

Impact of OFDI on the Manufacturing GVC position

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Abstract

This paper measures the index of manufacturing GVC position for 63 economies in OECD-ICIO from 1995 to 2018. And the impact of OFDI on manufacturing GVC position in home countries is explored empirically: first, OFDI in home countries will have a positive impact on their manufacturing GVC position through the "strategic asset acquisition effect", "marginal industrial transfer effect" and "market internalization effect. Second, OFDI in developed countries will promote the rise of their GVC positions, and the degree of impact is higher than that of developing countries.

Keywords

OFDI; GVC; GVC Position Index; Industrial Upgrading.

1. Introduction and Literature Review

The trade and size of intermediate goods in international trade flows of manufacturing products grew from \$6.8 trillion to \$21.7 trillion between 2000 and 2014 (Wang, Ching-Ching et al., 2021) [1]. In this context, the traditional research method of using trade volume as the object of study does not faithfully reflect the level of competitiveness of a country. Because intermediate goods are an important form of trade, with multiple cross-border inflows and outflows, the traditional trade accounting method can overestimate a country's competitiveness, leading to "low-end lock-in" and "comparative advantage trap". Therefore, many scholars have shifted their research perspective to the Global Value Chain (GVC).

Industrial upgrading in manufacturing is closely related to its position in the global value chain. The impact of a country's OFDI on its industrial upgrading has been supported by a large literature. Therefore, the impact of a country's OFDI on the GVC position of the home country has gradually become a hot topic of research. The relevant literature can be broadly divided into two categories: promotion effect and suppression effect.

Promotional role: Andreff (2009)[2] argues that OFDI can effectively enhance a country's position in the global value chain. Zhong Zuchang et al. (2021) [3] obtained that a country's OFDI network has the effect of enhancing a country's division of labor position in the global value chain by using the world input-output table from 2003 to 2011. Some scholars also get similar conclusions from China's perspective, Hu Xiaoyan and Guo Shuhua (2022)[4] through an empirical study that OFDI indirectly promotes China's participation in GVC division of labor through dynamic changes in comparative advantage, and shows a superior promotion effect on simple GVC division of labor compared to complex GVCs. Luo Jun and Feng Zhangwei (2018) [5] obtained from the perspective of technological heterogeneity of manufacturing industries that different factor-intensity manufacturing industries can promote the upgrading of GVC position through the service innovation effect of OFDI.

Inhibitory effect: the study by Herzer (2012)[6] concluded that OFDI is not significant in enhancing the position of global value chains. He et al. (2016)[7] also falsified the positive effect

of reverse technology spillover effect of OFDI. Xu Zhiqin (2019)[8] argued that the effect of OFDI on the upgrading of a country's value chain is negative.

Accordingly, this paper differs from previous literature by (1) analyzing the heterogeneity of the samples from developed and developing China and trying to give reasons for the differentiation by combining mechanisms. (2) Using the latest OECD-ICIO version 2021 database to further corroborate the findings in terms of the updated dimensions of the study sample. (3) Robustness tests are conducted using the GVC position index to replace the GVC position index.

2. Mechanism Analysis

2.1. Positive Impact of OFDI on the Manufacturing GVC Position

2.1.1. Strategic Asset Acquisition Effect

Duning (1993) [9] suggests that home countries often make OFDI through mergers, acquisitions or establishing relevant institutions in the host country. These investment methods will help the home country to acquire the relevant strategic assets of the host country, such as brand building, R&D capability and management innovation. Therefore, OFDI will improve the home country's global value chain position through the strategic asset acquisition effect, which will work through three specific paths:

First, the brand gain brought by the strategic asset acquisition effect is conducive to increasing the home country's manufacturing exports and forcing the home country to further improve its export structure, enhance quality and diversify categories, promote industrial upgrading and improve its GVC position in the fierce international market competition.

Second, home country OFDI often generates "reverse technology spillover effect" about R&D capability, which often occurs in OFDI from developing countries to developed countries. First, home countries can promote industrial optimization by setting up R&D institutions abroad and learning advanced foreign technology, which will promote technological progress in home countries; in addition, the employing foreign elites will also contribute to the cultivation of talents in home countries. That is, the home country through foreign direct investment, thus making the reverse technology spillover effect arise, promoting home country technological innovation and industrial upgrading, and improving the GVC position of the home country.

Third, advanced management capabilities, market capabilities and other comprehensive functions will enhance the production efficiency of the home country and promote the overall industrial progress through industry demonstration effects with the whole industry in order to achieve the GVC upgrading of relevant industries in the home country.

2.1.2. Marginal Industrial Transfer Effect

Industry has life cycle in development, transferring industries with low domestic comparative advantage abroad in order to shift its resources to develop industries with more comparative advantage in the home country is conducive to promoting domestic resource allocation and structural optimization, thus promoting industrial upgrading and helping the relevant industries to promote the GVC. Kiyoshi Kojima (1978)[10] summarized this industrial development practice as the "marginal industrial transfer effect", whose core idea is to transfer industries that have lost their advantages abroad to achieve the optimal allocation of resources. However, the actual transfer of industries overseas is subject to many risks such as legal, policy and market risks. By transferring industries through OFDI, we can avoid these risks to a greater extent and effectively promote industrial upgrading and advance up the global value chain.

2.1.3. Market Internalization Effect

Market internalization is the behavior of the home country to internalize the resources overseas, when the home country company merges and reorganizes or brownfield greenfield

investment in overseas enterprises, the home country can bypass the import and export and directly use the production resources, human capital and other production factors of the host country. Buckley and Casson (1976) [11] have suggested that market internalization can ensure that multinational companies can determine the nature of the buyer and effectively access to high technology, thus reducing the uncertainty of operations. Therefore, the market internalization effect has an important role in upgrading the global value chain of the home country industry.

2.2. Negative Impact of OFDI on the Manufacturing GVC Position

2.2.1. Industrial Hollowing Effect

In contrast to the marginal industrial transfer effect, which concentrates domestic resources and optimizes the allocation of industrial structure, thus improving the GVC position, the industrial hollowing out effect (Bluestone and Harrison, 1982) [12] argues that excessive foreign direct investment (including excessive export of capital and industry) may inhibit the development of healthy interaction of industries in the home country. In layman's terms, industrial hollowing refers to the underrepresentation of the primary and secondary industries in the national economy, centered on manufacturing, leading to the decline of the real economy towards a service-oriented economic model.

The United States had shifted the manufacturing industries of electric motors and automobiles to Europe, which prompted the rapid recovery of the European manufacturing industry on the one hand and reduced the manufacturing export advantage of the United States itself on the other. On the contrary, this phenomenon does exist in China today. Due to the rising prices of domestic production factors, the gradual disappearance of the demographic dividend of cheap labor and the overcapacity in manufacturing, the operating costs of enterprises have increased, and in this context, China has shifted industries with high resource endowment and labor endowment to Southeast Asian countries, with a view to achieving industrial specialization and promoting the restructuring of domestic production. However, this kind of OFDI based purely on cost considerations will accelerate the threat of industrial hollowing out faced by China. After domestic enterprises with comparative advantages in resources and labor are transferred abroad, domestic resources cannot be fully and rationally allocated before China has achieved industrial transformation, making the original domestic advantageous industries lose their advantages and inhibiting the climbing of the global value chain of manufacturing in the home country.

2.2.2. Barrier Effect

With the expansion of outward investment, many invested high-tech countries gradually start to beware of reverse technology spillover effect, hinder the strategic resource acquisition effect of home countries through policies and laws and regulations, and raise the threshold of reverse technology spillover from host countries to home countries. Under this situation, home countries will increase their outward FDI and invest more human capital to ensure the usual operation of the strategic resource acquisition effect. This practice will further take away and squeeze domestic research investment, which will then be detrimental to the optimal development of domestic industries and affect the climbing of the global value chain of domestic industries.

2.2.3. Hypothesis Proposal

Based on the above theoretical mechanism analysis, hypothesis 1 is proposed in this paper.

Hypothesis 1: OFDI in the home country positively affects the GVC position of manufacturing in the home country.

In addition, developed and developing countries face different manufacturing transformation situations. Developed countries' OFDI is mainly to transfer marginal industries outward to

improve their core competitiveness. Developing countries, on the other hand, are mainly motivated by the realization of strategic asset acquisition and market internalization effects. Along with the increase in barrier effects in recent years, the costs paid by developing countries to realize the former effects have increased and may even crowd out their own domestic industrial structure optimization, so how the effects will be needs to be analyzed more carefully. Accordingly, hypothesis 2 is proposed.

Hypothesis 2: The OFDI of developed countries will promote the rise of their GVC position, and the degree of influence is higher than that of developing countries.

3. Model Setting and Variable Description

3.1. Empirical Model Setting

Through the mechanism analysis in the previous section, it can be obtained that OFDI has an influential role in climbing the position of manufacturing GVC. The following section will provide data support for this conclusion by constructing an empirical econometric model. First, this paper takes 63 countries included in the OECD-ICIO database as the sample (the sample countries and regions are specifically: Argentina, Australia, Austria, Belgium, Bulgaria, Brazil, Canada, Switzerland, Chile, China, Colombia, Costa Rica, Cyprus, Czech Republic, Germany, Denmark, Spain, Estonia, Finland, France, UK, Greece, Hong Kong Croatia, Hungary, Indonesia, India, Ireland, Iceland, Israel, Italy, Japan, Kazakhstan, Cambodia, Korea, Laos, Lithuania, Luxembourg, Latvia, Morocco, Mexico, Malta, Malaysia, Netherlands, Norway, New Zealand, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovakia Slovenia, Sweden, Thailand, Tunisia, Turkey, Taiwan, the United States, and Vietnam) over the time period 1995-2018 for a full sample analysis to explore the impact of OFDI on the manufacturing GVC position.

$$GVCpos_{it} = b_0 + b_1 \ln OFDI_{it} + b_2 C_{it} + a_i + \eta_t + e_{it} \tag{1}$$

Where $GVCpos_{it}$ denotes the position index of GVC, which will be defined in detail below. $\ln OFDI_{it}$ is the natural logarithm of OFDI, reflecting a country's OFDI. c is a vector composed of control variables, the control variables of which will be described in detail later. a_i , η_t and e_{it} denote country effects, time effects and random error terms, respectively.

3.2. Variable description and data sources

Table 1. Model variables and data sources

Variable Type	Variable Name	Variable Symbols	description	sources
Dependent variable	GVC Position	<i>GVCpos</i>	Global Value Chain Position Index	Based on UIBE GVC database calculations
Independent variable	OFDI	<i>lnofdi</i>	Natural logarithm of the stock of OFDI	UNCTAD
Control variables	R&D Inputs	<i>rd</i>	Ratio of R&D investment to GDP of a country	World Bank
	Urbanization level	<i>city</i>	Ratio of urban population to total population	World Bank
	GDP per capita	<i>lnpgdp</i>	Ratio of a country's GDP to its total population	World Bank
	Capital Stock	<i>lnrna</i>	Capital stock	PWT Database
	Medium and high technology exports	<i>mhtechexp</i>	Ratio of exports of medium and high technology products to manufacturing exports	World Bank
	Foreign Trade Dependency	<i>openness</i>	Total trade to GDP ratio	World Bank

Dependent variable. The dependent variable in this paper refers to the GVC status index proposed by Koopman et al. (2014) [13]. The core idea is that if a country is at the upstream level of the GVC, the proportion of indirect value added of domestic value added to total exports (IV/E, forward participation) is greater than the proportion of foreign intermediate goods to total exports of the country (FV/E, backward participation), i.e., forward participation is higher than backward participation; if a country is at the downstream level of the GVC, the proportion of indirect value added of domestic value added to total exports (IV/E, forward participation) is smaller than that of foreign intermediate goods to total exports. If a country is at the downstream level of GVC, the proportion of indirect value added of domestic value added to total exports (IV/E, forward participation) is smaller than the proportion of foreign intermediate goods to total domestic exports (FV/E, backward participation), i.e., the forward participation is lower than the backward participation. The original data are obtained from the UIBE GVC database and through specific calculations. The expressions are shown below:

$$GVCpos = \ln\left(1 + \frac{IV}{E}\right) - \ln\left(1 + \frac{FV}{E}\right) \tag{2}$$

Independent variables. The independent variable of this paper is the level of OFDI, which is taken as the natural logarithm of the amount of OFDI. The data are obtained from the UNCTAD database.

Table 2. Descriptive statistics of variables

Variables	Observations	Mean	Standard deviation	Minimum value	Maximum value
<i>GVCpos</i>	1512	-0.788	0.632	-2.270	0.908
<i>lnofdi</i>	1481	9.976	2.955	1.204	15.878
<i>rd</i>	1186	1.349	0.980	0.037	4.797
<i>city</i>	1488	70.164	18.220	17.311	10.000
<i>lnpgdp</i>	1486	9.543	1.159	5.962	11.630
<i>lnrnna</i>	1512	14.341	1.653	9.874	18.353
<i>mhtechexp</i>	1488	47.285	19.392	0.000	85.388
<i>openness</i>	1486	94.351	70.492	0.656	442.620

Control variables. The control variables in this paper refer to Yu, Haiyan, Shen, Guilong (2020) [14] include: R&D investment, urbanization level, GDP per capita, capital stock, medium and high technology exports and foreign trade dependence. R&D investment, taking the ratio of R&D investment to GDP of a country, the higher the level of R&D of a country, means that the country is closer to the part of the smile curve with higher value added, thus promoting the optimization and upgrading of domestic industries and improving the GVC position. Urbanization level, which is the ratio of urban residents to the total population of a country. GDP per capita, which takes the ratio of a country's GDP to its total population, in constant 2015 U.S. dollars as the base period. Countries with higher urbanization level and higher GDP per capita have higher labor costs, and their domestic industries are more inclined to move toward higher value-added development to overcome labor cost disadvantages, optimize industrial structure development, achieve industrial upgrading, and promote the global value chain position. The higher the capital stock of a country, the higher the investment for upgrading manufacturing industries, which can promote the upgrading and development of industries. The higher a country's exports of medium and high technology products, the more it can play

the role of demonstration and leadership of medium and high technology industries and promote the process of industrial upgrading, thus contributing to the upgrading of the country's GVC value chain position. The higher the foreign trade dependence, the higher the ratio of total trade to GDP, the more a country's foreign trade dependence can promote the inflow of foreign advanced factors of production, thus playing the reverse technology spillover effect and achieving the improvement of the GVC position of manufacturing industries. The sources of control variables, as shown above, are detailed in Table 1. descriptive statistics of each variable are shown in Table 2.

4. Analysis of Empirical Results

After conducting Hausman test on the panel data, this paper selects fixed effects model for the empirical analysis of the panel data, and the results of the benchmark regression are shown in Table 3.

Table 3. Baseline regression and robust test results

	(1)	(2)	(3)	(4)
<i>lnofdi</i>	0.042* (0.022)	0.045* (0.025)	0.010** (0.004)	0.011** (0.004)
Control variables	No	Yes	No	Yes
Fixed Country Effect	Control	Control	Control	Control
Fixed Time Effect	Control	Control	Control	Control
<i>N</i>	1481	1171	1481	1171
<i>Adj-R²</i>	0.91	0.90	0.88	0.90

Note: Robust standard errors in parentheses, ***, **, * represent significant at 1%, 5% and 10% significance levels, respectively.

Model (1) represents the effect of the core independent variable OFDI on GVC status controlling for country individual effects and time effects, and the results show that the OFDI variable passes the significance test at the 10% significance level with a positive sign, indicating that OFDI has a positive contribution to the GVC position of the home country. Quantitatively, each 1% increase in home country OFDI affects its GVC status index by 0.042 on average. model (2) introduces relevant control variables based on model (1), and the results show that the effect of OFDI variable on GVC position index is positive and passes the significance test at 10% level of significance. Under model (2), each 1% increase in home country OFDI affects its GVC position index by 0.045 on average. This indicates that hypothesis 1 holds, and OFDI can enable home countries to enhance R&D capabilities and promote management progress through strategic asset acquisition effect, marginal industry transfer effect and market internalization effect, thus promoting industrial structure optimization and industrial upgrading, and helping home countries to promote the GVC position.

Model (3) and model (4), the dependent variable GVC position index is replaced with the new GVC position index proposed by Wang Z. et al. (2015) [15] for the robustness test of the replacement variable. Compared with the former GVC position index, which has stronger economic attributes, the new GVC position index portrays the relative position of a country in the global value chain from the perspective of production. It connotes the ratio of the forward production length index to the backward production index, where the forward production length is the sum of the simple forward production length and the complex forward production length, and the backward production length is the sum of the simple backward production length and the complex backward production length. The higher the new GVC position index,

the higher the position of the industry behind the index in the global value chain. The specific accounting formula is shown below:

Forward Production Index:

$$PLv_{GVC} = PLv_{GVC_S} + PLv_{GVC_C} \quad (3)$$

Backward production index:

$$PLy_{GVC} = PLy_{GVC_S} + PLy_{GVC_C} \quad (4)$$

The new GVC position index:

$$GVCpos2 = \frac{PLv_{GVC}}{PL_{GVC}} \quad (5)$$

In models (3) and (4) after the introduction of the GVC location index, the dependent variable OFDI variables pass the significance test at the 5% level under the estimation of the model with double fixed country individual effects and time effects, regardless of whether control variables are introduced or not. This indicates that the findings of the previous model (1) and model (2) are significant. Therefore, hypothesis 1 holds under the sample of this paper.

5. Further Analysis

5.1. Empirical Model Setting

In the previous discussion, Hypothesis 1 is proved by panel fixed effects and correlation stability tests. Next, this paper divides the overall sample into two dimensions, developed and developing countries, for further analysis with the level of national development as the heterogeneity criterion. The criteria for defining developed and developing countries are based on the official WTO list.

Table 4 divides the full sample into two samples, developed and developing countries, for heterogeneity analysis. Among them, model (1) and model (2) are empirically analyzed from the perspective of developed countries, and model (3) and model (4) are empirically analyzed with the sample of developing countries. model (1) and model (3) are models for empirical analysis with the GVC position index as the dependent variable, while model (2) and model (4) are models for robustness testing with the GVC position index as the dependent variable.

From model (1) and model (2), the dependent variable OFDI variable passes the significance test at 5% and 10% level respectively, and the direction of influence is positive. This means that under the sample of this paper, for developed countries, OFDI has a significant contribution to promote GVC position of home country. For developing countries, however, the results shown in the empirical evidence of the sample in this paper are more different. In model (3), the effect of OFDI on the GVC position of the home country is negative and does not pass the significance test, which indicates that the effect is not significant, while the results in the robustness test of model (4) show a positive effect, and the effect passes the significance test at the 5% level. In general, OFDI, for developed countries, is beneficial to promote their global value chain position and help climbing, the reason for this analysis is due to the fact that, developed countries have more marginal industries, and OFDI through overseas restructuring, mergers, acquisitions or investment in factory building, is beneficial for developed countries to transfer their marginal industries to other countries, thus concentrating production factors in industries with higher comparative advantage. This will optimize the industrial structure, bring into play the leading

and exemplary role of advantageous industries, prompt the domestic manufacturing industry to move to the direction of higher value added in the smile curve, and promote its position in the global value chain to climb up. For developing countries, OFDI can promote their GVC position index in relative physical attributes through strategic asset acquisition effect, marginal industry transfer effect and market internalization effect, but for GVC position index in relative economic attributes, this effect is even negative and insignificant. Analyzing the reasons, this paper argues that industrial hollowing drives developing countries into a low-end lock-in situation, and industrial hollowing makes the resource allocation of this country wrong, and the exported products actually do not have competitive advantages, which is not conducive to the optimization of industrial structure, and under the influence of barrier barrier effect, the home country cannot absorb the R&D capability, management level and marketing level of the host country at low cost, thus inhibiting the home country's GVC. This inhibits the rise of the home country's global value chain position. Therefore, hypothesis 2 is basically verified.

Table 4. Heterogeneity regression results for developed and developing countries

	Developed countries		Developing Countries	
	(1)	(2)	(3)	(4)
<i>lnofdi</i>	0.062** (0.024)	0.010*** (0.003)	-0.008 (0.057)	0.012** (0.011)
Control variables	Yes	Yes	Yes	Yes
Fixed Country Effect	Control	Control	Control	Control
Fixed Time Effect	Control	Control	Control	Control
<i>N</i>	815	815	356	356
<i>Adj-R²</i>	0.93	0.89	0.95	0.93

Note: Robust standard errors in parentheses, ***, **, * represent significant at 1%, 5% and 10% significance levels, respectively.

5.2. Endogeneity Test

Table 5. 2SLS instrumental variable method test

	(1)	(2)	(3)	(4)
<i>lnofdi</i>	0.056** (0.025)	0.014*** (0.005)	0.084*** (0.197)	0.014*** (0.004)
Control variables	Yes	Yes	Yes	Yes
Fixed Country Effect	Control	Control	Control	Control
Fixed Time Effect	Control	Control	Control	Control
<i>N</i>	1166	1166	1481	1171
<i>Kleibergen-Paap rk LM</i>	12.180	12.180	7.093	7.093
<i>Cragg-Donald Wald F</i>	5005.160	5005.160	2909.078	2909.078
<i>Kleibergen-Paap rk Wald F</i>	2539.652	2539.652	1103.767	1103.767

Note: Robust standard errors in parentheses, ***, **, * represent significant at 1%, 5% and 10% significance levels, respectively.

The endogeneity problem is often caused by omitted variables and mutual causality. This paper uses a two-way fixed model controlling for country and time effects for estimation, which better solves the problem of omitted variables. OFDI has a catalytic effect on the rise of manufacturing GVC position in the home country, and on the other hand, the rise of a country's GVC position enhances the core competitiveness of a country's manufacturing industry with respect to R&D and marketing, thus prompting the country to increase its outward investment to achieve

marginal industrial transfer and the effect of internalization of foreign markets. Therefore, this paper uses the first-order lagged variables of the dependent variable as the independent variables, and first confirms the validity of the instrumental variable through the unidentifiable test of the instrumental variable and the weak instrumental variable method, and then conducts the regression using 2SLS. The empirical results are shown in Table 5. The samples of model (1) and model (2) are full samples, and the samples of model (3) and model (4) are developed samples, and the dependent variables of model (1) and model (3) are GVC status index, and the dependent variables of model (2) and model (4) are GVC position index. The empirical results of the endogeneity test can be considered that the two hypotheses of this paper are robust.

6. Conclusion and Outlook

6.1. Conclusion

By combing the literature, this paper compiles the mechanism of the role of OFDI in upgrading manufacturing GVC position in the home country. It also conducts empirical tests, robustness tests and endogeneity tests through panel data of 63 countries from 1995 to 2018, which support the 2 hypotheses of this paper.

First, OFDI in the home country will have a positive impact on the manufacturing GVC position in the home country. The main mechanism of action is that a country's OFDI will promote the optimal allocation of production factors in the home country's domestic industry through strategic asset acquisition effect, marginal industrial transfer effect and market internalization effect, improve core competitiveness, promote the domestic manufacturing industry to move to the direction of higher value added of the smile curve, optimize the industrial structure, help industrial upgrading, and raise the country's position in the global value chain.

Then, OFDI of developed countries will promote the rise of their GVC position, and the degree of influence is higher than that of developing countries. Since the main motivation of OFDI from developed countries is to achieve optimal resource allocation and market expansion through marginal industrial transfer effect and market internalization effect, thus improving their GVC position, while the motivation of developing countries to acquire strategic assets is gradually hindered by the host country's legal rules and policies, the ability of OFDI from developed countries to promote their GVC position is higher than that of developing countries.

6.2. Outlook

This paper can be followed up by the following 2 aspects in order to develop a more in-depth study:

First, Adding mechanism tests. Due to the limitation of variable selection, the variables in this paper did not show significant results in the mechanism analysis, so they are not written in the paper. In the subsequent study, the effect of R&D, human capital effect and other variables can be processed to explore the mechanism test performance effect.

Second, Targeting the study country to China. To explore the impact of China's OFDI to other countries, on China's segmented manufacturing industry, in order to provide a more targeted opinion on China's climbing GVC position.

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