and advanced technologies. Meanwhile, low-skilled labor demands in traditional production and assembly sectors are shifting to less specialized regions, potentially offsetting the expected reduction in the urban–rural income gap resulting from productivity gains.

Finally, it is important to note that GVC embedding may also lead to “resistance” effects. Regions at the lower end of the GVC may face “low-end lock-in,” limiting their ability to capture value and exacerbating urban–rural disparities. This is especially evident in rural or underdeveloped areas, where challenges such as “elite outflow” and “deindustrialization” may arise. Therefore, in certain regions, GVC embedding could present risks of further segmentation, undermining efforts to achieve urban–rural common prosperity.

Hypothesis 5 (H5). *The effects of global value chain embedding on urban–rural common prosperity are heterogeneous.*

3. Research Design

3.1. Model Setting

To examine the impact of global value chain embedding on urban–rural common prosperity, this study, drawing on Autor et al. [45], constructs the following baseline estimation model that incorporates both “efficiency” and “equity” dimensions:

$$INCOME_{it} = \alpha + \beta_{11}GVC_{it} + \beta_{21}Cons_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

$$GINI_{it} = \alpha + \beta_{12}GVC_{it} + \beta_{22}Cons_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2)$$

Here, $Income_{it}$ denotes the per capita disposable income of urban and rural residents in region i during year t ; $Gini_{it}$ represents the urban–rural income gap in region i during

year t ; GVC_{it} measures the degree of global value chain embedding in region i during year t ; and $Cons_{it}$ denotes a set of control variables, including economic vitality, government intervention, transportation infrastructure, human capital, environmental regulation, and the level of digitalization. μ_i and δ_t capture regional and time fixed effects, respectively, while ε_{it} represents the random disturbance term. Equation (1) assesses the contribution of GVC embedding to local income growth, testing whether GVC embedding can achieve efficiency by raising household incomes. Equation (2) evaluates the impact of GVC embedding on the urban–rural income gap, testing whether GVC embedding can promote equity by narrowing income disparities.

Based on the theoretical analysis above, GVC embedding influences urban–rural common prosperity through the upgrading of agricultural industrial structure, agricultural technological innovation, and rural entrepreneurial activity. To examine this mechanism, and building on Equations (1) and (2), this study constructs the following mediation effect models. The stepwise regression method is employed for mediation analysis, following Baron and Kenny [46] and Li and Tian [47]:

$$Y_{it} = \theta + \beta_{31}GVC_{it} + \beta_{41}Cons_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (3)$$

$$Middle_{it} = \theta + \beta_{32}GVC_{it} + \beta_{42}Cons_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (4)$$

$$Y_{it} = \theta + \beta_{33}GVC_{it} + \beta_5 Middle_{it} + \beta_{43}Cons_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (5)$$

Equations (3)–(5) present the stepwise regression models used to examine mediation effects. Y_{it} denotes the dependent variable, measured by either per capita disposable income of urban and rural residents or the urban–rural Gini coefficient. $Middle_{it}$ represents the mediating variables, including the degree of agricultural industrial upgrading, agricultural technological innovation, and rural entrepreneurial vitality in region i during year t . The remaining variables are defined as in Equation (1). Following Wen and Ye [48], mediation is established when regression coefficients β_{31} , β_{32} , β_{33} , and β_5 are all statistically significant. If coefficient β_{31} is significant but either β_{32} or β_5 is not, the significance of the product term $\beta_{32} \times \beta_5$ must be tested. A statistically significant result for this interaction term indicates the presence of a mediation effect.

3.2. Variable Selection

3.2.1. Dependent Variable: Urban–Rural Common Prosperity

Following He and Zhang [49], urban–rural common prosperity is defined and measured along two dimensions: efficiency and equity.

1. Efficiency dimension. The logarithm of per capita disposable income of urban and rural residents (*INCOME*) is adopted as the indicator of income level. Per capita disposable income is calculated as: $INCOME = (\text{Urban per capita disposable income} \times \text{Urban population share}) + (\text{Rural per capita disposable income} \times \text{Rural population share})$.
2. Equity dimension. The urban–rural Gini coefficient (*GINI*) is employed to measure income inequality between urban and rural areas, defined as: $GINI = \text{Total income of urban residents} / \text{Total regional income} - \text{Urban population share}$.

3.2.2. Core Explanatory Variable: Global Value Chain Embedding

Export technological complexity not only objectively reflects a country's position within the global value chain during its process of economic integration [50], but also serves as an indicator of the technological sophistication and international competitiveness of its export products. Based on the premise that trade structure mirrors production structure, a country's or region's export complexity reveals its standing in the global

value chain. Drawing on the “Cost Discovery” framework by Hausmann et al. [51], we developed a production function and conducted a microeconomic analysis, demonstrating that countries with export enterprises at the productivity frontier are more likely to produce technologically complex products, thus securing a higher value chain position within the global production network. Furthermore, as China’s provincial input–output tables are only available for the years 1997, 2002, 2007, 2012, 2015, and 2017, and the data are not continuous, the calculation of export technological complexity is not affected by this limitation, making it a robust measure for assessing regional GVC embedding, as suggested by Hausmann et al. [51]. The specific calculation method is outlined in two steps:

$$Prody_h = \sum_n \frac{\frac{Export_{nh}}{Total_Export_n}}{\sum_n \frac{Export_{nh}}{Total_Export_n}} \times PGDP_n \quad (6)$$

In Equation (6), $Prody_h$ represents the technological complexity of HS6 products; h denotes a specific HS6 product code; n refers to a country or region; $Export_{nh}$ indicates the export value of product h from country or region n . $Total_Export_n$ refers to the total export value of country or region n ; $\frac{Export_{nh}}{Total_Export_n}$ represents the export share of product h in country or region n , defined as the ratio of its export value to the total exports of country or region n . $PGDP_n$ denotes the per capita GDP of country or region (GDP refers to a country’s gross domestic product, representing the total value of all final goods and services produced by all resident units within a country or region over a given period).

To ensure the robustness of the findings, this study further recalculates and adjusts the export technology complexity [52,53]. Specifically, the unit value of export products is employed as a proxy for quality adjustment. This adjustment allows for the calculation of the technology complexity of products, accounting for quality differences.

$$Quality_{nh} = \frac{Price_{nh}}{\sum_n \mu_{nh} \times Price_{nh}} \quad (7)$$

In Equation (7), $Quality_{nh}$ represents the quality index of product h from country or region n . The larger the value of $Quality_{nh}$, the higher the relative price of product h , indicating that the export product is of higher quality. $Price_{nh}$ denotes the unit export price of product h from country or region n . μ_{nh} represents the share of product h in the total world exports, reflecting the comparative advantage of product h from country or region n in global exports. Following the approach of Wang et al. [54], ρ is set to 0.2 for the quality adjustment of product technological complexity.

$$Quality_h = (Quality_{nh})^\rho \times Prody_h \quad (8)$$

Second, the product-level export technological complexity is adjusted to the regional level based on the export product weight of each region:

$$GVC_i = \sum_h \frac{Export_{ih}}{total_export_i} \times Qprody_h \quad (9)$$

In Equation (9), $\frac{Export_{ih}}{total_export_i}$ represents the share of product h ’s exports from region i in its total exports, $total_export_i$; similar to Equation (8), $Qprody_h$ denotes the export technological complexity of Chinese product h after quality adjustment using the relative price index. Finally, the export technological complexity at the provincial level is obtained by aggregating data at the regional level. Generally, the higher the export technological complexity index, the higher the technological level embedded in the product, its com-

petitiveness, the added value generated during its production process, and the higher its position in the value chain.

3.2.3. Mechanism Variables

This study examines three mechanism variables: agricultural industrial upgrading, agricultural technological innovation, and rural entrepreneurial vitality.

1. **Agricultural Industrial Upgrading.** Previous research typically measures industrial upgrading by the ratio of tertiary to secondary industry output. For the agricultural sector, however, a more appropriate measure involves the ratio of livestock to crop output and the ratio of agricultural processing output to primary agricultural output [55]. Given data availability and indicator validity, this study measures agricultural industrial upgrading as the share of agricultural, forestry, animal husbandry, and fishery services in the total output of agriculture, forestry, animal husbandry, and fishery.
2. **Agricultural Technological Innovation.** Data on agricultural R&D expenditures and personnel across Chinese regions are not available in official yearbooks or other statistical databases. In addition, innovation indicators derived from input–output data using methods such as data envelopment analysis or stochastic frontier analysis face drawbacks, including limited transparency and difficulties in longitudinal comparison. Therefore, following Zhang and Wang [56], this study measures agricultural technological innovation by the total number of agricultural patents (covering agriculture, forestry, animal husbandry, and fishery). This variable is expressed in logarithmic form and denoted as ATE.
3. **Rural Entrepreneurial Vitality.** To capture the dynamics of rural entrepreneurship, and drawing on the approaches of Gu and Xie [57] and Li and Ran [58], this study measures rural entrepreneurial vitality as the ratio of the sum of rural private enterprise investors and rural self-employed households to total rural employment. A higher ratio indicates greater rural entrepreneurial vitality.

3.2.4. Control Variables

Given the multifaceted determinants of urban–rural common prosperity, this study introduces several control variables: economic vitality (*ECO*), government intervention (*GOV*), transportation infrastructure (*TRANS*), human capital (*EDU*), environmental regulation (*GRE*), and digitalization (*DIG*). Economic vitality, reflecting the dynamism of regional development, is measured using night-time light data at the regional level, expressed in logarithmic form. Government plays a pivotal role in local economic development. Greater fiscal autonomy enhances the independence of local governments in economic governance, allowing them to balance “efficiency” and “equity” in accordance with local conditions, thereby shaping urban–rural common prosperity [59]. Accordingly, government intervention is measured as the ratio of fiscal expenditure to GDP. Transportation infrastructure is proxied by the logarithm of highway mileage and total freight volume, following Gao et al. [60]. Human capital, critical for long-term urban–rural convergence, facilitates the transfer of rural labor into urban sectors and increases income growth opportunities [61]. It is measured as the ratio of higher-education enrollment to the total regional population. Environmental pollution not only leads to resource misallocation and constrains growth but also shapes urban–rural income disparities through its effects on household investment decisions [62]. Following Chen and Chen [63], environmental regulation is proxied by the logarithm of the frequency of environment-related terms appearing in government work reports. Finally, following the study of Yuan et al. [64], this study measures the level of digital informatization using the proportion of post and telecommunications revenue in the Gross Regional Product.

3.3. Data Sources

This study utilizes panel data from 30 provinces, municipalities, and autonomous regions in China spanning the period 2011–2022. The data are compiled from multiple authoritative sources, including the Foreign Trade Database of the Development Research Center of the State Council (2012–2023), the CSMAR series databases of the GTA Research Service Center, the China E-Commerce Development Index Report, provincial statistical yearbooks, the CNKI database, the CCER database, and publications from the Ministry of Industry and Information Technology of the People’s Republic of China. Table 1 reports the descriptive statistics for the variables.

Table 1. Variable descriptive statistics.

Variable Type	Meaning of Variables	Variable Name	Sample Size	Maximum Value	Minimum Value	Mean	Standard Deviation
Dependent Variable	Logarithm of per capita disposable income of urban and rural residents	INCOME	360	11.281	8.990	10.088	0.441
	Urban–rural Gini coefficient	GINI	360	0.332	0.053	0.190	0.060
Core Explanatory Variable	Global value chain embedding	GVC	360	9.631	8.518	9.123	0.243
Mechanism Variables	Agricultural industrial upgrading	AIS	360	0.131	0.013	0.043	0.020
	Agricultural technological innovation	ATE	360	9.720	3.664	7.500	1.090
	Rural entrepreneurial vitality	ANC	360	2.846	0.018	0.265	0.426
Control Variables	Economic vitality	ECO	360	46.796	0.101	7.998	9.653
	Government intervention	GOV	360	0.643	0.107	0.247	0.102
	Transportation infrastructure	TRANS	360	12.981	9.440	11.633	0.834
	Human Capital	EDU	360	0.044	0.008	0.021	0.006
	Environmental regulation	GRE	360	4.820	1.792	4.005	0.359
	Digitalization	DIG	360	2.520	0.015	0.067	0.140

4. Estimated Results and Analysis

4.1. Variable Correlation and VIF Test

To address potential multicollinearity between control and explanatory variables, this study applies the Variance Inflation Factor (VIF) method. The results, shown in Table 2, reveal an overall average VIF of 2.17, with individual VIF values well below the critical threshold of 10. These findings suggest that multicollinearity is not a significant concern in this study, and the selected variables do not undermine the robustness of the baseline estimation results.

Table 2. Variance Inflation Factor (VIF) Test.

Variable	VIF	1/VIF
GVC	2.01	0.497
ECO	3.48	0.287
GOV	2.29	0.437
TRANS	3.30	0.303
EDU	1.97	0.509
GRE	1.16	0.866
DIG	1.02	0.981
Mean VIF	2.17	

Based on the data presented in Table 1, a preliminary scatter plot was constructed to examine the relationship between global value chain embedding, per capita disposable income, and the Gini coefficient between urban and rural areas. As shown in Figure 2, both Panel (a) and Panel (b) reveal that most data points are closely aligned along a straight line.

This suggests a preliminary linear relationship between global value chain embedding and urban–rural common prosperity.

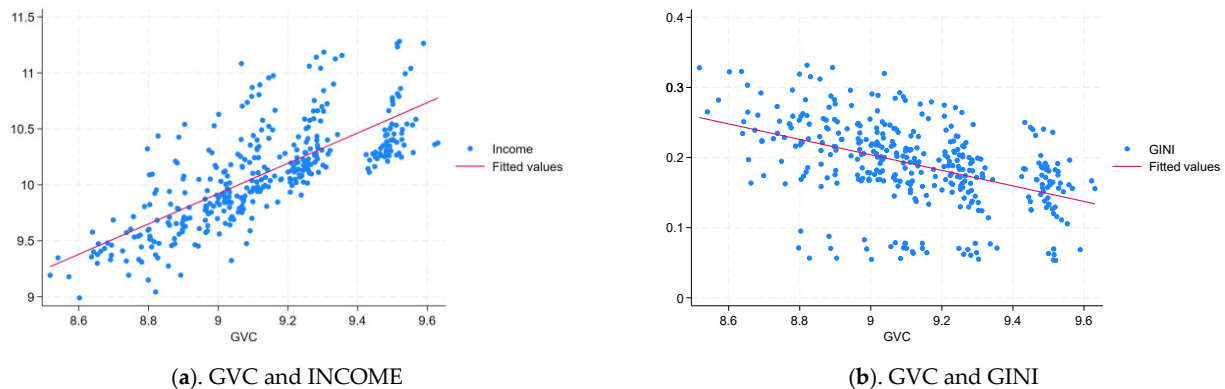


Figure 2. Serial Correlation Coefficient Scatter Plot.

4.2. Baseline Regression Analysis

The results of the baseline regression are shown in Table 3. Columns (1)–(2) present the effects of global value chain embedding on urban–rural common prosperity without control variables. The estimates show that GVC embedding significantly increases per capita income while reducing the urban–rural Gini coefficient, indicating that GVC embedding both raises local income levels and narrows the income gap between urban and rural residents.

Table 3. Testing the Effects of Global Value Chain Embedding on Common Prosperity in Urban and Rural Areas.

Variable	(1)	(2)	(3)	(4)
	INCOME	GINI	INCOME	GINI
GVC	1.257 *** (0.000)	−0.093 *** (0.000)	1.069 *** (0.000)	−0.054 *** (0.000)
ECO			0.002 (0.559)	0.001 (0.271)
GOV			0.610 ** (0.045)	0.025 (0.386)
TRANS			0.176 *** (0.002)	−0.045 *** (0.027)
EDU			7.550 (0.276)	−2.482 *** (0.002)
GRE			0.033 * (0.081)	−0.003 (0.180)
DIG			0.084 (0.385)	−0.008 ** (0.076)
_cons	−1.379 *** (0.000)	1.034 *** (0.000)	−2.010 *** (0.004)	1.209 *** (0.000)
Province Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
N	360	360	360	360
Adjusted-R ²	0.945	0.967	0.950	0.976
F-value	1136.98	241.29	300.49	137.90

Note: *, **, and *** denote significance at the 10%, 5%, and 1% statistical levels; *p*-value are in parentheses.

Columns (3)–(4), which include control variables and account for regional and time fixed effects, produce consistent results. GVC embedding continues to exhibit a significantly positive effect on per capita income and a significantly negative effect on the urban–rural Gini coefficient. Moreover, the model fit improves once regional and time fixed effects are

controlled for. These findings suggest that GVC embedding promotes the market-oriented allocation of labor, thereby reconciling “efficiency” with “equity” and fostering urban–rural common prosperity. Overall, the results provide strong empirical support for the argument that GVC embedding shapes both income levels and income distribution across urban and rural areas.

With respect to the control variables, government intervention exhibits a positive and statistically significant effect on “efficiency”, with a coefficient of 0.610 at the 5% level, while its effect on “equity” is not statistically significant. This finding suggests that government intervention primarily serves as a catalyst for improving “efficiency,” rather than as a direct and decisive driver of “equity.” Two explanations are plausible. First, under the long-standing “GDP-oriented” performance evaluation system, local governments have tended to prioritize urban industrial development, while investments in education, healthcare, and infrastructure in rural areas have remained relatively insufficient, thereby exacerbating urban–rural disparities. Second, the effects of government intervention on “equity” are often indirect, long-term, and contingent on specific conditions. Policies aimed at alleviating development bottlenecks or improving infrastructure typically benefit regions with higher growth efficiency first; as a result, such interventions may fail to narrow—and may even widen—the urban–rural income gap in the short run.

Transportation infrastructure exerts statistically significant effects on both “efficiency” and “equity,” with coefficients of 0.176 and -0.045 , respectively, both significant at the 1% level. This indicates that improvements in transportation infrastructure not only strengthen urban–rural connectivity but also facilitate the circulation of agricultural products, thereby contributing to higher income levels for both urban and rural residents and promoting coordinated urban–rural development. Overall, transportation infrastructure development is conducive to advancing urban–rural common prosperity. By contrast, improvements in human capital significantly reduce the urban–rural income gap at the 1% level, thereby enhancing “equity,” but do not have a statistically significant effect on “efficiency.” This pattern may be explained as follows. On the one hand, higher human capital levels enable rural labor to access higher value-added industries, mitigate urban–rural employment discrimination, raise incomes among low- and middle-income groups, and improve the overall structure of urban–rural income distribution, thereby substantially promoting “equity.” On the other hand, at China’s current stage of development, persistent structural barriers to factor mobility between urban and rural areas have led to pronounced differences in industrial structure—cities are largely dominated by high-end service industries, whereas rural areas remain concentrated in traditional agriculture. Consequently, returns to education in rural areas may be lower than those in urban areas, diluting the aggregate income growth effect and resulting in an insignificant impact on “efficiency.”

Although environmental regulation does not significantly affect the urban–rural Gini coefficient, it has a significant positive effect on urban–rural per capita income at the 10% level. This suggests that environmental regulations contribute to higher income levels for residents. As economic development shifts toward a focus on “quality,” both central and local governments are progressively refining performance evaluation systems with a growing emphasis on environmental quality. Consequently, during this transition to high-quality development, local governments are likely to adjust environmental protection expenditures based on their economic structure and environmental needs. This collaboration between local governments and environmental regulations drives high-quality economic growth, establishing an effective mechanism for promoting “competitive upgrading” among local governments. Ultimately, this is expected to improve income levels for both urban and rural residents.

Lastly, the level of digital informatization significantly fosters “equity” development at the 10% level, demonstrating that digital empowerment is becoming a crucial driver in advancing urban–rural common prosperity.

4.3. Robustness Tests

To further enhance the credibility of the baseline estimation results, this study conducts a series of robustness checks using four distinct methods. First, the dependent variables are replaced. Following He Weiwei and Zhang Yabin [31], this study employs the logarithm of total urban–rural household income and the urban–rural income disparity index—calculated as the difference between urban per capita disposable income and rural per capita net income, divided by overall urban–rural per capita disposable income—as alternative measures of per capita income and the urban–rural Gini coefficient, denoted TOTAL and DIV, respectively. Second, a stricter control strategy is implemented by including year $\times$ province fixed effects to account for time-varying regional factors. Third, outliers are addressed by winsorizing all variables at the 1% level and re-estimating the models. Fourth, subsample regressions are conducted to mitigate potential sample selection bias due to regional economic disparities and policy differences; specifically, the four municipalities—Beijing, Tianjin, Shanghai, and Chongqing—are excluded, and the models are re-estimated with the adjusted sample.

Table 4 presents the results of these robustness checks on the impact of global value chain embedding on urban–rural common prosperity. Across all approaches—including alternative dependent variables, stricter controls, outlier adjustment, and subsample estimation—the results remain consistent with the baseline regressions. GVC embedding continues to exert a significantly positive effect on per capita urban–rural income and a significantly negative effect on the urban–rural Gini coefficient. These findings confirm that GVC embedding simultaneously enhances “efficiency” and “equity” in urban–rural income, supporting high-quality development of common prosperity, and demonstrate that the baseline results are robust.

Table 4. Robustness Test of the Urban–Rural Common Prosperity Effect Embedded in Global Value Chains.

Variable	Replace the Explained Variable		More Stringent Control Methods		Remove Outliers		Exclude Samples from Municipalities Directly Under the Central Government	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TOTAL	DIV	INCOME	GINI	INCOME	GINI	INCOME	GINI
GVC	1.133 *** (0.000)	−0.169 *** (0.002)	0.769 *** (0.000)	−0.036 *** (0.007)	1.080 *** (0.000)	−0.061 *** (0.000)	0.994 *** (0.000)	−0.070 *** (0.000)
_cons	14.16 *** (0.000)	5.157 *** (0.000)	−45.44 *** (0.000)	4.609 *** (0.002)	−2.450 *** (0.299)	1.109 *** (0.000)	−3.144 *** (0.292)	1.095 *** (0.000)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province $\times$ Year Fixed Effects	No	No	Yes	Yes	No	No	No	No
N	360	360	360	360	313	286	312	312
Adjusted-R ²	0.983	0.709	0.988	0.979	0.946	0.970	0.930	0.964
F-value	288.90	61.10	300.21	133.21	304.73	123.07	153.37	168.08

Note: *** denote significance at the 1% statistical levels; *p*-value are in parentheses.

4.4. Endogeneity Test

4.4.1. SYS-GMM Model

To address the dynamic endogeneity arising from potential reverse causality between GVC embedding and urban–rural common prosperity, this section first introduces the first-order lagged terms of urban and rural per capita disposable income and the urban–

rural Gini coefficient as instrumental variables. The System GMM model is then employed for estimation.

Table 5 presents the estimation results from the System GMM dynamic panel model. In column (1), the dependent variable is urban–rural per capita disposable income, while in column (2), the dependent variable is the urban–rural Gini coefficient. The regression coefficients for the lagged values of urban–rural per capita disposable income and the urban–rural Gini coefficient are 0.701 and 0.756, respectively, both significant at the 1% level. The coefficients for the effect of global value chain embedding on urban–rural per capita disposable income and the urban–rural Gini coefficient are 0.243 and -0.014 , respectively, both significant at the 5% level. These findings suggest that global value chain embedding fosters both “efficiency” and “equity,” positively influencing the advancement of urban–rural common prosperity.

Table 5. Endogeneity Test Results.

Variable	(1)	(2)
	INCOME	GINI
L.INCOME	0.701 *** (0.000)	
L.GINI		0.756 *** (0.000)
GVC	0.243 ** (0.019)	-0.014 ** (0.023)
_cons	0.728 * (0.072)	0.113 ** (0.026)
Control Variables	Yes	Yes
AR(1) p-value	0.000	0.000
AR(2) p-value	0.123	0.103
Hansen p-value	0.554	0.527
N	330	330

Note: *, **, and *** denote significance at the 10%, 5%, and 1% statistical levels; *p*-value are in parentheses.

Furthermore, the Arellano–Bond test shows that AR(1) is significant (p -value < 0.01), while AR(2) is not significant (p -value > 0.1), indicating the absence of second-order autocorrelation in the residuals. The Hansen test p -values of 0.554 and 0.527 suggest that the over-identifying restrictions are not violated, confirming the validity of the instrumental variables and the robustness of the model estimates.

4.4.2. Bartik IV

To address potential endogeneity in the identification strategy, an instrumental variable (IV) approach based on a Bartik-type instrument is employed. Following Bartik [65], Yi and Zhou [66], a Bartik instrument is constructed as the interaction between the one-period lag of provincial global value chain embedding and the first difference in national-level GVC embedding over time. This Bartik IV is used to instrument provincial GVC embedding in the 2SLS estimation.

The validity of the instrument relies on two considerations. First, lagged provincial GVC embedding is strongly predictive of its current level, and temporal variations in national-level GVC embedding are closely correlated with contemporaneous provincial GVC embedding, thereby satisfying the relevance condition. Second, national-level GVC embedding is calculated as the aggregate average across 30 provinces and is plausibly exogenous to idiosyncratic shocks at the prefecture-level city, supporting the exclusion restriction.

The estimation is conducted using the two-stage least squares instrumental variable (IV-2SLS) method, and the results are reported in Table 6. In column (1), the dependent

variable is urban–rural per capita disposable income. The Cragg–Donald Wald F statistic and the Kleibergen–Paap Wald rk F statistic are 53.18 and 191.18, respectively, both well above the Stock–Yogo critical value for a 10% maximal IV size (16.38). In column (2), where the dependent variable is the urban–rural Gini coefficient, the corresponding Cragg–Donald Wald F statistic and Kleibergen–Paap Wald rk F statistic are 45.86 and 222.16, respectively, again exceeding the 10% Stock–Yogo critical value (16.38). These results allow rejection of the null hypothesis of weak instruments, confirming the strength and validity of the instrumental variables.

Table 6. 2SLS-IV Estimation Results.

Variable	(1)		(2)	
	First-Stage Regression	Second-Stage Regression	First-Stage Regression	Second-Stage Regression
Bartik IV	0.065 *** (0.000)		0.071 *** (0.000)	
GVC		0.200 * (0.064)		−0.019 * (0.058)
Control Variable	Yes	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Cragg–Donald Wald F statistic		53.18		45.86
Kleibergen–Paap Wald rk F statistic		191.98		222.16
N	330	330	330	330

Note: *, and *** denote significance at the 10%, and 1% statistical levels; *p*-value are in parentheses.

Column (1) of Table 6 shows that, in the first-stage regression, the instrumental variable significantly increases the level of global value chain embedding at the 1% level, with an estimated coefficient of 0.065. The second-stage results indicate that GVC embedding has a positive effect on urban–rural per capita disposable income, with a coefficient of 0.200, significant at the 10% level. Column (2) of Table 6 reports similar first-stage results, with the instrumental variable significantly increasing GVC embedding at the 1% level and an estimated coefficient of 0.071. The second-stage estimates show that GVC embedding exerts a negative and statistically significant effect on the urban–rural Gini coefficient (−0.019) at the 10% level. Overall, these findings suggest that deeper GVC embedding simultaneously enhances efficiency and equity, and its positive role in promoting urban–rural shared prosperity and sustainable development remains robust after accounting for endogeneity.

4.5. Mechanism Analysis

The preceding analysis indicates that deeper embedding into global value chains promotes urban–rural common prosperity by raising per capita urban–rural income (“efficiency”) and positively influencing the urban–rural income gap (“equity”). This section will explore the mechanisms through which global value chain embedding influences both “efficiency” and “equity.” Tables 7–9 report the results.

Column (1) of Table 7 shows that GVC embedding significantly promotes agricultural industrial upgrading at the 5% level. During GVC embedding, the agricultural sector captures upgrading dividends, with embedding in agricultural processing having a stronger effect than primary agriculture. In other words, embedding agricultural processing is more conducive to structural advancement. By meeting the requirements of foreign processors and consumers, the agricultural sector increases its market competitiveness, generates value added, and participates in higher value-added segments. This transformation enhances domestic value added, strengthens the international competitiveness of

agricultural enterprises, improves profitability within the agricultural GVC, and facilitates structural upgrading.

Table 7. Mechanism Testing: Agricultural Industrial Upgrading.

Variable	(1)	(2)	(3)
	AIS	INCOME	GINI
GVC	0.009 ** (0.040)	1.750 *** (0.009)	−0.061 *** (0.000)
AIS		1.053 *** (0.000)	−0.019 (0.765)
_cons	−0.159 ** (0.001)	−11.82 *** (0.000)	0.750 *** (0.000)
Control Variables	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
N	360	360	360
Adjusted-R ²	0.837	0.951	0.975
F-value	20.20	428.03	259.97

Note: **, and *** denote significance at the 5%, and 1% statistical levels; *p*-value are in parentheses.

Table 8. Mechanism Testing: Agricultural Technological Innovation.

Variable	(1)	(2)	(3)
	ATE	INCOME	GINI
GVC	2.587 *** (0.000)	0.787 *** (0.000)	−0.035 ** (0.012)
ATE		0.109 *** (0.000)	−0.010 *** (0.000)
_cons	−34.61 *** (0.000)	1.760 * (0.068)	0.591 *** (0.000)
Control Variables	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
N	360	360	360
Adjusted-R ²	0.909	0.956	0.978
F-value	95.40	279.02	151.28

Note: *, **, and *** denote significance at the 10%, 5%, and 1% statistical levels; *p*-value are in parentheses.

Table 9. Mechanism Testing: Rural Entrepreneurial Vitality.

Variable	(1)	(2)	(3)
	ANC	INCOME	GINI
GVC	0.367 ** (0.012)	1.007 *** (0.000)	−0.012 ** (0.033)
ANC		0.168 ** (0.014)	−0.083 *** (0.007)
_cons	−4.376 ** (0.011)	−1.275 (0.107)	−0.250 *** (0.000)
Control Variables	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
N	360	360	360
Adjusted-R ²	0.908	0.952	0.784
F-value	4.97	208.23	135.78

Note: **, and *** denote significance at the 5%, and 1% statistical levels; *p*-value are in parentheses.

Columns (2)–(3) indicate that agricultural industrial upgrading significantly raises per capita urban–rural income but does not significantly affect the urban–rural income gap.

Thus, when acting as a mediating mechanism, agricultural industrial upgrading primarily enhances “efficiency” in the GVC’s contribution to urban–rural common prosperity, while its effect on “equity” is limited. A potential explanation for this is the “distortion of the distribution mechanism,” which limits the practical effectiveness of promoting “equity.” When rural industries integrate into global value chains, profits often become concentrated in urban leading enterprises, leaving farmers with only minimal wages. This dynamic makes it difficult to reduce the urban–rural income gap. Additionally, the “siphoning effect” of cities on rural areas—characterized by the continuous outflow of skilled labor and capital toward urban industries—further undermines the potential for rural industrial upgrading to address the urban–rural divide. As a result, the ability of global value chain embedding to promote “equity” is significantly diminished.

Column (1) of Table 8 indicates that GVC embedding exerts a positive and highly significant effect on agricultural technological innovation at the 1% level, demonstrating that deeper embedding into GVCs fosters agricultural innovation. When relevant value chain activities concentrate in a specific region, they create a “cluster effect” that reduces the search costs for agricultural production factors, lowers transaction costs, and mitigates risks. This clustering also attracts key resources, including talent, technology, and infrastructure, which further enhances the specialization of agricultural production. As a result, agricultural efficiency improves and technological innovation is stimulated. Moreover, the high standards imposed by international markets for product quality, safety, and low-carbon emissions compel local agriculture to increase investment in the development of smart and green technologies to meet global supply chain requirements, thereby fostering further innovation in agricultural technology.

Columns (2)–(3) show that agricultural technological innovation significantly increases per capita urban–rural income and reduces the urban–rural income gap. Thus, when acting as a mediating mechanism, agricultural technological innovation enables GVC embedding to contribute positively to both “efficiency” and “equity” in promoting urban–rural common prosperity. Agricultural technological innovation is distinguished by its “low barriers to entry and wide applicability,” enabling it to effectively target vulnerable groups, such as smallholder farmers and remote rural communities. This characteristic helps prevent the concentration of technological benefits among a few entities, thereby mitigating the “Matthew effect” in wealth distribution. Moreover, within the context of digitalization, technological advancements can significantly empower and revitalize rural sectors, including intangible cultural heritage tourism and ecological agriculture. These innovations also create income opportunities for migrant workers returning to rural areas, left-behind women, and other low- and middle-income groups. As a result, such technological progress helps reduce the “polarization” of urban–rural income distribution, narrowing the income gap while raising per capita income in both urban and rural areas.

Column (1) of Table 9 shows that GVC embedding significantly enhances rural entrepreneurial vitality at the 1% level. The embeddedness of global value chains enables regions to develop the “three chains”—industry, supply, and value chains—creating numerous employment opportunities for skilled returnees. In addition, local governments provide favorable conditions for rural entrepreneurship, including supportive policies, funding, and infrastructure, alongside a conducive living, production, and ecological environment. These factors have attracted many highly educated young migrants, equipped with technical expertise and broad perspectives, to return to their hometowns and start businesses. Furthermore, the diffusion of industrial technologies from foreign-invested enterprises in rural areas has reduced entrepreneurial barriers, continuously stimulating rural entrepreneurship.

The estimation results presented in columns (2) and (3) reveal that rural entrepreneurial activity significantly impacts urban–rural per capita disposable income and the urban–rural Gini coefficient, with coefficients of 0.168 and -0.083 , respectively, both significant at the 5% and 1% levels. These findings suggest that rural entrepreneurship, as a mechanism, not only enhances “efficiency” but also contributes to promoting “equity” in the context of global value chain embedding, advancing urban–rural common prosperity. Specifically, global value chain embedding creates a favorable economic environment and technological conditions that foster rural entrepreneurship, thereby improving the region’s entrepreneurial activities. This, in turn, increases employment opportunities. Drawing on innovation theory for low-income populations (BOP), the use of digital technologies and big data platforms helps break down urban–rural barriers, allowing agricultural products to access urban markets at a premium. This not only boosts farmers’ income but also reduces the income gap between urban and rural areas. Additionally, businesses can develop new products and processes to meet the unmet needs of low-income groups, thus achieving poverty reduction and stimulating rural economic development. By integrating local labor, unique agricultural products, and other resources, entrepreneurship can support the development of specialized farming cooperatives, which not only increase farmers’ incomes but also narrow the urban–rural income disparity, reinforcing the “equity” effect and promoting urban–rural common prosperity.

To strengthen the robustness of the mediation analysis and to address the limitations of the stepwise regression approach, the Sobel–Goodman test and the bootstrap resampling method are employed to further assess the mediating roles of agricultural industrial structure upgrading, agricultural technological innovation, and rural entrepreneurial activity. The results of the Sobel–Goodman test are reported in Table 10. When the dependent variable is urban–rural per capita disposable income, the Sobel test Z-statistics for agricultural industrial structure upgrading, agricultural technological innovation, and rural entrepreneurial activity are 2.908, 7.330, and 2.331, respectively, all statistically significant at the 1% level, indicating that each channel exerts a significant mediating effect.

Table 10. Sobel–Goodman Mediation Test Results.

Statistic	INCOME			GINI		
	AIS	ATE	ANC	AIS	ATE	ANC
Z statistic	2.908	7.330	2.231	-0.384	-4.805	-2.215
Standard Error	0.020	0.035	0.054	0.007	0.007	0.008
P statistic	0.004	2.298×10^{-13}	0.026	0.701	1.544×10^{-6}	0.027

When the dependent variable is the urban–rural Gini coefficient, the corresponding Sobel test Z-statistics are -0.384 , -4.805 , and -2.215 , respectively. However, the p -value associated with agricultural industrial structure upgrading is 0.701, suggesting that its mediating role in promoting equity is not statistically significant, whereas agricultural technological innovation and rural entrepreneurial activity continue to exhibit significant mediating effects.

A bootstrap procedure was employed to examine whether the bias-corrected 95% confidence intervals of the estimates include zero. Confidence intervals excluding zero indicate a significant mediating effect. As shown in Table 11, when the dependent variable is the urban–rural Gini coefficient, the 95% confidence interval for agricultural industrial upgrading is $[-0.008, 0.007]$, encompassing zero. This suggests that, as a mediating mechanism, agricultural industrial upgrading significantly enhances “efficiency” in the impact of global value chain embedding on urban–rural common prosperity, but its effect

on “equity” is negligible. Additional results further support the robustness of the stepwise regression approach in assessing mediating effects.

Table 11. Bootstrap Test Results.

Dependent Variable	Mechanism Variables	Impact Pathway	Coefficient	BootSE	Z-Value	95% Confidence Interval	
						Lower Bound	Upper Bound
INCOME	AIS	Direct Effect	1.113	0.082	13.63	0.953	1.273
		Indirect Effect	0.040	0.022	1.78	0.004	0.084
	ATE	Direct Effect	1.052	0.067	15.75	0.921	1.183
		Indirect Effect	0.194	0.047	4.12	0.102	0.287
	ANC	Direct Effect	1.182	0.058	20.34	1.068	1.296
		Indirect Effect	0.064	0.025	2.53	0.014	0.114
GINI	AIS	Direct Effect	−0.073	0.008	−8.64	−0.089	−0.056
		Indirect Effect	−0.004	0.004	−0.11	−0.008	0.007
	ATE	Direct Effect	−0.060	0.011	−5.20	−0.082	−0.037
		Indirect Effect	−0.013	0.006	−2.14	−0.026	−0.001
	ANC	Direct Effect	−0.069	0.009	−7.48	−0.087	−0.051
		Indirect Effect	−0.004	0.002	−2.13	−0.007	−0.000

5. Expanded Analysis

5.1. Heterogeneity Analysis

As discussed above, embedding in global value chains not only directly increases urban–rural income levels in China but also plays a pivotal role in mitigating income inequality and narrowing urban–rural disparities. However, China’s vast geographic expanse is characterized by substantial regional differences in natural conditions, location advantages, factor endowments, industrial bases, and development policies. As a result, the impact of GVC embedding on urban–rural common prosperity is likely to be heterogeneous across regions. To systematically examine these variations, this study conducts a heterogeneity analysis along three dimensions: regional differences, geographic location, and income level.

5.1.1. Regional Heterogeneity

This section divides the sample regions into eastern and central–western, as well as southern and northern, to conduct a heterogeneity analysis. As shown in Table 12, the embeddedness of global value chains has a significantly positive effect on urban–rural per capita disposable income and a significantly negative effect on the urban–rural Gini coefficient in the eastern and southern regions. However, the impact of global value chain embedding on urban–rural common prosperity is not significant in the central–western and northern regions. One possible explanation is that regional heterogeneity drives the optimization of interregional labor division. The eastern and southern regions, benefiting from faster economic growth, more developed infrastructure, and a higher degree of openness, are better equipped to absorb and adapt advanced technologies. In contrast, the western regions have relatively lower levels of openness and still face infrastructure and industrial policy gaps compared to the eastern and southern regions.

Table 12. Test for Regional Heterogeneity.

Variable	Eastern Region		Central and Western Regions		Southern Region		Northern Region	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	INCOME	GINI	INCOME	GINI	INCOME	GINI	INCOME	GINI
GVC	1.028 *** (0.000)	−0.045 ** (0.012)	0.088 (0.769)	−0.014 (0.638)	0.988 *** (0.000)	−0.057 *** (0.000)	−0.145 (0.372)	−0.016 (0.777)
_cons	−19.50 * (0.076)	0.658 *** (0.009)	10.53 *** (0.001)	0.189 (0.644)	−0.152 (0.964)	1.124 *** (0.000)	9.002 *** (0.000)	1.207 ** (0.046)

Table 12. Cont.

Variable	Eastern Region		Central and Western Regions		Southern Region		Northern Region	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	INCOME	GINI	INCOME	GINI	INCOME	GINI	INCOME	GINI
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	132	132	228	228	180	180	180	180
Adjusted-R ²	0.981	0.972	0.901	0.971	0.966	0.978	0.960	0.978
F-value	416.44	4.14	3.29	6.12	214.73	406.33	5.02	4.27

Note: *, **, and *** denote significance at the 10%, 5%, and 1% statistical levels; *p*-value are in parentheses.

5.1.2. Geographic Heterogeneity (Coastal vs. Inland Provinces)

Geographic location is closely related to GVC embedding and the ease of trade; regions with more favorable trade conditions typically exhibit higher technological sophistication in their industrial products. Based on coastal versus inland status, this study categorizes China's provinces, municipalities, and autonomous regions accordingly and examines the geographic heterogeneity of GVC embedding's impact on urban–rural common prosperity. The results, reported in Columns (1)–(4) of Table 13, reveal that in coastal provinces, GVC embedding has a significantly positive effect on per capita urban–rural income and a significantly negative effect on the urban–rural Gini coefficient, indicating that GVC embedding in these regions broadly promotes urban–rural common prosperity.

Table 13. Test for Heterogeneity in Geographic Location and Income Levels.

Variable	Coastal Provinces		Inland Provinces		Developed Regions		Less-Developed Regions	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	INCOME	GINI	INCOME	GINI	INCOME	GINI	INCOME	GINI
GVC	1.002 *** (0.000)	−0.048 ** (0.016)	0.421 (0.321)	−0.096 (0.373)	0.997 *** (0.000)	−0.217 ** (0.039)	0.965 *** (0.000)	−0.009 (0.612)
_cons	1.688 (0.535)	1.088 *** (0.009)	8.282 ** (0.049)	0.641 (0.513)	−19.16 *** (0.008)	9.499 *** (0.000)	−3.756 (0.176)	0.289 (0.259)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	132	132	228	228	120	120	240	240
Adjusted-R ²	0.978	0.970	0.889	0.750	0.985	0.980	0.900	0.973
F-value	910.64	59.38	5.91	11.05	1484.53	18.87	123.97	10.02

Note: *, **, and *** denote significance at the 5%, and 1% statistical levels; *p*-value are in parentheses.

By contrast, for inland provinces, GVC embedding has no significant effect on either per capita income or the Gini coefficient. In other words, the contribution of GVC embedding to urban–rural common prosperity in inland provinces is limited in terms of both “efficiency” and “equity.” This difference likely arises because coastal provinces benefit from superior transportation infrastructure and a stronger industrial base, which translates into higher dependence on foreign trade and more integrated urban–rural development, thereby enhancing the urban–rural common prosperity effect. Inland provinces, however, face relatively limited transport connectivity and weaker industrial foundations, resulting in slower trade development and a pronounced urban–rural dual structure. Surplus rural labor in these regions tends to migrate toward coastal provinces rather than clustering in local industrial sectors. Consequently, while trade liberalization improves urban–rural income distribution, its effect on overall income growth in inland regions remains limited.

5.1.3. Income-Level Heterogeneity

Based on the average GDP of each region in 2022, the sample is divided into developed and underdeveloped regions to conduct a heterogeneity analysis of income levels. The results in Table 13 show that GVC embedding has a significantly positive effect on per capita urban–rural income in both developed and less-developed regions. Moreover, GVC embedding significantly reduces the urban–rural Gini coefficient in developed regions, whereas its effect on the Gini coefficient in less-developed regions is not statistically significant.

In developed regions, where economic scale is relatively high, factor allocation is more efficient, and integration between industrial and agricultural sectors is well established, GVC embedding not only enhances “efficiency” but also fosters “equity” in urban–rural development. By contrast, in less-developed regions with smaller economic scales, the immediate focus is on improving “efficiency” and overcoming growth constraints. Under these circumstances, local governments tend to prioritize industrial development, which limits the ability to balance sectoral priorities. Consequently, while GVC embedding in less-developed regions contributes to “efficiency” through the dual development of industrial and agricultural sectors, its positive impact on “equity” remains constrained.

5.2. Further Discussion: The Persistence of GVC Embedding Effects on Urban–Rural Common Prosperity

Global value chain embedding fosters agricultural industrial upgrading, technological innovation, and rural entrepreneurial vitality, thereby promoting urban–rural common prosperity. A key question, however, is whether the effects of GVC embedding are transient or persist over time. To assess the durability of these impacts on farmers’ income growth, this study examines the relationship between current GVC embedding and urban–rural common prosperity outcomes one to three periods ahead.

The results, reported in Table 14, indicate robust persistence. In terms of efficiency, when the dependent variables are per capita urban–rural disposable income in periods $t + 1$, $t + 2$, and $t + 3$, the coefficients of GVC embedding are all positive and statistically significant at the 1% level. Regarding equity, the coefficients for the impact of global value chain embedding on the urban–rural Gini coefficients in the next, second, and third periods are all significantly negative at the 1% level. This further confirms that global value chain embedding not only bridges the “gap” in urban–rural labor productivity but also helps reduce income disparities among individual urban and rural residents, thereby enhancing the effect of global value chain embedding on urban–rural common prosperity.

Table 14. The Long-Term Effects of Global Value Chain Embedding on Shared Prosperity in Urban and Rural Areas.

Variable	Urban–Rural Common Prosperity Effect: Efficiency Dimension			Urban–Rural Common Prosperity Effect: Equity Dimension		
	(1)	(2)	(3)	(4)	(5)	(6)
	INCOME _{t+1}	INCOME _{t+2}	INCOME _{t+3}	GINI _{t+1}	GINI _{t+2}	GINI _{t+3}
GVC	0.625 *** (0.000)	0.789 *** (0.000)	0.749 *** (0.000)	−0.036 *** (0.004)	−0.051 *** (0.000)	−0.026 *** (0.005)
_cons	−47.49 *** (0.000)	−35.97 *** (0.000)	−33.99 *** (0.000)	4.854 *** (0.000)	4.251 *** (0.000)	5.058 *** (0.000)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	330	300	270	330	300	270
Adjusted-R2	0.954	0.958	0.953	0.984	0.984	0.987
F-value	223.85	422.06	331.95	132.94	144.08	198.82

Note: *** denote significance at 1% statistical levels; *p*-value are in parentheses.

6. Conclusions and Policy Implications

This study, based on provincial panel data from China covering the period from 2011 to 2022, constructs panel data models and mediation effect models to examine the impact of global value chain embedding on urban–rural common prosperity. This is explored within the unified framework of two key dimensions of common prosperity: “efficiency” and “equity.” The empirical analysis identifies the mechanisms and pathways through which GVC embedding affects urban–rural common prosperity. The key findings are as follows:

First, embedding in global value chains significantly increases per capita income levels in both urban and rural areas and narrows the urban–rural income gap, thereby promoting urban–rural common prosperity through both efficiency-enhancing and equity-improving channels. These findings remain robust after a series of robustness checks, including replacing the dependent variables, applying more stringent control strategies, excluding outliers and centrally administered municipalities, as well as conducting endogeneity tests using a system generalized method of moments (GMM) estimator and a Bartik-style instrumental variable within a two-stage least squares (2SLS) framework. Moreover, further analysis indicates that the positive effect of global value chain embedding on urban–rural common prosperity is persistent over time.

Second, mediation effect tests reveal that GVC embedding significantly enhances “efficiency” through the upgrading of agricultural industrial structure, but its impact on “equity” is not significant. However, agricultural technological innovation and rural entrepreneurship play key roles in enhancing both “efficiency” and “equity” within the GVC embedding process. These mechanisms accelerate the realization of urban–rural common prosperity. Additionally, both the Sobel–Goodman test and the bootstrap resampling method further confirm the robustness of the above mediation effect results.

Third, heterogeneity analysis shows that in the eastern, southern, coastal, and developed regions, GVC embedding has a significantly positive impact on urban–rural common prosperity. In contrast, in the central–western, northern, inland, and underdeveloped regions, the effects of GVC embedding on urban–rural per capita disposable income and the income gap are not significant, indicating that the expected urban–rural common prosperity effects have not materialized in these regions.

To effectively enhance China’s position in the global value chain and maximize the positive impact of GVC embedding on urban–rural common prosperity, the following strategies should be implemented:

First, vigorously guide industrial upgrading toward a transformation that balances efficiency and equity. On one hand, encourage the extension of urban capital and technology to both ends of the agricultural value chain “smile curve,” fostering new integrated sectors such as agricultural product processing, rural e-commerce, and leisure agriculture. On the other hand, establish robust benefit-sharing mechanisms to ensure that value-added gains and employment opportunities are retained by farmers—particularly low-income rural populations—so that they capture a greater share of industrial value creation, thereby narrowing the urban–rural income gap.

Second, strengthen the enabling role of technological innovation in promoting urban–rural common prosperity. Specifically, focus on disruptive agricultural technological innovations, integrate leading research resources, and develop agricultural technology innovation platforms, with particular emphasis on technologies suitable for rural contexts. Efforts should aim to convert technological achievements into tangible income growth for farmers. In addition, leverage digital technologies to optimize the allocation of production factors, improve resource-use efficiency across agricultural value chains, and provide a solid foundation for agricultural technological innovation to advance urban–rural common prosperity.

Third, local governments should actively explore multi-dimensional pathways for re-turning rural entrepreneurship to promote employment. This includes increasing regional support for entrepreneurship, providing start-up subsidies, and maximizing the employment effects of entrepreneurial ventures to broaden farmers' income channels, thereby improving overall entrepreneurship quality and non-agricultural employment levels. Simultaneously, mechanisms should be established to ensure the smooth flow of factors between urban and rural areas, avoiding negative impacts on agricultural production when surplus rural labor shifts to non-agricultural sectors.

Fourth, implement region-specific policies combined with coordinated, cross-regional development strategies. For central, western, northern, inland, and less-developed regions, accelerate investment in both traditional infrastructure and new infrastructure to address existing gaps, enhance physical connectivity with external markets, and overcome geographic and informational barriers to regional trade, thereby strengthening GVC resilience. At the same time, promote collaboration between eastern coastal regions and less-developed provinces through joint industrial parks and resource processing bases. These initiatives can absorb overflow activities from developed regions, such as primary agricultural processing or foreign-trade contract manufacturing, helping to reduce regional economic disparities and achieve genuine urban–rural common prosperity.

Although this study draws on extensive data and employs rigorous empirical methods to investigate the effects of global value chain embedding on urban–rural common prosperity from the dual perspective of efficiency and equity, several limitations should be acknowledged. First, common prosperity reflects not only the integrated pursuit of efficiency and equity but also the coexistence of material and spiritual well-being. The current analysis evaluates GVC embedding primarily through efficiency- and equity-related dimensions, both of which focus on material outcomes. The exclusion of spiritual or cultural well-being may limit the conceptual scope and overall analytical completeness of the research.

Second, regarding the measurement of GVC embedding, the use of export technological complexity offers notable advantages, particularly its reliance solely on export and income data without the need for detailed industry-level trade matching or precise product classification standards. Nevertheless, this approach does not account for the technological content embedded in imported intermediate goods, potentially leading to an overestimation of a country's GVC embedding. Future research should consider incorporating alternative indicators or methodological refinements to more accurately capture the multidimensional nature of GVC embedding and enhance the empirical robustness of related findings.

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