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The Impact of China's Global Value Chain Embedding on Bilateral Trade with Southeast Asian Countries

Lingyun Zhao
School of Management, University of Shanghai for Science and Technology, Shanghai, China
Email: 2068420940@qq.com

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Abstract

Under the dual background of global value chain (GVC) restructuring and a new round of technological revolution, this paper examines the effect of China's GVC embedding degree on bilateral trade with Southeast Asian countries, which have remained China's largest trading partner since 2020, accounting for 15.94% of China's total foreign trade in 2024. Combining literature analysis, descriptive data analysis, and a time-series regression on annual data from 2015 to 2023, the GVC embedding degree is measured by the share of intermediate-goods trade in total trade, following Yeats (1998). The results show that a one-unit increase in China's GVC embedding degree raises bilateral trade by 12.94 units on average, with an R-squared of 0.86, indicating strong explanatory power. Sub-country regressions reveal heterogeneous effects, with coefficients of 14.98 for Vietnam, 6.84 for Singapore, and 10.39 for the Philippines, all statistically significant. The findings confirm that high-quality GVC embedding promotes trade through technology spillovers, industrial upgrading, and deepened division of labor. Policy recommendations are accordingly proposed for the government, industries, and enterprises to enhance the resilience of regional value chains and the quality of bilateral trade.

Keywords

Global Value Chain Embedding; China-Southeast Asia Trade; Intermediate Goods; Time-Series Regression; Industrial Upgrading; Trade Complementarity

1. Introduction

1.1. Background

Amid profound changes in the global economic landscape, anti-globalization sentiment and technological blockades by developed economies have accelerated the restructuring of global value chains. The United States has repeatedly imposed technology export controls and raised tariffs, pushing some manufacturing activities to relocate to lower-cost Southeast Asian countries, while the European Union has strengthened trade barriers against Chinese electric vehicles. As a result, global

economic integration is gradually being replaced by regional economic integration, forming a tripartite structure of North American, European, and Asian value chains.

Within this context, Southeast Asia has become increasingly important to China. ASEAN has remained China's largest trading partner for five consecutive years since 2020. In 2024, China's bilateral trade with Southeast Asian countries reached approximately 6,990.8 billion RMB, accounting for 15.94% of China's total foreign trade. Vietnam, Malaysia, Indonesia, Thailand, and Singapore were the five largest trading partners. This stable and expanding trade relationship provides a solid foundation for deepening regional cooperation.

At the same time, the new round of technological revolution, centered on digital, new-energy, and new-material technologies, is reshaping the international division of labor and creating new opportunities for latecomer countries. China, with its complete industrial system and strong manufacturing capabilities, and Southeast Asian countries, with their labor-cost advantages, are both well positioned to benefit. Deepening the quality of China's GVC embedding is therefore considered a key channel for injecting new impetus into China-Southeast Asia trade through technology spillovers, industrial upgrading, and a balanced international balance of payments.

The restructuring of global value chains is characterized by regionalization and dispersion, as global economic integration is gradually replaced by regional economic integration, forming a tripartite pattern of North American, European, and Asian value chains. In this process, Southeast Asia has partly undertaken the role of China's “world factory”, engaging in the processing and assembly links of the GVC. Meanwhile, the digital economy has greatly improved production efficiency and spawned new industries and new business models, which is consistent with China's advocacy of multilateralism. Given that China and Southeast Asian countries are both latecomers in global competition, their complementary advantages provide a favorable condition for deepening the quality of GVC embedding and upgrading the division of labor in the regional value chain.

1.2. Literature Review

Existing studies generally agree that raising a country's GVC embedding degree improves trade through three pathways: increasing the technology content of exports, promoting domestic industrial upgrading, and optimizing the trade structure. Wiryawan et al. (2023) construct a GVC database for 37 countries and find that GVC participation raises the share of high-technology sectors by about 0.4%. Zhao et al. (2023) verify that GVC embedding contributes to the upgrading and rationalization of industrial structures, with significant effects in eastern China. Zhu (2024), using provincial data from 2017 to 2021, demonstrates that GVC embedding improves the resilience of export trade.

Regarding regional trade, Luo (2025) analyzes the impact of the Regional

Comprehensive Economic Partnership (RCEP) on China-ASEAN bilateral trade, and Li and Tang (2024) document a deepening trade complementarity between China and Southeast Asia. Lee et al. (2021) compare the automotive sectors in Malaysia, Thailand, and China, and Xue (2024) examines the new motivations and challenges of Chinese manufacturing investment in Southeast Asia. However, most studies focus on the effects of GVC embedding on national endogenous issues such as export technology sophistication or industrial upgrading, while paying limited attention to the radiation effects on regional trade networks. This paper fills this gap by taking bilateral trade with Southeast Asia as the dependent variable.

1.3. Research Purpose, Method and Contribution

To verify whether high-quality GVC embedding can inject new impetus into China-Southeast Asia trade, this paper combines literature analysis, quantitative data analysis, and empirical regression. The main explanatory variable is China's GVC embedding degree, and the dependent variable is the total bilateral trade between China and Southeast Asian countries. The innovation lies in constructing a three-path mechanism of "technology spillover, industrial linkage, and deepening division of labor" to analyze how GVC embedding promotes bilateral trade through regional value chain synergies, thereby enriching the measurement of GVC participation at the regional level.

Theoretically, the study enriches the application of the national competitive advantage theory, the global value chain theory, and the marginal industry theory in regional economic cooperation. Practically, it clarifies the respective export advantages of China and Southeast Asian countries and provides decision-making references for Chinese enterprises aiming to expand into the Southeast Asian market, which is characterized by a vast market, low costs, favorable policies, and geographical proximity.

2. Trade Status and Trends between China and Southeast Asia

2.1. Overall Trade Data

Based on data released by the General Administration of Customs of China, the total import and export value between China and Southeast Asian countries in 2024 was approximately 6,990.8 billion RMB. Table 1 presents the trade data for the five largest partners. Vietnam was China's largest trading partner in Southeast Asia, with a bilateral trade volume of 1,854.7 billion RMB, up 14.6% year on year; Malaysia and Indonesia followed with 1,508.3 and 1,051.5 billion RMB, respectively.

Table 1. Bilateral trade between China and Southeast Asian countries in 2024 (unit: 100 million RMB).

Country	Import & Export	Share (%)	YoY Growth (%)
Vietnam	18546.9	26.53	14.6
Malaysia	15083.0	21.58	12.7

Indonesia	10515.0	15.05	7.4
Thailand	9532.8	13.64	7.4
Singapore	7904.3	11.31	3.9

Source: compiled from data released by the General Administration of Customs of China (www.customs.gov.cn).

Among the remaining countries, the Philippines (509.4 billion RMB, +1%) and Cambodia (126.9 billion RMB, +22%) grew steadily, while trade with Myanmar (-21%) and Timor-Leste (-20%) declined markedly due to geopolitical and structural factors.

In terms of trade balance, China ran a surplus with most Southeast Asian countries in 2024, with the most significant surpluses of 449.1 billion RMB with Vietnam, 336.6 billion RMB with Singapore, and 234.3 billion RMB with the Philippines, while recording a deficit with Malaysia, Laos, and Brunei. Overall, China's trade with Southeast Asia remained in surplus, which is closely related to the different positions of the two sides in the regional division of labor.

2.2. Structural Features and GVC Embedding Trend

In terms of commodity structure, electromechanical products and electronic-information intermediate goods constitute the core of China's exports to Southeast Asia, while agricultural products and mineral resources dominate imports. This complementary trade structure reflects the advantages of regional division of labor. Meanwhile, China's GVC embedding degree, measured by the share of intermediate-goods trade in total trade, showed a fluctuating upward trend from 2015 to 2023, with an average annual increase of about 0.6%, as shown in Table 2 and Figure 1.

Table 2. Degree of China's GVC embedding, 2015-2023.

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023
Degree	0.565	0.564	0.581	0.59	0.589	0.576	0.605	0.625	0.61

Source: calculated from intermediate-goods trade data in the UN Comtrade database (comtradeplus.un.org).

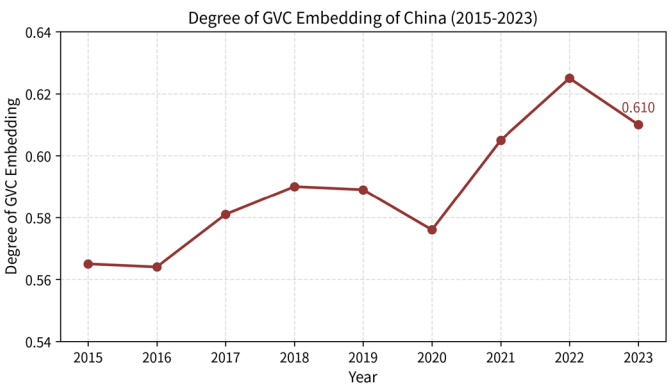


Figure 1. Degree of China's GVC embedding, 2015-2023.

The GVC embedding degree fluctuated in a small range during 2015-2019, declined by 0.013 in 2020 due to the COVID-19 shock, and rebounded rapidly to a peak of

0.625 in 2022, reflecting the resilience of China's supply chains and the synergy of regional value chains brought by RCEP. Although the degree declined slightly in 2022-2023, bilateral trade continued to grow, highlighting the need for an empirical test of the relationship between the two variables.

2.3. Trade Complementarity and Potential

The deepening cooperation is also reflected in investment. According to the 2023 Statistical Bulletin of China's Outward Foreign Direct Investment, China's FDI flow to Southeast Asia reached 25.1 billion USD in 2023, with its share in China's global investment expanding to about 14.17%. The continuous progress of high-value-added manufacturing, such as new-energy vehicles and electronic information products, has strengthened the industrial linkage between the two sides. The main categories of high-value-added manufactured goods traded between the two sides are shown in Table 3. Emerging fields including cross-border e-commerce, digital payment, tourism, and the blue economy have become new growth points for bilateral cooperation.

Table 3. Main high-value-added manufactured goods and corresponding HS codes (4-digit).

Electronic Equipment	Precision Machinery	Pharmaceutical	Automotive
ICs (8542)	Medical instruments (9018)	Pharmaceuticals (3004)	Passenger cars (8703)
Communication equipment (8517)	Semiconductor manufacturing (8486)	Antibiotic raw materials (2941)	Auto parts (8708)
Computer parts (8471)	X-ray inspection (9022)	-	-

Source: compiled from data released by the General Administration of Customs of China (www.customs.gov.cn).

3. Major Problems in Bilateral Trade

3.1. Export Structure Problems

First, China and Southeast Asian countries, as developing economies, are prone to falling into the comparative-advantage trap by relying on labor-intensive and primary products, which leads to low value added and worsening terms of trade. Second, China's export competitiveness still faces challenges such as technology blockades by developed countries, low-end lock-in in the GVC, and an export structure that relies heavily on mid- and low-end products. Third, the export market is overly concentrated, which increases the fragility of bilateral trade and the risk of trade frictions.

3.2. International Balance of Payments Imbalance

The imbalance of international payments between China and Southeast Asia is significant. For example, China's trade surplus with Vietnam was about 449.1 billion RMB, accounting for 13.12% of Vietnam's GDP in 2024, which may be identified as a huge surplus and easily trigger trade frictions. An excessive surplus is essentially an intensive exploitation of domestic resources, which not only causes resource waste but also increases the pressure of RMB appreciation and the risk of inflation.

3.3. Industrial Structure Problems

China's industrial structure also faces problems of homogeneity, insufficient upgrading momentum, and imperfect internal coordination. Overlapping industrial structures, such as the textile industry in both China and Vietnam, intensify low-end competition; a lack of high-quality foreign investment and independent innovation capability restricts the upgrading to high-value-added industries; and lagging infrastructure increases the cost of agricultural product trade.

In addition, the imbalance of the international economic environment and stricter environmental regulations also constrain the sustainable development of bilateral trade. Trade protectionism such as anti-dumping and countervailing investigations compresses China's trade gains, while differentiated environmental standards among Southeast Asian countries raise the compliance costs of Chinese multinational enterprises. These factors collectively suggest that simply expanding the scale of trade is insufficient; it is necessary to enhance the quality of GVC embedding through technological innovation and industrial upgrading.

4. Empirical Analysis

4.1. Theoretical Mechanism

Embedding into the GVC can improve export product quality through technology spillovers. At the early stage of embedding, developing countries can absorb knowledge spillovers and technology transfer from developed countries, thereby improving production efficiency and innovation capability. GVC embedding also promotes industrial structure upgrading through industrial linkage effects, as the expansion of intermediate-goods trade drives the growth of related industries. In addition, participating in the GVC enhances international competitiveness at the enterprise, industry, and national levels, and improves the balance of payments by upgrading the value added of exports.

Theoretically, the GVC concept evolved from the value-chain theory of Michael Porter in The Competitive Advantage of Nations, was extended to the global spatial dimension by Krugman in 1995, and was formally proposed as “global value chains” by Gereffi in 2001. As a country's GVC embedding degree rises, its foreign-trade dependence also increases, drawing more countries into the scope of the GVC and reshaping the mode of international trade and the structure of commodities. In particular, the heterogeneous-firm theory of Melitz suggests that resources tend to flow from low-productivity to high-productivity firms, implying that when an industry's production level improves and trade gains increase, social resources will be reallocated toward high-profit, high-efficiency industries, thereby upgrading the industrial structure.

The manufacturing transfer from China to Southeast Asia is not merely an outflow of production capacity but a result of regional value chain coordination. As RCEP takes effect, the agglomeration effect of regional industrial, supply, and value chains will

be amplified, creating favorable conditions for forming an expanded “world factory” centered on China. Therefore, the core hypothesis of this paper is that raising China's GVC embedding degree promotes the quality and quantity of bilateral trade.

4.2. Model Specification and Data

Following Yeats (1998), China's GVC embedding degree is measured by the ratio of intermediate-goods trade to total trade. The dependent variable is the total bilateral trade between China and Southeast Asian countries (Y, in logarithm), and the explanatory variable is China's GVC embedding degree (X). The data cover the period 2015-2023, with nine annual observations. Trade data are from the General Administration of Customs of China, and intermediate-goods data are from the UN Comtrade database based on the BEC classification. The BEC codes of intermediate goods adopted in this paper are listed in Table 4.

Table 4. BEC codes of intermediate goods used in this paper.

BEC Code	Description
111	Food and beverages, primary, mainly for industry
121	Food and beverages, processed, mainly for industry
21	Industrial supplies not elsewhere specified, primary
22	Industrial supplies not elsewhere specified, processed
31	Fuels and lubricants, primary
322	Other fuel and lubricants
42	Parts and accessories of capital goods
53	Parts and accessories of transport equipment

4.3. Descriptive Statistics

Table 5 reports the descriptive statistics of the two variables. The dependent variable Y has a mean of 27.21 and a standard deviation of 0.29, indicating that bilateral trade is relatively stable. The explanatory variable X has a mean of 0.5896 and a standard deviation of 0.02, with a range of only 0.0606, indicating that China's GVC embedding degree changed smoothly during the sample period.

Table 5. Descriptive statistics.

	Y	X
Mean	27.20729	0.589629
Median	27.18789	0.589327
Maximum	27.6065	0.624892
Minimum	26.83799	0.564308
Std. Dev.	0.288141	0.020682
Observations	9	9

4.4. Correlation Analysis

The Pearson correlation coefficient between X and Y is 0.929, significant at the 1% level, indicating a high positive correlation between China's GVC embedding degree and bilateral trade, which is consistent with expectations, as shown in Table 6.

Table 6. Correlation matrix.

	Y	X
Y	1	
X	0.929***	1

Note: *** denotes significance at the 1% level.

4.5. Unit Root Test

To examine the stationarity of the time series and avoid spurious regression, an ADF unit root test is conducted. As shown in Table 7, the original series y and x are non-stationary, with p-values of 0.8599 and 0.1496, respectively. After first differencing, both Δy and Δx become stationary at the 5% significance level, indicating that the two series are integrated of order one, I(1).

Table 7. ADF unit root test results.

Variable	ADF Statistic	P-value	Stationary
y	-0.4209	0.8599	No
x	-3.0225	0.1496	No
Δy	-2.3718	0.0211	Yes
Δx	-3.4021	0.0227	Yes

4.6. Regression Results

Table 8 reports the regression results of X on Y. The coefficient of X is 12.943 (p = 0.0003), significant at the 1% level, indicating that a one-unit increase in China's GVC embedding degree raises bilateral trade by an average of 12.94 units. The R-squared is 0.863 and the adjusted R-squared is 0.844, indicating that the model explains about 86% of the variation in bilateral trade. The F-statistic (44.13, p = 0.000) confirms the overall significance of the model. The estimated regression equation is Y = 12.94X + 19.58.

Table 8. Regression results of the main model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X	12.943	1.948	6.643	0.0
C	19.576	1.149	17.03	0.0
R-squared	0.863	Mean dep. var	27.207	
Adjusted R-squared	0.844	S.D. dep. var	0.288	
F-statistic	44.127	Durbin-Watson	1.332	
Prob(F-statistic)	0.0			

To examine heterogeneity, regressions are run separately for Vietnam, Singapore, and the Philippines, as shown in Table 9. The coefficient is 14.98 (p = 0.0024) for Vietnam, 6.84 (p = 0.0006) for Singapore, and 10.39 (p = 0.0002) for the Philippines, all significant at the 1% level. The strong effect on Vietnam reflects its role as a major destination of China's manufacturing relocation, while the relatively small effect on Singapore reflects its high share of high-value-added services. The results consistently confirm that raising China's GVC embedding degree significantly promotes bilateral trade, providing a differentiated path for policy design.

Table 9. Sub-country regression results (coefficient of X).

Country	Coefficient	Std. Error	t-Statistic	Prob.	R-squared
Vietnam	14.982	3.228	4.642	0.0024	0.755
Singapore	6.84	1.159	5.899	0.0006	0.833
Philippines	10.391	1.515	6.859	0.0002	0.87

5. Conclusions and Policy Recommendations

5.1. Conclusions

Based on data analysis, theoretical discussion, and empirical research, this paper draws the following conclusions. First, China-Southeast Asia trade is generally growing and stable, with the regional value chain and economic initiatives such as RCEP as core drivers. Second, China's GVC embedding degree has a significant positive effect on bilateral trade: a one-unit increase raises trade by 12.94 units on average, with a model explanatory power of 86%, verifying the pathways of technology spillover, industrial linkage, and deepened division of labor. Third, bilateral trade still faces problems such as balance-of-payments imbalance, export structure risks, and industrial homogeneity, leaving room for improvement.

5.2. Policy Recommendations

For the government, it is essential to strengthen top-level design by boosting domestic demand and supporting strategic emerging industries, to build resilient and secure supply chains through independent innovation, and to deepen regional rule alignment and trade facilitation with Southeast Asian countries by leveraging digital technology. In particular, the government should implement a strategic trade policy, promote the consumption upgrading of new business forms, formulate new international trade rules that align with high-standard international standards, and deepen the joint construction of regional industrial and supply chains.

For industries, it is necessary to cultivate independent innovation and independent brands, completing the transition from OEM to ODM to OBM; to optimize the business environment, as a 1% improvement in the business environment index is associated with a 0.3% increase in manufacturing total factor productivity; and to enhance talent competitiveness through educational investment and international talent mobility, as well as to promote the transformation and upgrading of the service industry through supply chain integration and cross-border cooperation.

For enterprises, it is advisable to respond to the national strategy by expanding business through overseas investment in Southeast Asia, to develop high-value-added industries, and to build global brands through strengthened brand promotion, product quality, and international marketing, thereby improving the international competitiveness of Chinese enterprises. By combining technological innovation with brand building, enterprises can better integrate into the regional value chain and enhance the resilience and quality of bilateral trade.

5.3. Research Outlook

Future research could focus on practical value, such as constructing an evaluation index system for the "dual circulation" strategy, and deepening the study of value chain coordination in strategic emerging industries such as new energy and artificial intelligence, so as to better adapt to the "regionalization plus digitalization" restructuring trend of the global value chain and build a more explanatory theoretical system of regional value chains.

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