OFDI and Global Value Chain Reconstruction under the "Belt and Road" Initiative

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Abstract: The global industrial structure is accelerating its transformation, and global value chains are being restructured under the differentiation of trade systems and investment. This paper discusses the impact of OFDI on GVC restructuring under the "Belt and Road" initiative, aiming to analyze the resource reallocation of Chinese enterprises in the global market and its role in value chain upgrading. This paper finds that OFDI can significantly increase the degree of GVC embeddedness of enterprises, in which technological innovation, vertical integration adjustment, specialization and industrial chain integration are important mechanisms affecting the upgrading of GVC. The moderating effect of "Belt and Road" is weakly negatively correlated, but the trade facilitation, digital infrastructure improvement and financial support it promotes provide long-term development momentum for enterprise GVC embeddedness. Meanwhile, private firms, manufacturing firms, and non-asset-intensive firms are more likely to benefit from OFDI and enhance GVC embeddedness.

Keywords: Belt and Road Initiative, outward foreign direct investment, global value chain

1. Introduction

Global value chains (GVC) have reshaped production and trade integration, allowing firms to operate within both domestic industrial clusters and global networks [1]. As Chinese enterprises deepen GVC participation, they face shifts in global industrial division. OFDI trends show "de-globalization," "localization," and regionalization. Rising labor and land costs, along with trade protectionism-driven "de-Chinaization" by developed nations, threaten China's labor- and resource-intensive industries. Meanwhile, ASEAN trade, the Belt and Road Initiative (B&R), and U.S. "near-shoring" accelerate regionalized value chain development.

The BRI has expanded from the Ancient Silk Road to a global initiative, covering three economic belts and two maritime routes. By October 2024, China had signed agreements with 158 countries and 30+ international organizations, with total trade exceeding $21 trillion and direct investment surpassing $270 billion since 2013. While the BRI's trade volume is rising, a key question remains: Can OFDI under the BRI drive China's industrial upgrading and improve its GVC position through high-quality exports?

This paper makes three key contributions. First, unlike existing studies focusing on trade volume or GVC impacts under the global trading system, this paper integrates the economic and trade effects of the BRI into the GVC framework, analyzing China's industrial chain upgrading and trade shifts along the BRI. Second, amid evolving OFDI trends and China's changing global trade position, this

paper examines how the BRI can serve as a catalyst for strengthening China's GVC position, offering valuable insights for economic development.

2. Literature review

The scientific and technological progress and trade facilitation brought by OFDI have refined the international division of labor and deepened GVCs. However, Brakman et al. noted that due to geopolitics and trade friction, the division of labor is shifting toward regionalization, leading to GVC reconstruction [2]. As a key global economic player, China's B&R will significantly impact this restructuring.

At present, the research on global value chains (GVC) is mainly divided into three categories. The first category is mainly related to the motivation of GVC reconstruction in the context of China's development. Niu et al. [3] proposed that reverse globalization and the value chain break triggered by it is not a short-term phenomenon, and global demand shrinkage is a long-term trend. China's supply advantage in GVC is hard to replace, but the incremental increase is low due to anti-globalization. The second type of literature mainly analyzes the interaction mechanism between economic and trade factors and GVC. This type of literature is mainly based on the "vertical specialization index" constructed by Hummels et al. [4], and the "GVC status index" and "GVC participation rate" by Koopman et al. [5]. ". Some scholars have constructed simulation models through the fixed scale coefficient allocation method to analyze the impact of trade friction between China and the U.S. and other trade shocks on GVC [6]. The above literature has studied GVC and the division of labor in China's value chain in some depth, but it has not analyzed the current situation of OFDI in relation to GVC. More relevant to this theme is the third category of GVC-related studies, where attention is focused on value chain resilience. Qi et al. [7] found that industrial robots inhibit OFDI, improve industrial toughness, and mitigate the impact of the "binary paradox" of the industrial chain. Based on the vertical correlation of the industrial chain, Zhang and Yang [8] found that forward spillover effects increase downstream resilience and backward spillover inhibits upstream resilience.

Existing research generally agrees that OFDI positively impacts GVCs. Song [9] found that OFDI improves GVC quality, efficiency, and stability, while Liu [10] examined its role in GVC reconstruction through bilateral cooperation and positioning. Song et al. [11] emphasized foundational restructuring capacity as a moderating factor, and Liang et al. [12] found that OFDI enhances bilateral value chain positioning within RCEP countries, though with heterogeneity. However, most studies focus on regional or national levels, while this paper examines the enterprise level.

B&R continually brings new growth opportunities for GVC reconstruction, potentially driving China's industrial upgrading. Gravity models show that regional agreements can significantly influence trade expectations [13]. Early studies, such as Kong and Dong [14], found that trade facilitation under the initiative enhances GVC potential. Using a difference-in-differences model, researchers demonstrated that transportation investments by Chinese firms promote export growth [15], though most research focuses on trade scale rather than value chain growth. Lu et al. [16] found that improved export quality in domestic cities along the B&R drives high-quality exports. Recent studies focus on digital trade, with Cao et al. [17] concluding that digital trade facilitation significantly boosts GVC upgrading, particularly in manufacturing and developed countries. The shift in industrial centers and value chain divisions under OFDI's influence remains underexplored, making this paper's focus on OFDI's role in GVC reconstruction within the B&R framework particularly relevant.

3. Theoretical Analysis and Research Hypotheses

3.1. Relationship between OFDI and GVC

In the context of economic globalization and regional integration, OFDI drives global production integration by enabling developed regions to invest in less developed ones, enhancing their role in the global industrial and value chains.

First, OFDI fosters GVC reconstruction through technological innovation by transferring industrial technology and R&D activities, accelerating innovation in developing regions, upgrading their industrial chain status, and strengthening GVC embeddedness.

Second, OFDI enhances GVC embeddedness through vertical integration, enabling firms to expand beyond manufacturing into services, boosting economic growth, national competitiveness, and industry diversification in developing regions.

Third, OFDI promotes value chain synergy by facilitating industrial chain integration, balancing specialization and vertical integration. This strengthens firm networks, enhances industrial collaboration, and deepens countries' GVC participation.

Thus, Hypothesis 1 proposes that OFDI positively impacts GVC status through technological innovation, vertical integration, and industrial chain integration.

3.2. Relationship between B&R and GVC reconstruction

B&R promotes infrastructure connectivity, trade, financial integration, and policy coordination, driving economic growth and optimizing global resource allocation through OFDI, thereby restructuring the global value chain (GVC).

First, it fosters technological progress via infrastructure development, OFDI, and technological exchanges, enhancing industrial competitiveness and GVC restructuring. Bair [18] emphasizes that firms improve their GVC position by increasing high value-added activities and using GVCs more efficiently. Efficient information exchange and technological advancement enable the transfer of inefficient production to emerging markets, further upgrading firms' GVC positions [19].

Second, it stabilizes policies and reduces supply chain risks through multilateral and bilateral cooperation, lowering trade and investment barriers. Firms in GVCs engage in more intermediate goods trade, which is highly dependent on cross-border trade facilitation and sensitive to supply chain risks. To mitigate these risks, firms adopt localized sourcing and "nearshore solutions" [20], reducing GVC embeddedness. The initiative counters this by aligning policies and enhancing governance efficiency.

Thus, Hypothesis 2 posits that B&R can significantly moderate and enhance OFDI participation in GVC.

3.3. Heterogeneity analysis of the characteristics of countries along the Road

Countries along the Road have significant heterogeneity in the division of labor in the GVC due to differences in their economic development level, market size, and institutional environment. Countries with higher levels of development are more likely to attract outward foreign direct investment with high technological content and high value-addedness, thus integrating into and upgrading their position in the global value chain faster, while countries with lower levels of development may undertake more low-end production links, which will have an impact on the restructuring of the global GVC promoted by B&R.

Therefore, hypothesis 3 is that the higher the level of economic development of countries along the Belt and Road, the more significant the GVC restructuring effect triggered by OFDI.

4. Research Design

4.1. Sample Selection and Data Source

This paper selects A-share listed companies in China's Shanghai and Shenzhen cities from 2012 to 2016 for the study, and screens the samples as follows: samples with missing data of important variables are excluded; samples of the financial and insurance industries are excluded due to the fact that the business and financial nature of the financial industry is quite different from that of the other industries; and finally 4,190 sample observations are obtained. All the company financial data and related control variables are from Wind database. Meanwhile, in order to avoid the influence of extreme values, this paper carries out the Winsorize shrinkage treatment at the 1% level for continuous variables.

4.2. Variable Definition and Measurement

Global value chain restructuring is the explained variable. Referring to Lv et al.[21] , this paper adopts the change in GVC embeddedness as a proxy variable for GVC reconstruction, and measures the GVC embeddedness of enterprises based on the customs matching data and the export decomposition information of World Input-Output Database.

Outward foreign direct investment (OFDI) is the explanatory variable. The dollar flow of OFDI is adopted as a proxy indicator and logarithmized to reduce estimation bias.

The "Belt and Road" (OBOR) is the moderator variable. This paper focuses on the impact of B&R on OFDI and GVC reconstruction, so we refer to Wang and Lu's study [22], and according to the China Belt and Road Network, whether enterprises participate in the Belt and Road Initiative, and whether they directly invest in B&R countries are used as moderator variable.

With reference to the literature on OFDI and GVC, the following control variables are introduced into the model: enterprise size (AY), which is equal to the natural logarithm of annual total assets; gearing ratio (LEV), which is equal to total liabilities/total assets at the end of the year; cash flow (CF); the proportion of research and development (RD); and the shareholding concentration (SCR), which is equal to the weighted ratio of the top 10%, 30%, and 50% shareholders' shareholdings. ratio. In addition, yearly time effects are controlled.

4.3. Model

In order to test the impact of OFDI on global value chain restructuring, this paper constructs the following model (1):

$$GVC_t = \beta_0 + \beta_1 OFDI_t + \sum \beta_k Controls_t + \varepsilon_t \tag{1}$$

The explanatory variable GVC denotes the degree of GVC embeddedness. $Control$ is the relevant control variable, and ε is the random error term. With reference to the theoretical analysis of this paper, the $OFDI$ coefficient in model (1) is expected to be significantly positive.

5. Result

5.1. Descriptive Statistics

Table 1 reports the results of descriptive statistics of the variables, in which the mean value of enterprise global value chain embeddedness (GVC) is 0.202 and the standard deviation is 0.370, while the median is only 0.003, which can be found that most of the listed enterprises in China have a low degree of embeddedness in the global value chain, but there is also a significant differentiation

between enterprises, with the minimum and maximum values of 0 and 1, respectively, which is a more obvious difference.

The OFDI-related variable (OFDI) is a logarithmic treatment of OFDI, with a mean value of 13.896 and a standard deviation of 3.109, which shows the volatility characteristics of enterprises' OFDI. The minimum value of OFDI is 1.255 and the maximum value is 22.983, which further indicates that there is a significant volatility of enterprises in the absolute level of OFDI. However, the median OFDI is 14.157 and the interquartile range is 11.982-16.009, indicating that the distribution of OFDI is more concentrated in most enterprises.

The "Belt and Road" Initiative Participation Variable (OBOR) reflects whether enterprises take the B&R countries as investment destinations, and only 12.1% of enterprises participate in B&R. Only 12.1% of enterprises have participated in B&R. Its standard deviation is 0.326, with a difference in distribution characteristics, reflecting the diversity of choices made by enterprises in China.

Table 1: Descriptive statistics.

Var	Obs	Mean	SD	Median	P25	P75	Min	Max
GVC	4190	0.202	0.370	0.003	0.000	0.126	0.000	1.000
OFDI	3178	13.896	3.109	14.157	11.982	16.009	1.255	22.983
OBOR	4190	0.121	0.326	0.000	0.000	0.000	0.000	1.000
AY	4190	7.651	1.139	7.564	6.847	8.371	4.500	11.135
LEV	4190	39.471	20.611	37.438	22.889	55.101	5.029	90.028
CF	4190	4.589	6.429	4.544	1.007	8.489	-18.354	23.842
RD	4190	0.172	0.446	0.082	0.039	0.162	0.000	12.300
SCR	4190	58.910	15.012	60.070	48.250	70.600	22.600	91.380

5.2. Benchmark Regression

Table 2 reports the regression results of OFDI, AY and control variables on firms' global value chain embeddedness (GVC). Based on model (1) and model (2), it can be seen that the regression coefficients of OFDI on GVC are 0.0186 in both the baseline regression and the robustness standard error case, both of which are significant at the 1% level, and thus the level of firms' OFDI significantly enhances their global value chain embeddedness. The key control variable of AY (firm size) is introduced in model (3), and the regression coefficient of OFDI on GVC is 0.0171, which is still significant at the 1% level, and the regression coefficient of AY on GVC is 0.0157, which is significant at the 5% level. This indicates that the larger the size of the enterprise, the more it can promote the enhancement of the enterprise's GVC embeddedness, which may be attributed to the fact that large-scale enterprises have a larger amount of OFDI investment, which is more capable of generating a scale effect and reconstructing the GVC.

Key control variables such as corporate gearing ratio (LEV), cash flow (CF), R&D investment ratio (RD) and shareholding concentration (SCR) are further introduced in model (4). At this point, the regression coefficient of OFDI on GVC is 0.0158, which still maintains 1% significance. Other results show that the regression coefficient of firms' capital structure on GVC is 0.0016 and significant at 1% level, so firms' capital structure optimization can promote their GVC embedding. The regression coefficient of cash flow is -0.0021 and is significant at 10% level, indicating that too much cash flow of a firm may be wasteful of resources or inefficiently allocated, instead of being detrimental to the deep participation in GVCs. The coefficients of both R&D investment share and equity concentration are insignificant, which may indicate that the marginal contribution of R&D investment and equity concentration to GVC embeddedness is limited after controlling for other variables.

The addition of control variables improves the model's explanatory power, as evidenced by the steady improvement in R^2 and adjusted R^2 in terms of the goodness-of-fit of the model, from 0.031 to 0.037.

Table 2: Benchmark regression results.

	(1)	(2)	(3)	(4)
	GVC	GVC	GVC	GVC
OFDI	0.0186***	0.0186***	0.0171***	0.0158***
	(0.00)	(0.00)	(0.00)	(0.00)
AY			0.0157**	0.0039
			(0.01)	(0.01)
LEV				0.0016***
				(0.00)
CF				-0.0021*
				(0.00)
RD				0.0117
				(0.02)
SCR				0.0001
				(0.00)
Year	Yes	Yes	Yes	Yes
_cons	0.0350	0.0350	-0.0639	-0.0201
	(0.04)	(0.04)	(0.05)	(0.06)
N	3178	3178	3178	3178
R^2	0.031	0.031	0.033	0.040
adj. R^2	0.029	0.029	0.031	0.037

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.3. Intermediation

By increasing the quality of innovation as shown by R&D spending, patent applications, and citations, OFDI improves GVC restructuring for innovation. According to Model (1), OFDI significantly improves innovation quality (coefficient = 0.0225, p < 0.05). It does this by increasing R&D and technological capabilities, promoting attention to high-value segments, fortifying innovation-driven growth, and improving GVC embeddedness.

Vertical integration level (integration) reflects enterprise coverage across the industrial chain. OFDI reduces direct control over all industries by shifting lower-tech manufacturing and services to developing regions, thereby lowering vertical integration and increasing GVC embeddedness. Model (2) shows a significant negative effect (coefficient = -0.006, p < 0.01), suggesting that reduced vertical integration decreases resource consumption, improves operational flexibility, and enhances global embeddedness.

Specialized division of labor (specialized), the inverse of vertical integration, measures firms' focus on specific industry segments. OFDI enables enterprises to concentrate on core business, integrate through supply chains, and enhance GVC embeddedness. Model (3) reports a significant positive effect (coefficient = 0.006, p < 0.01), demonstrating that OFDI promotes specialization in high-value segments, leading to more efficient resource allocation and value creation.

Industry chain integration (chain_inte) assesses firms' ability to integrate resources and coordinate within the GVC. OFDI optimizes resource allocation and strengthens collaboration by balancing

vertical integration and specialization. Model (4) shows a significant positive impact (coefficient = 0.0848, p < 0.01), confirming that OFDI enhances firms' resource integration and synergistic development, supporting GVC restructuring.

Table 3: Intermediation.

	(1)	(2)	(3)	(4)
	innovation	integration	specialized	chain_inte
OFDI	0.0225**	-0.0060***	0.0060***	0.0848***
	(0.01)	(0.00)	(0.00)	(0.02)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
_cons	-2.7317***	0.5258***	0.4742***	-2.3273***
	(0.23)	(0.03)	(0.03)	(0.56)
N	3178	2616	2616	2616
R^2	0.305	0.094	0.094	0.086
adj. R^2	0.303	0.091	0.091	0.082

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.4. Heterogeneity Test

In this study, the heterogeneity test is conducted from the three dimensions of the nature of ownership (SOEs/private enterprises), industry category (manufacturing/non-manufacturing) and asset intensity (asset-intensive/non-asset-intensive), and the results are shown in Table 6.

For the heterogeneity test of ownership, OFDI by private enterprises has a significant positive effect on GVC embeddedness, with a regression coefficient of 0.0215, significant at the 1% level, while the regression coefficient of 0.035 for SOEs is not statistically significant, which indicates that the effect of OFDI on GVC embeddedness enhancement and restructuring is more pronounced in the case of private enterprises, and that their flexible market response mechanism enables them to utilize international investment opportunities more effectively. Its flexible market response mechanism enables it to more effectively utilize international investment opportunities to enhance the level of GVC embeddedness. On the other hand, SOEs may be affected by policy orientation or administrative intervention, and the marginal effect on OFDI is weakened.

In the heterogeneity test of industry categories, manufacturing enterprises can significantly promote GVC reconstruction through OFDI, with a regression coefficient of 0.0192, which is significantly higher than the 1% level, while the regression coefficient of non-manufacturing enterprises, although still positive, does not reach statistical significance. Thus manufacturing firms have a more pronounced advantage in promoting GVC embeddedness due to their capital- and technology-intensive nature.

In the heterogeneity test of asset-intensity, non-asset-intensive firms are more sensitive to OFDI, with a regression coefficient of 0.0174, which is significant at the 1% level. Due to their lower fixed asset dependence and higher capital allocation flexibility, non-asset-intensive firms are able to utilize OFDI more efficiently to enhance their GVC embeddedness.

Table 4: Heterogeneity Test.

	(1)	(2)	(3)	(4)	(5)	(6)
	GVC	GVC	GVC	GVC	GVC	GVC
OFDI	0.0035	0.0215***	0.0192***	0.0120	0.0090	0.0174***

Table 4: (continued).

	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-0.0375	0.0889	-0.0023	0.0421	0.2746**	-0.1165
	(0.11)	(0.08)	(0.06)	(0.21)	(0.14)	(0.07)
N	971	2207	2745	320	689	2376
R^2	0.039	0.052	0.046	0.051	0.073	0.038
adj. R^2	0.029	0.048	0.043	0.020	0.059	0.034

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.5. Robustness Test

Replacement of explanatory variables: This paper replaces the enterprise import and export volume, closely related to OFDI, with a regression coefficient of 0.0037, which remains significant at the 1% level. The direction and significance of other control variables remain consistent, confirming the robustness of OFDI's effect on GVC upgrading.

Change of measurement method: Using the generalized least squares (GLS) method to re-estimate the model corrects for heteroskedasticity and autocorrelation issues in manufacturing industry regressions. The OFDI coefficient remains significant (0.0158, 1% level), with control variables' regression directions and significance unchanged, demonstrating strong robustness.

Excluding city influence: After removing first-tier cities (Beijing, Shanghai, Guangzhou, and Shenzhen), the regression coefficient is 0.0166 and remains significant, indicating that OFDI's positive effect on GVC does not rely on specific enterprise conditions, further supporting robustness.

Cluster-adjusted correlation: Accounting for firm-level correlation, the OFDI coefficient on GVC is 0.0158, still significant at the 1% level and close to other results, reinforcing result reliability.

Table 5: Robustness Test.

	(1)	(2)	(3)	(4)
	GVC	GVC	GVC	GVC
OFDI		0.0158***	0.0166***	0.0158***
		(0.00)	(0.00)	(0.00)
amount	0.0037**			
	(0.00)			
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
_cons	-0.0928***	-0.0201	-0.0758	-0.0201
	(0.04)	(0.06)	(0.07)	(0.11)
N	3661	3178	2480	3178
R^2	0.032		0.047	0.040
adj. R^2	0.029		0.044	0.037

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.6. Moderating effect

To test the moderating effect of enterprises' participation in the Belt and Road Initiative on the relationship between OFDI and enterprises' GVC restructuring, regressions are conducted for participating enterprises and non-participating enterprises respectively. The study finds that although both have positive effects and are significant at the 1% level, the regression coefficient of 0.0281 for participating enterprises is more significant than that of 0.0161 for non-participating enterprises, indicating that B&R may enhance the positive effect of OFDI on GVC participation through policy support, infrastructure improvement and other factors. This indicates that B&R may enhance the positive impact of OFDI on GVC participation through policy support and infrastructure improvement.

Table 6: Moderating effect.

	(1)	(2)
	GVC	GVC
OFDI	0.0281***	0.0161***
	(0.01)	(0.00)
Controls	Yes	Yes
Year	Yes	Yes
_cons	0.4737**	-0.0539
	(0.23)	(0.06)
N	209	2969
R^2	0.062	0.044
adj. R^2	0.015	0.041

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Conclusion

This paper examines the impact of Chinese enterprises' OFDI on global value chain (GVC) reconstruction under the background of "Belt and Road". The results of the study show that OFDI can significantly increase the GVC embeddedness of enterprises, with technological innovation, vertical integration adjustment, specialization and industrial chain integration as important mechanisms influencing the upgrading of GVC. The "Belt and Road" initiative plays an important role in regulating the relationship between OFDI and GVC embeddedness. Although the moderating effect is weakly negative due to the business environment and investment industry characteristics of the countries along the B&R, the trade facilitation, improvement of digital infrastructure, and financial support it promotes provide long-term development momentum for corporate GVC embeddedness. Meanwhile, the study also finds that private firms, manufacturing firms and non-asset-intensive firms are more likely to benefit from OFDI, enhance GVC embeddedness and carry out GVC reconstruction.

This study not only enriches the theoretical research on OFDI and GVC reconstruction under B&R, but also provides important insights for policymaking. The government should continue to promote trade facilitation and strengthen international economic and trade cooperation to optimize the overseas investment environment. Specifically, it should promote customs clearance integration, reduce trade barriers, improve logistics efficiency, and enhance legal protection for overseas investment through bilateral and multilateral investment agreements. At the same time, it should further improve the network of free trade agreements and strengthen policy coordination with countries along the Belt and Road, so as to provide a better development environment for enterprises

embedded in global value chains. In addition, the government should encourage enterprises to enhance their technological innovation capacity and global industrial chain integration capacity to improve the level of GVC upgrading. It can promote enterprises to increase R&D investment and break through core technology bottlenecks through financial support and tax incentives, and strengthen overseas mergers and acquisitions and strategic cooperation to improve global resource allocation capacity.

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