The Impact of Trade Liberalization on Global Value Chain Participation under the Belt and Road Initiative

Yining Wu, Jing Yu *

School of Economics and Management, Nanjing University of Science and Technology, Nanjing, China

* Corresponding Author Email: jingyu@njsut.edu.cn

Abstract. The division of labor within the global value chain (GVC) has become a defining characteristic of the global economy. Trade liberalization serves as a crucial driver for the in-depth advancement of this GVC division system. This study utilizes bilateral trade data from 25 Belt and Road countries spanning 2010 to 2023, and empirically explores how trade liberalization levels influence these nations' engagement in global value chains—relying on GVC participation indices and trade liberalization metrics specific to the sample countries. The findings demonstrate that heightened trade liberalization substantially boosts the degree to which countries partake in global value chains.

Keywords: Trade Liberalization, Global Value Chain Participation, Belt and Road Initiative.

1. Introduction

Trade liberalization acts as a vital driver of national development and global economic integration. In the context of deepening economic globalization, the division of labor within GVC has turned into a notable trait of the current world economy, reshaping the production and trade landscape of all countries. Under the production framework led by multinational enterprises, innovative production and trade modes—including fragmented international production, global procurement, and service outsourcing—have come into being via the optimization of resource allocation worldwide. This new pattern has not only improved the efficiency of global resource utilization but also created new development opportunities for countries to participate in international division of labor [1].

Nevertheless, developing nations that have long been part of the GVC division of labor reap limited gains and face structural dilemmas in their development. The primary cause is that most developing countries are trapped in the low-end segment of the GVC system due to their reliance on abundant natural resources, low-cost labor, and other factor endowments. The products they export are mostly resource-intensive and labor-intensive, with extremely low added value, making it difficult to achieve technological upgrading and industrial transformation [2]. Meanwhile, developed countries, relying on their advantages in core technologies, intellectual property, and brand operations, occupy the high-value-added links of the GVC and maintain a dominant position, which further exacerbates the imbalance of interests between developing and developed countries [3].

Thus, figuring out how to break the existing GVC division of labor structure, assist developing countries in breaking free from the inherent low-end lock-in, and shake off the advanced technological blockade imposed by developed countries is a pressing problem to address in the current global economic governance. For developing countries, integrating into the GVC and gradually moving up the value chain by virtue of this process has become an important path to achieve the trans nationalization of comparative advantages and enhance their international competitiveness. Against this backdrop, the Belt and Road Initiative, has continuously strengthened economic and trade ties among participating countries since its proposal. The total trade and investment volume among Belt and Road countries has exhibited an upward tendency, and the level of trade liberalization has been continuously improved with the advancement of policy coordination, infrastructure connectivity, and unimpeded trade.

In this context, in-depth exploration of the impact of trade liberalization on the GVC participation of Belt and Road countries, as well as its internal mechanism and heterogeneous characteristics, holds

important theoretical and practical significance. Theoretically, existing research on the relationship between trade liberalization and GVC participation mostly focuses on developed economies or global samples, while there is a relative lack of targeted empirical analysis on developing and emerging economies along the Belt and Road. This study takes 25 Belt and Road countries as the research object, which helps to supplement the empirical evidence of GVC theory in specific regional cooperation scenarios and enrich the research system of international trade and global value chain economics. Practically, clarifying the specific impact of trade liberalization on the GVC participation of Belt and Road countries, as well as the differences in the impact effect among countries in different regions such as Europe and Asia, can provide targeted policy references for participating countries to formulate trade liberalization strategies, optimize the path of GVC participation, and promote industrial upgrading. It is also conducive to deepening economic and trade cooperation among Belt and Road countries, building a more inclusive and mutually beneficial regional value chain system, and further promoting the construction of a community with a shared future for mankind in the economic field. Therefore, based on the bilateral trade data of 25 Belt and Road countries from 2010 to 2023, this study empirically examines the impact of trade liberalization on GVC participation, aiming to provide theoretical support and practical guidance for the high-quality development of the Belt and Road Initiative and the optimal allocation of global value chain resources.

2. Model Specification and Data Sources

2.1. Model Construction

For the empirical assessment of GVC participation, this study establishes the following benchmark econometric model:

$$GVCpt_{it}=\beta_0+\beta_1 Trade_{it}+\theta X_{it}+u_i{}^{+}v_t{}^{+}\varepsilon_{it} \quad (1)$$

In the equation: $GVCpt_{it}$ represents the global value chain participation degree; $Trade_{it}$ denotes the foreign trade dependence; X_{it} stands for other influencing factors affecting GVC participation, which are included as control variables; u_i and v_t are the regional fixed effect and time fixed effect respectively.

2.2. Variable Selection and Data Description

2.2.1. Dependent Variable

The forward GVC ratio refers to the proportion of a country's intermediate goods exported to other economies, reflecting its contribution to the value-added of other economies' exports.

The backward GVC ratio measures the contribution of a country's imported intermediate goods to its own value-added exports. The overall GVC participation degree is calculated by summing these two indicators (forward and backward participation), as shown in the following formula:

$$GVCpt=GVCpt\text{-}f+GVCpt\text{-}b \quad (2)$$

2.2.2. Core Explanatory Variable

The core explanatory variable is the trade liberalization of each country, which can be represented by the foreign trade dependence. A higher foreign trade dependence indicates a higher level of trade liberalization.

2.2.3. Control Variables

The following control variables are selected in this study: domestic market size (GDP), expressed by the logarithm of gross national product; economic strength (PGDP), measured by per capita gross domestic product; foreign direct investment (FDI) level, represented by the stock of foreign direct investment; physical capital level (CAP), measured by the ratio of gross fixed capital formation to GDP.

2.3. Data Sources

Data on forward and backward GVC participation are sourced from the UIBE GVC Index Database. Other variables are obtained from the World Bank Database, UNCTADstat Database, etc. Table1 lists variable description of this study.

Table 1. Variable Description

Variable Nature	Indicator Name	Variable Description	Data Source
Dependent Variable	*GVCPt*	Global Value Chain Participation	UIBE-GVC Database
Explanatory Variable	*Trade*	Foreign Trade Dependence	World Bank Database
Control Variables	*lnGDP*	Domestic Market Size	World Bank Database
	FDI	FDI Stock	UNCTADstat Database
	PGDP	Per Capita GDP	World Bank Database
	CAP	Physical Capital Level (Ratio of Gross Fixed Capital Formation to GDP)	World Bank Database

3. Empirical Results Analysis

3.1. Descriptive Statistics

The descriptive statistical results of the main variables are shown in Table 2.

Table 2. Descriptive Statistics of Main Variables

Variable Name	Variable Code	Observations	Mean	Standard Deviation	Minimum	Maximum
Global Value Chain Participation	*GVCpt*	350	0.430	0.172	0.133	0.903
Foreign Trade Dependence	*trade*	350	106.5	67.65	24.70	437.3
MFN Weighted Average Tariff Rate	*tariff*	350	4.525	2.402	0.0300	17.50
Domestic Market Size	*lnGDP*	350	25.86	1.589	22.06	30.32
Domestic Economic Development Level	*PGDP*	350	11,835	10,813	900.0	61,386
Foreign Direct Investment Level	*FDI*	350	116,373	301,897	0.519	2600000

3.2. Benchmark Regression Analysis

This empirical research covers a sample period from 2010 to 2023, with data from 25 Belt and Road countries listed in table 3.

Table 3. Belt and Road countries

Asia	Europe
China, Cyprus, Indonesia, India, Kazakhstan, Kyrgyzstan, Sri Lanka, Malaysia, Pakistan, Philippines, Singapore, Turkey, Vietnam	Bulgaria, Estonia, Greece, Croatia, Hungary, Lithuania, Latvia, Poland, Romania, Russia, Slovakia

As shown in Column (1) of Table 4, the estimation results reveal that the level of trade liberalization exerts a significantly positive influence on the dependent variable (GVC participation) at the 1% significance level. When market size (lnGDP) is incorporated into the regression equation in Column (3), trade liberalization still plays a significant role in promoting GVC participation, while

the coefficient of lnGDP is negative and has an impact on the dependent variable at the 1% level. This phenomenon might be attributed to the fact that countries with higher GDP possess larger economic scales and more comprehensive domestic industrial chains, resulting in relatively lower levels of GVC participation [4].

Column (4) includes economic strength (PGDP) in the regression equation. Trade liberalization still significantly promotes the GVC participation of various countries. The regression coefficient of PGDP is positive and has a significant impact on the dependent variable, indicating that economic strength has a positive promoting effect on GVC participation. Column (5) shows the regression results after including all control variables. The promoting effect of trade facilitation on GVC integration still exists and passes the robustness test.

Table 4. Benchmark Regression Results

Variable	(1)	(2)	(3)	(4)	(5)
trade	0.002***	0.003***	0.003***	0.003***	0.003***
	(19.8705)	(8.9945)	(7.6156)	(11.5811)	(11.4091)
lnGDP			-0.027*	-0.041***	-0.036**
			(-1.9352)	(-2.6521)	(-2.3286)
PGDP				0.000***	0.000***
				(4.4486)	(4.8352)
FDI					-0.000***
					(-3.6638)
Constant Term	0.189***	0.179***	0.863**	1.123***	1.002**
	(16.7392)	(4.8701)	(2.3276)	(2.8532)	(2.5338)
Year Fixed Effect	No	Yes	Yes	Yes	Yes
Country Fixed Effect	No	Yes	Yes	Yes	Yes
Observations	350	350	350	350	350
R^2	0.798	0.967	0.968	0.972	0.972

3.3. Robustness Analysis

To verify the reliability of the benchmark regression results, this study conducts multi-dimensional robustness tests, including variable substitution, lag term processing, and instrumental variable methods.

3.3.1. Replacing the Dependent Variable

This study replaces the original GVC participation index with the GVC trade participation index (GVCpar) from the UIBE-GVC Database. Regression results in table 5 (see Columns 1-2 of the robustness test table) show that the coefficient of trade liberalization remains significantly positive at the 1% level, indicating that the promotional effect of trade liberalization on GVC participation is stable.

Table 5. Robustness Test Results by Replacing the Dependent Variable

Variable	(1)	(2)
trade	0.003***	0.091***
	(11.4091)	(7.7372)
lnGDP	-0.036**	-4.218***
	(-2.3286)	(-3.1997)
PGDP	0.000***	0.000
	(4.8352)	(1.0455)
FDI	-0.000***	0.000
	(-3.6638)	(1.0520)
Constant term	1.002**	144.633***
	(2.5338)	(4.3742)
Year Fixed Effect	Yes	Yes
Country Fixed Effect	Yes	Yes
Observations	350	350
Adjusted R^2	0.972	0.956

Note: *** , **, and * indicate significance at the 1%, 5%, and 10% levels respectively; T-values are in parentheses.

3.3.2. Lagging the Core Variable

To mitigate potential endogeneity issues caused by reverse causality, this study uses the first and second lags of the core explanatory variable for regression. Results in table 6 show that the impact of trade openness on GVC participation remains significantly positive, further confirming the robustness of the conclusion.

Table 6. Robustness Test Results by Lagging the Core Explanatory Variable

	(1)	(2)
	GVCpt	GVCpat
L.trade	0.002***	0.085***
	(11.9262)	(8.0481)
lnGDP	-0.060***	-5.017***
	(-3.8556)	(-4.8857)
PGDP	0.000***	0.000
	(5.1834)	(1.2809)
FDI	-0.000	0.000
	(-1.2145)	(1.6045)
Constant term	1.628***	167.189***
	(4.1819)	(6.4908)
Year Fixed Effect	Yes	Yes
Country Fixed Effect	Yes	Yes
Observations	325	325
Adjusted R^2	0.971	0.963

Note: *** , **, and * indicate significance at the 1%, 5%, and 10% levels respectively; T-values are in parentheses.

3.3.3. Instrumental Variable Method

Benchmark regression results suggest that trade liberalization promotes GVC participation, while deep GVC participation may also increase import and export trade, thereby enhancing trade liberalization—creating potential endogeneity. To address this, this study selects the first and second lags of trade liberalization as instrumental variables in table 7. Results in Columns (1)-(2) of the instrumental variable test table show that the instrumental variables pass the under-identification test

and weak instrumental variable test, confirming their validity. The regression coefficient of trade liberalization remains significantly positive, further verifying the stability of the core conclusion.

Table 7. Robustness Analysis Results Based on Instrumental Variable Method

	(1) *L. trade*	(2) *L2. trade*
trade	0.003***	0.004***
	(0.000)	(0.000)
Control Variables	Yes	Yes
Year Fixed Effect	Yes	Yes
Kleibergen - Paap rk LM	72.025	46.144
Cragg - Donald Wald F	496.741	211.987
Kleibergen - Paap rk Wald F	111.848	120.677
F Value	45.29	38.17
R^2	0.6707	0.6821
Observations	325	300

Note: *** , **, and * indicate significance at the 1%, 5%, and 10% levels respectively; T-values are in parentheses.

3.4. Heterogeneity Analysis

To investigate whether the impact of trade liberalization on GVC participation varies across different countries (i.e., national heterogeneity), this study classifies the 25 Belt and Road countries in the full sample into two groups: European countries and Asian countries. For these two sub-samples, control variables are directly incorporated into the regression analysis in table 8. The results indicate that trade liberalization promotes GVC participation in both European and Asian Belt and Road countries, and this effect passes the significance test at the 1% level. Specifically, the promotional effect of trade liberalization on GVC participation is more significant for European Belt and Road countries.

Table 8. Heterogeneity Analysis Results

	(1)	(2)
Variable	Europe	Asia
trade	0.00298***	0.00142***
	(0.000227)	(0.000252)
lnGDP	-0.00223	0.125***
	(0.0249)	(0.0250)
PGDP	0.00000437*	0.00000683***
	(0.0000023)	(0.00000205)
FDI	-0.0000000319	-0.0000000423***
	(0.0000000497)	(0.0000000129)
Constant terms	0.103	-2.988***
	(0.618)	(0.635)
Observations	196	154
Number of Countries	14	11
R^2	0.848	0.665

Note: ***, **, and * indicate significance at the 1%, 5%, and 10% levels respectively.

4. Conclusion

Drawing on data from 25 Belt and Road countries over the period 2010-2023, this study conducts an empirical analysis of how trade liberalization affects GVC participation, using the GVC participation indices and trade liberalization levels of these countries as the basis. Through benchmark regression, robustness tests (including variable substitution, lag term processing, and instrumental

variable method), and heterogeneity analysis, the study obtains comprehensive and reliable research conclusions, which provide important insights for understanding the economic and trade cooperation mechanism of the Belt and Road and optimizing the GVC participation strategy of participating countries.

The findings demonstrate that the enhancement of trade liberalization effectively facilitates countries' integration into the global value chain. Specifically, by promoting the free flow of goods, services, and production factors, trade liberalization enables Belt and Road countries to better participate in the global division of labor, expand the scale of intermediate goods trade, and thus improve their GVC participation. This conclusion remains robust after addressing the endogeneity issue, substituting variables, and dividing the sample into subsamples, indicating that the promoting effect of trade liberalization on GVC participation is stable and not affected by model setting or variable selection. This result is consistent with the core viewpoints of international trade theory, which emphasizes that trade openness is conducive to improving resource allocation efficiency and promoting industrial specialization, and further verifies the positive role of trade liberalization in driving global value chain integration in the specific context of the Belt and Road.

From the perspective of national heterogeneity, compared with Asian Belt and Road countries, trade liberalization has a more notable promotional effect on the GVC participation of European Belt and Road countries. This heterogeneous performance may be attributed to the following aspects: First, European countries generally have more complete industrial systems and stronger technological innovation capabilities, which enable them to better absorb and utilize the opportunities brought by trade liberalization and quickly integrate into high-value-added links of the GVC. Second, European countries are geographically close to each other, with a high degree of regional economic integration and relatively smooth trade and investment flows, which strengthens the role of trade liberalization in promoting GVC participation. In contrast, Asian Belt and Road countries are characterized by large differences in economic development levels and relatively prominent infrastructure gaps in some regions, which to a certain extent restrict the transmission efficiency of the promoting effect of trade liberalization on GVC participation.

It should be noted that this study still has certain limitations. For example, the sample only covers 25 Belt and Road countries, and the research perspective can be further expanded to more participating countries in the future. In addition, the impact of trade liberalization on GVC participation may be affected by other intermediate variables such as digital economy development and institutional quality, which can be explored in depth in subsequent studies.

References

[1] Huang, T., & Chen, W. (2021). The Impact of Intellectual Property Protection and Trade Openness on Foreign Investment Introduction. Journal of Technology Economics, 40 (1), 82 - 90.

[2] Baldwin R, Lopez-Gonzalez J. Supply-chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses [J]. The World Economy, 2015, 38 (11): 1682 - 1721.

[3] Lv, Y., & Li, M. Y. (2020). Trade Facilitation and Global Value Chain Integration. Journal of Beijing Technology and Business University (Social Sciences Edition), 35 (5), 46 - 57.

[4] Han, J., Feng, F., & Jiang, X. Y. (2018). Internet Development and Global Value Chain Integration—A Cross-Country Empirical Study Based on GVC Indices. Nankai Economic Studies, (4), 21 - 35, 52.