

Impact of Global Value Chain Participation on the Performance of Shipbuilding Enterprises

Lina Yu¹, Jiaxin Wei¹, Wanting Jiang^{2, a}, Tao Wang^{2, *}

¹Ocean University of China, School of Economics, Qingdao 266100; China

²Hanyang University, Seoul, 04763, Republic of Korea

*Corresponding author: Tao Wang (Email: oucwangtao@163.com), ^ajwt2021@hanyang.ac.kr

LY, JW, WJ, TW these authors are co-first authors.

Abstract: In the context of increasingly interconnected production networks, the present study investigates the potential influence of Global Value Chains (GVCs) participation on the operational performance of shipbuilding enterprises. Leveraging extant scholarly contributions, this study quantifies the degree of GVCs involvement exhibited by Chinese shipbuilding enterprises over a five-year temporal span. In addition, robustness tests, endogeneity tests and heterogeneity analyses are conducted to take into account various biases and enterprise heterogeneity. The empirical outcomes of this study unveil noteworthy insights. Firstly, GVCs participation contributes to enterprise performance. Secondly, GVCs participation has different impact mechanisms on enterprises with different ownership and locations. These findings provide recommendations for both how economics can further develop their shipbuilding industries and how enterprises can improve their performance. Enterprises ought to actively engage in GVCs, concurrently strategizing to elevate their standing within such chains through concerted efforts in technological advancements.

Keywords: Shipbuilding Industry, Global Value Chains, Enterprise Performance.

1. Introduction

In light of diminishing transportation expenses, advancements in communication technologies, and the globalization of procurement networks, global value chains (GVCs) are experiencing rapid proliferation, engaging an expanding array of nations in a collaborative production framework. Against this background, the shipbuilding industry is progressively manifesting a proclivity towards an integrated production network and decentralized production stages. Numerous scholarly investigations substantiate the assertion that GVCs function as a potent catalyst for enhancing productivity and bolstering the competitive standing of enterprises. (Audretsch et al., 2016; Gereffi et al., 2005).

As a sector with a high impact on employment, more and more countries are focusing their public policy on the shipbuilding industry (Gavalas et al., 2022). At the same time, shipbuilding is an assembly industry that relies heavily on intermediate inputs. In the major shipbuilding economies, 70%-80% of the output of shipbuilding companies comes from intermediate inputs (Gourdon and Steidl, 2019). As a result, the advancement of shipbuilding enterprises is inevitably influenced by the international division of labor. The degree of influence and the mechanisms by which GVCs affect the development of enterprises can vary depending on their position in the production network. The consequential ramifications of these variations manifest predominantly in their influence on business performance. Consequently, the examination of how the positioning of shipbuilding enterprises within the international division of labor precipitates effects on the performance of shipbuilding enterprises stands as a matter of paramount significance.

In recent years, substantial advancements have been achieved within this domain, particularly concerning the discernible influence of the international division of labor on

industrial performance. Some scholars believe that in the context of GVCs division of labor, enterprise performance would be better. Gereffi et al. (2005) argue that participation in GVCs exposes enterprises to greater export markets and the facility of economies of scale. Sturgeon et al. (2008) posit that this exposed enterprises to greater competition, which increases their labor efficiency, capital efficiency and technological innovation. Amiti and Konings (2007), on the other hand, put forward an alternative view, as their study find that enterprises' participation in GVCs, the expansion of intermediate product imports, the improvement of intermediate product quality and the technological spillover effect on intermediate product imports would also improve the quality of enterprises' products. Concurrently, divergent perspectives have been posited by scholars. Vanloqueren and Barte (2008) point out that there is a risk of lock-in at the low end when enterprises participate in GVCs. Freeman and Kleiner (2005) and Bugamelli et al. (2010) not only support this view, but also argue that enterprises in developing countries are more vulnerable to lock-in at the low end when they participate in GVCs.

Over the years, extensive researches have been devoted to the evaluation of the shipbuilding industry's performance. Numerous researchers have systematically examined the nexus between various factors and enterprise performance, such as the level of social responsibility performance (Para-González and Mascaraque-Ramírez, 2019; Para-González and Mascaraque-Ramírez, 2020), the degree of marketing promotion (Mascaraque-Ramírez and Para-González, 2022) and the managerial talent.

Several scholars have undertaken investigations into the correlation between various factors and the performance of enterprises within the realm of shipbuilding production processes, such as the precision allocation of production process (Praharsi et al., 2022), and the supply chain of shipbuilding industry (Ramirez-Peña et al., 2019) and other

factors.

In summation, scholarly endeavors within this domain have yielded notable advancements; however, further strides are imperative, particularly in the following domains: Primarily, scant scholarly attention has been directed towards the examination of shipbuilding enterprises within the framework of the international division of labor. Prevailing literature predominantly scrutinizes the correlation between GVCs participation and enterprise performance on a macroscopic scale. Nonetheless, given the inherent heterogeneity among industries, there exists a requisite to amplify the development of industry-specific enterprises tailored to specific needs. Secondly, extant analyses pertaining to the determinants of shipbuilding enterprise performance predominantly explore the impact of management and production factors, with a conspicuous dearth in literature delving into enterprise performance through the lens of the international division of labor.

China holds a prominent position within the global shipbuilding industry, actively participating in the intricate web of international division of labor. In light of this, this study adopts Chinese shipbuilding enterprises as an example to further explore the impact of GVCs participation on enterprise performance. Firstly, this study constructs enterprise-level indicators of GVCs participation and calculate the GVCs participation of Chinese shipbuilding enterprises accordingly; secondly, this study constructs a fixed effects model to investigate the impact of GVCs on enterprise performance in the Chinese shipbuilding industry. To fortify the robustness of our findings, this study executes a series of robustness tests employing various methodologies, and explore the differences in the impact results due to enterprise heterogeneity.

Compared with previous studies, this study makes the following contributions:

Firstly, from the perspective of international division of labor, this study investigates the relationship between GVCs participation of shipbuilding enterprises and enterprise performance. The export value-added rate is chosen as a measure of enterprise's GVCs participation. Secondly, the heterogeneity of the influence mechanisms is analyzed in terms of both enterprise affiliation and enterprise ownership, and the possible channels of GVCs participation of the enterprise on the enterprise performance are further explored. Thirdly, focusing on Chinese shipbuilding industry, the article explores the influence mechanisms associated with GVCs participation and enterprise performance of enterprises in specific industries. And by fixing the effect of the year of Chinese explicit comparative advantage, a more accurate effect of impact mechanism can be obtained.

2. Methods and Model Construction

The subsequent section delineates the meticulous process of variable selection, encompassing the independent variables, dependent variables and control variables, as well as comparing the methods used to measure the various variables. Additionally, the construction of the model will be described in this section.

2.1. Variable Selection

2.2. Dependent variable

The dependent variable chosen for this study is enterprise performance. In existing studies, the main indicators to

measure business performance include subjective indicators, objective financial indicators and objective non-financial indicators. The most commonly used subjective indicator is the measurement scale. The measurement scale covers financial indicators, such as profitability and sales. Objective financial indicators, including financial ratio indicators are usually used to measure business performance. Alternatively, scholars also choose objective non-financial indicators, such as employee productivity to measure the performance of service enterprises (Mehra, 1996). The paramount merit inherent in employing objective financial indicators is the high availability and credibility of data that can be used to measure a single enterprise. In addition, ratio-based measures can increase comparability between enterprises in the same industry. The data from the database of Chinese industrial enterprises is of objective financial indicators. Therefore, this study selects objective financial indicators to measure the company's performance. Based on the above analysis, this study uses objective financial indicators to measure corporate performance. In the subsequent section, non-objective financial indicators are incorporated and a relatively dynamic measure is employed as a robustness check.

Objective financial indicator formula is as follows:

$$mkp_{it} = \frac{r_{it}}{ass_{it}} \quad (1)$$

mkp_{it} denotes the asset profit margin of enterprise i in the t period; rit denotes the total profit of enterprise i during the t period, and ass_{it} denotes the total assets of enterprise i in the t period.

Among the non-objective financial indicators, intangible assets (Carmeli and Tishler, 2004) is chosen because data on intangible assets is highly available and this study is based on the fact that Chinese companies have made this choice. As an important non-objective financial indicator, intangible assets provide a more dynamic measure of an enterprise's growth prospects. Intangible assets assume a pivotal role in the integration of Chinese enterprises into GVCs.

2.3. Independent Variable

The independent variable in this study is foreign value added in exports. The FVAR stands as a widely employed metric to measure the participation of GVCs, which can better measure the degree of a company's participation and participated position in the GVCs. Numerous scholarly researches have explicated the specific method of measuring the FVAR at the enterprise level. The measurement of GVCs participation degree typically initiates at the broader scopes of country and industry, including Hummels et al. (2001) approach and Koopman et al. (2012) approach. Macro data from non-competitive input-output tables are used to measure GVCs participation degree, i.e., the proportion of foreign value added in a country's or industry's exports. The quantification of GVCs participation among micro-scale enterprises poses a considerable challenge. The feasibility of measuring the degree of GVCs participation at the enterprise level is based on the availability of data on micro enterprises in the China Customs Database. Scholars have mainly used a measure of the proportion of foreign value added of MSMEs' products, i.e., the foreign value-added rate, to measure the extent of enterprises' GVCs participation. Upward et al. (2013) use the BEC classification to distinguish the applications of

intermediate product imports and classifies intermediate products into intermediate inputs, consumer goods and capital goods, and Zhang et al. (2013) incorporates intermediate traders into the calculation method, effectively addressing the undervaluation of foreign value added rates of Chinese companies. However, both methods fail to duly consider the presence of foreign components within the domestic raw materials utilized by Chinese enterprises, meaning that the value added of indirect imports is ignored. To ensure the accuracy of the enterprise GVCs participation index to a heightened degree, this study adopts the methods of Wang et al. (2017) and Lu et al. (2018) to further improve the above methods and construct a foreign value-added rate index for Chinese micro and small enterprises.

The method of this position is as follows:

$$FVAR = \frac{V_{AF}}{X} = \frac{\{M_A^P + X^0 \times [M_{Am}^0 / D + X^0]\} + 0.05\{M^T - M_A^P - M_{Am}^0\}}{X} \quad (2)$$

FVAR denotes the foreign value-added rate of enterprise export, which is used to measure the degree of integration of enterprises into GVCs; *V_{AF}* denotes the actual foreign added value of the enterprise; *M_A^P* denotes the enterprise actual processing trade import; *M_{Am}⁰* denotes the actual import volume of general trade intermediate products of enterprises; *M^T* denotes the intermediate product input of the enterprise; *D* denotes the domestic sales of enterprises; *X* is the enterprise export volume; *X₀* denotes the general trade export of enterprises.

2.4. Control variables

In consideration of the influence of other factors on the

dependent variable, this study uses enterprise age (Reddy and Subash, 2019), salary per capital (Durongkaveroj, 2022) and intangible capital as control variables.

2.5. Model Construction

The capital profitability is not only influenced by the GVCs participation of enterprises, but also by the enterprise's technological proficiency, labor capabilities, and financial aptitude of the enterprise itself. This study hypothesizes that there is a certain logarithmic relationship between a enterprise's capital profitability and its participation in GVCs and tests the hypothesis through regression methods and the test holds. Therefore, the study takes the logarithm of the enterprise capital profit rate.

$$\text{Lnroa}_{it} = \beta_0 + \beta_1 \times \text{GVC}_{it} + \beta_2 \times X_{it} + \lambda_{id} + \lambda_{year} + \varepsilon_{it} \quad (3)$$

Lnroa_{it} indicates the logarithm of the capital profit rate of *i* enterprise in *t* period; *GVC_{it}* indicates GVCs participation degree in *i* enterprise *t* period, the greater the value, the deeper the participation degree; *λ_{id}* and *λ_{year}* are virtual variables controlling individual and year fixed effects respectively. *β₀* is a constant and *ε_{it}* is a random perturbation. *X_{it}* is the control variable, mainly including enterprise size (size); enterprise capital intensity (kl), namely the ratio of enterprise fixed assets to all employees; the average wage of enterprise workers (mwage), that is, the ratio of the total wage payable to all employees; intangible capital. Table 1 is the descriptive statistics of the main variables.

Table 1. Descriptive statistics for major variables. (N=399)

Variable	AVG	SD	MIN	MAX
Lnroa	-2.507074	2.779834	-9.583833	7.341412
GVCs	0.5290634	0.4223865	0	1
Mwage	24.05789	18.39689	0	109.4773
Inatngible capital	8315.304	34762.75	0	325852
Size	10.54626	3.347834	0	16.11942
Kl	723.5213	1099.44	0	12120.63
Age	18.11422	23.69045	1	154
Export	26.09517	437.4404	0	9196.5

Note: * stands for P<0.5, ** stands for P<0.01, *** stands for P<0.001.

This study uses the maximum likelihood method (MLM) to estimate the impact of GVC participation degree on the logarithm of a enterprise's profit-to-asset ratio.

$$\text{Lnroa}_{it} = \beta_1 + \beta_2 \times e^{\beta_3 \times \text{GVC}_{it}} + \varepsilon_1 \quad (4)$$

It can be seen that *β₁* is significantly positive, and is significantly negative.

3. Analysis Result

The following part describes the results of the data analysis, including regression analysis, robustness tests and

heterogeneity analysis. Ultimately, we substantiate the soundness of the model.

3.1. Regressions

Considered at the enterprise level, fixed effects model regressions can better reduce the regression bias caused by enterprise heterogeneity. In addition, the use of panel data with a certain time horizon can also better avoid the specificity of the regression results due to the specificity of the selected years. Therefore, this study chooses panel data for fixed effects regressions and Stata is used for regression.

Table 2 presents the results of the baseline regression of the impact of GVCs participation on the logarithm of the enterprise's profit-to-asset ratio.

Table 2. Regression test results.

Variable	(1)	(2)	(3)	(4)	(5)
GVCs	-0.537*** (-3.13)	-0.546*** (-3.31)	-0.556*** (-3.38)	-0.556*** (-3.37)	0.134*** (1.43)
Mwage		0.020*** (4.54)	0.019*** (4.29)	0.019*** (4.28)	
Inatngible capital			-0.000* (-1.70)	-0.000 (-1.59)	
Age				0.003 (0.38)	
Constant	-3.132*** (-30.87)	-3.610*** (-25.14)	-3.550*** (-24.09)	-3.613*** (-16.24)	12.864***
N	399	399	399	399	443
R2	0.039	0.114	0.124	0.125	0.103
Id FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Note: * stands for P<0. 05, ** for P<0. 01, *** for P<0. 001

To ensure the robustness of the measurement results, a stepwise regression approach is used to include the control variables in the regression equation in turn. Columns (2)-(4) add to column (1) the control variables of average wage (mwage), enterprise intangible assets and enterprise age (age) to control for the effect of enterprise heterogeneity factors on the regression results. First, GVCs participation significantly contributes to the growth of the enterprise's profit-asset ratio and a decrease in the marginal contribution. This finding aligns consistently with the inclusion of different control variables and different control effects. Secondly, the inclusion of different control variables reveals that the estimated coefficient of average enterprise wage (mwage) on GVCs is significantly positive at the 99% confidence level, which is consistent with the expected results. The effect of corporate intangible assets on the variable is almost zero at 90% confidence level, which may be due to the fact that the shipbuilding industry is a traditional equipment manufacturing industry and corporate intangible assets do not have a significant impact on corporate performance; the coefficient of the variable of corporate age (age), although positive, is insignificant in the model. This may be due to the high barriers to entry in the shipbuilding industry and the splitting of Chinese shipbuilding enterprises into new branches or the formation of subsidiaries between 2003 and 2007. The substantial magnitude and elevated technological sophistication characterizing the emergent corporate entity, in conjunction with an expanded market footprint, emerge as pivotal factors mitigating the susceptibility of the company's performance to the temporal factor of corporate age. However, as can be seen in Table 2, enterprise performance is affected by enterprise heterogeneity, suggesting that controlling for enterprise heterogeneity is key to reduce potential endogeneity problems. In light of the absence of data pertaining to the year 2010, data from 2011-2014 are selected for sample replacement in this study. Column 5 of Table 2 demonstrates the impact of GVCs on the performance of ship manufacturing enterprises from 2011-2014. The impact of GVCs on the performance of ship manufacturing enterprises

remains significantly positive with increasing marginal contribution, probably due to the increased competitiveness of China in the global market, increased explicit comparative advantage and reduced low-end lock-in for ship manufacturing enterprises.

3.2. Robustness Test

Firstly, in the previous regression analysis, panel data is used with control variables and a fixed individual control effects model was used to minimize the endogeneity problems associated with missing variables. However, due to the presence of multiple heterogeneous factors at the enterprise level, and the possible lagged impact of GVCs participation on enterprise performance, the study has therefore further considered two additional factors of enterprise heterogeneity and lags the explanatory variables by one period to mitigate possible reverse causality. Considering that adopting different methods to measure company performance may lead to biased results, this study chooses different methods to measure company performance and conducts regressions. Finally, the study employs Hausman method to test the robustness of the data for the existence of self-selection problems.

The results are as follows:

Firstly, to column (1) of Table 2, the article adds two variables: enterprise debt ratio (bonds) and export output ratio (exports). The specific estimation results are shown in columns (1)-(2) of Table 3. The estimated coefficients of GVCs are significantly negative at the 99% confidence level and do not change substantially.

Secondly, another source of endogenous bias is reverse causality. The study uses the method of lagging the explanatory variables by one period to test whether reverse causality affects the estimation results in this research. The study lags the Lnroa variable by one period to mitigate possible two-way causality. As can be seen from column (3) of Table 3, the estimated coefficient on GVCs is significantly negative at the 99% confidence level, with no substantial change, which indicates that there is no reverse causality between the two period.

Table 3. Robustness test results.

Variables	(1)	(2)	(3)
GVCs	-0.542*** (-3.11)	-0.529*** (-3.12)	-0.657*** (-3.20)
Bond	0.083 (0.16)	0.113 (0.23)	
Export		-0.001*** (-3.93)	
Constant	-3.185*** (-9.21)	-3.194*** (-9.51)	-3.138*** (-27.28)
N	399	399	399
R2	0.039399	0.096399	0.123198
Id FE	YES	YES	YES
Year FE	YES	YES	YES

Note: * stands for P<0. 05, ** for P<0. 01, *** for P<0. 001

Thirdly, as for dependent variable, this study adopts the objective financial indicator method and chooses the profitability of assets (roa) as a measure of enterprise performance. To verify the robustness of the relationship between an enterprise's degree of GVCs participation and its performance, this study selects the annual average amount of current assets, i.e., the ratio of current assets to the enterprise's current industrial output, as a new dependent variable. It is found that the degree of an enterprise 's GVCs participation still contributes positively to the annual average amount of an enterprise's current assets, with a decreasing marginal contribution.

Fourth, due to the lack of data in the China Industrial Enterprise Database, there may be a selection problem in sample selection, so the article uses the Heckman two-step method to test the sample selection problem. The results show that there is no severe sample selection bias in the original model, which indicates the results are robust.

3.3. Heterogeneity Analysis

In the previous analyses, it is discerned that enterprise - level heterogeneity constitutes a significant determinant of bias within the regression outcomes. This investigation undertakes an examination encompassing the international landscape and the contemporary Chinese context.

Consequently, the article posits that the influence of GVCs participation on enterprise performance is contingent upon enterprise ownership. Simultaneously, owing to the influences of scale, agglomeration, and competition within the shipbuilding industry, the modalities and degree to which GVCs participation impacts enterprises across distinct provinces exhibit variations. Therefore, this study analyses the heterogeneity of the benchmark model from the perspective of enterprise ownership and enterprise location.

3.4. Enterprise ownership of heterogeneity analysis

According to the ratio of enterprise capital, the samples are divided into three categories: foreign capital enterprises, state-owned enterprises and other enterprises. In this study, enterprises with state-owned capital accounting for 50% or more of the owner's equity are designated as state-owned capital enterprises, enterprises with foreign capital accounting for 50% or more of the owner's equity are foreign-owned enterprises, and the remainder of the sample are other enterprises. Columns (1)-(3) of Table 4 show the regression estimation results for foreign-owned, state-owned and other enterprises, respectively.

Table 4. Heterogeneity results of enterprise ownership heterogeneity.

Variables	(1)	(2)	(3)
GVCs	-0.407* (-1.63)	-0.537*** (-3.13)	-0.698** (-2.49)
Constant	-2.588*** (-19.03)	-3.132*** (-30.87)	-3.261*** (-20.48)
N	164	399	155
R2	0.029164	0.039399	0.069155
Id FE	YES	YES	YES

Note: * stands for P<0. 05, ** for P<0. 01, *** for P<0. 001

From the results, the article finds that column (1) of Table 4 shows that the estimated coefficient of GVCs is -0.407 at 90% confidence level. column (2) of Table 4 shows that the estimated coefficient of GVCs is -0.537 at 99% confidence level; column (3) of Table 4 shows that the estimated coefficient of GVCs is -0.698 at 90% confidence level; and this indicates that the marginal contribution of GVCs participation degree to roa declines at different rates for enterprises with different ownership, with foreign enterprises declining at the slowest rate, followed by state-owned enterprises. This implies that enterprises are affected

differently by GVCs participation due to differences in capital structure. Foreign enterprises are less constrained in terms of competitive effects and technological barriers. State-owned enterprises are subject to fewer restrictions in international markets than ordinary enterprises due to the support of the state regime.

3.5. Enterprise location of heterogeneity analysis

In this study, the sample is stratified based on the economic development status of the provinces under consideration,

categorizing them as either economically developed or developing. According to the China Statistical Yearbook, Guangdong Province, Shandong Province and Jiangsu Province are the top three provinces in China in terms of total GDP, and all three provinces are coastal provinces with natural geographical advantages for the development of shipbuilding industry. At the same time, the number of shipbuilding enterprises in the three provinces are dense, and

it can be explored whether the cluster effect affects the performance of shipbuilding enterprises. Consequently, this study classifies the above three provinces as economically developed provinces. Columns (1)-(2) of Table 5 show the regression estimation results for enterprises located in economically developing provinces and enterprises located in economically developed provinces in terms of total GDP.

Table 5. Estimation results of the heterogeneity of the enterprise.

Variables	(1)	(2)
GVCs	-0.471** (-2.11)	-0.629** (-2.34)
Constant	-3.261*** (-24.62)	-2.965*** (-18.73)
N	221	178
R2	0.032221	0.048178
Id FE	YES	YES

Note: * stands for $P < 0.05$, ** for $P < 0.01$, *** for $P < 0.001$

Column (1) of Table 5 shows that the estimated coefficient of GVCs is -0.471 at the 90% confidence level, while column (2) of Table 5 shows that the estimated coefficient of GVCs is -0.629 at the 90% confidence level; this indicates that enterprises in economically developed provinces have a faster decline in the marginal contribution of GVCs participation degree to roa than enterprises in economically developing provinces. This can be attributed to the intense competition in the shipbuilding industry in economically developed provinces, which has a negative impact on enterprises.

4. Discussion

The findings of this study are poised to elucidate and contribute valuable insights to the comprehension of enhancements in the operational efficacy of shipbuilding enterprises.

Firstly, GVCs participation of shipbuilding enterprises has significantly improved corporate performance. Consequently, shipbuilders should actively participate in international division of labor and cooperation, sign inter-company agreements, integrate deeply into the international market and conduct international exchanges to promote the performance of shipbuilders.

Secondly, the marginal contribution of enterprises' degree of participation in GVCs to their overall performance has exhibited a decline, probably due to the negative impact of the lock-in and competitive effect of low-end technologies in international markets. Enterprises should further increase their investment in research and technology and actively break the technological barriers in the international market. Shipbuilding enterprises ought to take advantage of the agglomeration effect of enterprises to generate heightened international competitiveness.

Thirdly, shipbuilding enterprises should actively introduce foreign investment and investment from state-owned enterprises, which will not only facilitate their integration into the international market, but also contribute substantively to the enhancement of their overall operational performance.

5. Conclusions

This study systematically investigates the influence of GVCs participation intensity on the operational performance

of shipbuilding enterprises, employing Chinese shipbuilding enterprises as a representative case study. As a prominent player in the domain of shipbuilding, China serves as a pertinent exemplar for elucidating the dynamics associated with GVCs involvement and its consequential effects on enterprise performance within this industrial sector. In the regression analysis, this study reduces the effect of enterprise heterogeneity by fixing the year and by the individual enterprise and adding three control variables enterprise average wage (mwage), enterprise age (age) and enterprise intangible assets. Based on the results, this study posits the following observations. Previously, GVCs participation of shipbuilding enterprises significantly contributes to enterprise performance, despite its marginal contribution decreases, which suggests that shipbuilding enterprise performance is positively affected by an enterprise's participation of GVCs, and that the heightened engagement of a enterprise within the international division of labor can afford it the opportunity to acquire more sophisticated technologies, procure raw materials and components at reduced costs, and enhance its global market expansion endeavors, thereby securing access to a broader customer base. To optimize corporate performance substantially, an enterprise should strategically reassess its involvement in international markets. This necessitates a comprehensive evaluation of the incremental costs and benefits associated with engagement in international markets. Rigorous quantitative analyses should be conducted to ascertain the optimal degree of participation within GVCs that would effectively maximize performance outcomes. By considering the endogeneity bias, this study conducts a series of robustness analyses to test for the presence of sample selection bias, and the findings remain valid. Subsequently, the findings derived from the heterogeneity analyses in this study are notably rich. Firstly, the marginal contribution of GVCs participation of foreign-owned shipbuilding enterprises to the performance of shipbuilding enterprises declines slower than that of state-owned enterprises. Secondly, the marginal contribution of increased GVCs participation to shipbuilding enterprise performance declines more slowly for state-owned shipbuilding enterprises than for other enterprises. Thirdly, the marginal contribution of increased GVCs participation to the performance of shipbuilding enterprises declines more

slowly in developed provinces than in less developed provinces.

Acknowledgment

Funding: This research was funded by [National social science fund of China] grant number [23BGJ027]

References

- [1] Amiti M, Konings J. Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia. *The American Economic Review* 2007;97(5): 1611-1638.
- [2] Audretsch, B. D, Lehmann, E. E, Paleari, Stefano, et al. Entrepreneurial finance and technology transfer. *The journal of technology transfer* 2016;41(1): 1-9.
- [3] Bugamelli M, Fabiani S and Sette E. The pro-competitive effect of imports from China: an analysis of firm-level price data. *Temi di discussione (Economic working papers)* 2010;31(1): 78-93.
- [4] Carlos MR and Lorena PG. Can the six dimensions of Marketing Promotion enhance performance in the international shipbuilding industry? *Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment* 2022;236(1): 245-256.
- [5] Carmeli A, Tishler A. Resources, Capabilities, and the Performance of Industrial Firms: A Multivariate Analysis. *Managerial and Decision Economics* 2004;25(6/7): 299-315.
- [6] Dimitris G, Theodoros S, Michael T. COVID-19 impact on the shipping industry: An event study approach. *Transport Policy* 2022;116: 157-164.
- [7] FREEMAN RB, KLEINER MM. The Last American Shoe Manufacturers: Decreasing Productivity and Increasing Profits in the Shift from Piece Rates to Continuous Flow Production*. *Industrial Relations: A Journal of Economy and Society* 2005;44(2): 307-330.
- [8] Gereffi G, Humphrey J, and Sturgeon T. The Governance of Global Value Chains. *Review of International Political Economy* 2005;12(1): 78-104.
- [9] Gourdon, K and Steidl, C. Global value chains and the shipbuilding industry. Report, OECDE, Paris, July 2019.
- [10] Hummels D, Ishii J, and Yi K-M. The nature and growth of vertical specialization in world trade. *Journal of International Economics* 2001;54(1): 75-96.
- [11] Koopman R, Wang Z, and Wei S-J. Estimating domestic content in exports when processing trade is pervasive. *Journal of Development Economics* 2012;99(1): 178-189.
- [12] Lu Y, Shi H, Luo W, and Liu B. Productivity, financial constraints, and firms' global value chain participation: Evidence from China. *Economic Modelling* 2018;73: 184-194.
- [13] Mehra, A. Resource and market based determinants of performance in the US banking industry. *Strategic Management Journal* 1996;17(4): 307-322.
- [14] Para-González L and Mascaraque-Ramírez C. The importance of official certifications in globalized companies' performance: An empirical approach to the shipbuilding industry. *Corporate Social Responsibility and Environmental Management* 2019;26(2): 408-415.
- [15] Para-González L, Mascaraque-Ramírez C. The six dimensions of CSR as a driver of key results in the shipbuilding industry. *Corporate Social Responsibility and Environmental Management* 2019; 27(2): 576-584.
- [16] Praharsi Y, Jami'In MA, Suhardjito G, et al. Supply chain performance for a traditional shipbuilding industry in Indonesia. *Benchmarking An International Journal*. Epub ahead of print 15 June 2021. DOI: 10.1108/BIJ-05-2020-0232.
- [17] Ramirez-Pea M, Fraga F, Sotano A, et al. Shipbuilding 4.0 Index Approaching Supply Chain. *Materials* 2019;12(24): 4129.
- [18] Sturgeon T, Biesebroeck JV and Gereffi G. Value chains, networks and clusters: reframing the global automotive industry. *Journal of Economic Geography* 2008;8(3): 297-321.
- [19] Upward R, Wang Z and Zheng J. Weighing China's export basket: The domestic content and technology intensity of Chinese exports. *Journal of Comparative Economics* 2013;41(2): 527-543.
- [20] Vanloqueren G and Baret PV. Why are ecological, low-input, multi-resistant wheat cultivars slow to develop commercially? A Belgian agricultural 'lock-in' case study. *Ecological Economics* 2007;66(2): 436-446.
- [21] Wang Z, Wei SJ, Yu X, et al. Measures of Participation in Global Value Chains and Global Business Cycles. *Social Science Electronic Publishing* 2017.
- [22] Zhang J, Chen Z, and Liu Y. Measuring the Domestic Value Added in China's Exports and the Mechanism of Change. *Economic Research Journal* 2013;48(10): 124-137.