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Does regional value chain participation affect global value chain positions? Evidence from China

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ABSTRACT

Does participation in the ASEAN-China regional value chain (RVC) affect China's manufacturing enterprises' global value chain (GVC) positions in the context of the establishment of the ASEAN-China Free Trade Area (ACFTA)? In this paper, we discuss the theoretical mechanisms and impacts of RVC participation on GVC positions and use an input-output model to decompose the gross exports of China by different sources and destinations. The model measures China's manufacturing industries' total, upstream and downstream participation within the ASEAN-China regional value chain. Using panel data from the OECD for 2005 to 2015, the empirical results show that (1) the participation of China's manufacturing industries in the RVC is conducive to improvement in their GVC positions, (2) moving to more upstream can indeed promote the GVC positions of enterprises, and (3) in contrast to labour-intensive and capital-intensive manufacturing, knowledge-intensive manufacturing in upstream activities of the RVC contributes the most to GVC positions. It is suggested that China should develop knowledge-oriented industries and move to more upstream of the ASEAN-China RVC to raise manufacturing industries' positions in the GVC.

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1. Introduction

Since the mid-1980s, significant changes have taken place in the international fragmentation of production, and the South-North production network has begun to replace the North-North production network as the main form of fragmentation of the GVC. In the last decade, however, the development of trade liberalization has led developing countries to sign regional trade agreements (RTAs) with 'deep' provisions (Baldwin & Lopez-Gonzalez, 2015), since the South-South production network is developing gradually. According to the World Bank, the cumulative number of RTAs in force rose from 22 in 1990 to 305 by 2020.[1] In addition to the significant changes

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in volume, the content of RTAs has also been deepened, with earlier RTAs focusing on industrial and agricultural tariff commitments and later RTAs extending their scope to trade remedies and intellectual property rights.

Regional integration (RI) and globalization are two different spatial paths of producing fragmentation. To date, there is no clear definition of 'regional integration'. Farrell (2004) argued that uneven development, such as that of the European Union, is a hallmark of regional integration. Generally, integrated regions facilitate the flow of goods within regions by reducing trade barriers. The EU, the North American Free Trade Area (NAFTA) and East Asia are the regions most studied for regional integration (Baldwin, 1993, 2006; Fry-McKibbin et al., 2018; Kitwiwattanachai et al., 2010; Kose & Rebucci, 2005; Los et al., 2015; Zhang et al., 2018). These studies usually work with trade costs, geographical distances, exports, tariffs, welfare benefits, and so on. Although the existing literature has produced many insights, less is known about RTAs. Therefore, this paper takes RTAs as the unit analysis to study regional integration. Johnson and Noguera (2012) found that geographical distance has a strong influence on bilateral value-added trade, suggesting that regionalism seems to be more important than globalization. By breaking down foreign value added (FVA) into both regional FVA and global FVA, however, Los et al. (2015) made the opposite conclusion i.e., the speed of global fragmentation of value chains is much faster than that of regional fragmentation. However, regional integration and globalization are not completely separated. Baldwin (2006) pointed out that multilateral regionalism is the cornerstone of global trade liberalization from the perspective of the 'spaghetti bowls as building blocs' mechanism. Ruta (2017) believed that the multilateral trading system and GVC are complementary, and that preferential trade areas (PTAs) and GVC integration are related; i.e., the two should have a positive relationship. Overall, this does not mean that regional integration is necessarily good for globalization. Hayakawa et al. (2020) demonstrated that the tariff advantages brought by RTAs did not help the development of GVCs. To sum up, some papers compare the process of regionalization and globalization, other related papers study the effect of regionalization on globalization from the theoretical perspective. Therefore, research gap exists. Firstly, the results of RTAs on the GVC are mixed. Secondly, there is a lack of empirical research on the impact of RVC participation on GVC positions. Thirdly, as a successful case of RTA, ASEAN-China FTA is rarely discussed in literature on the significance of RI for the globalization of member countries.

In contrast to developed countries, China actively participates in the production link of the GVC based on its labour force advantage and has become the 'world's factory'. As a result, China's manufacturers are concentrated at the bottom of the 'smiling curve' of the GVC (Baldwin et al., 2014; Gereffi & Fernandez-Stark, 2016). Can China's participation in regional economic integration (REI) solve its practical problems and improve the position of China's manufacturing industry in the GVC? As it is uncertain which RTA provisions will have a positive impact on trade flows (Anderson & Wincoop, 2004), will the participation of China's manufacturing companies in the RVC help solve the problem of locking in the middle and lower ends of the GVC? Furthermore, what is the internal mechanism? These are questions that need to be answered. This paper takes RVC as the representative of regional

integration to study the correlation between regional integration and globalization. It will expand and provide evidence the research on RVC, regional integration and GVC.

Specifically, this paper contributes to the existing literature as follows: (1) We further improve the existing RVC indicators. Regional integration and globalization are constructed in a unified measurement framework, and both indexes are measured based on an input-output model, ensuring that both are measured from the perspective of added value. The indices to measure RVC are constructed by decomposing the gross exports of China. (2) Three variables are applied as explanatory variables in the model, namely the total RVC participation, upstream participation and downstream participation. We not only discuss the impact of China's total participation in RVC on the GVC position, but also study the difference between upstream and downstream participation on the GVC position. (3) We take the ACFTA as a representative region of China's regional integration. ACFTA, as the largest FTA among developing countries, has been relatively successful in its development, so it is representative as the research object of regional integration.

The remaining of this paper is organized as follows. Section 2 states the literature review, hypotheses and index construction. Section 3 is about data sources and processing. Section 4 describes the empirical results and robustness tests. Section 5 is the conclusions.

2. Literature review and hypotheses

The channels through which regional integration influences GVC positions are summarized as four aspects: trade creation effect, real cost of trade, allocation of factor endowment and regional market, competition and innovation incentives.

First, regional integration will make a trade creation effect. FTAs will increase trade volume between member countries and improve trade facilitation, thus bringing about a trade creation effect. The signing of FTAs brings about tariff reduction and partial relief. Members' imports of raw materials will shift to more preferential regions from the original relatively high cost of the regions. As a result, the establishment of an FTA can significantly promote the flow of trade in member countries, increase the diversity of domestic exports (Dennis & Shepherd, 2011), increase production and sales, and eventually bring economic growth. The economic growth of a country will lead to transformation and development of its industrial structure, promote the accumulation of capital and knowledge and increase its investment in medium and high-knowledge manufacturing. The increase in funds in medium- and high-knowledge manufacturing leads to the continuous research and development of products and the improvement of product quality, which means the improvement of the value-added ability of the country's manufacturing industry in the GVC.

Second, reductions in real cost terms of trade have been recognized in the past literature. On the one hand, regional integration will cause transportation cost reductions due to the close geographical locations of countries. Geographic distance may affect transport and communication costs. Transport and regional economic integration have been shown to be clearly linked (He et al., 2019). The geographical

proximity of member countries means lower transportation costs in the process of trade. On the other hand, regional integration will lead to lower transaction costs. Geographic distance may affect other transaction costs, and cultural dimension may impact consumers' preferences (Ghemawat, 2001). Economic, trade and investment cooperation among parties will be strengthened. Lower trade costs will decrease the price of imported goods, allowing access to products more likely to add value. In addition to the decreased price, intermediate products will enter and exit national borders more frequently, the production process will expand continuously, and the division of labour will be refined continuously; thus, the value-added will increase. In addition, lower trade costs allow firms to invest in higher quality and a greater variety of imported intermediate goods, thus increasing the demand for highly skilled labour and improving the labour input structure. As one of the factors of the source of added value, the increase of quantity and quality of labour will help increase a country's GVC positions.

Third, regional integration will bring about regional factor allocation and regional markets. On the one hand, FTAs will bring regional markets to members. Regional integration at a deep level brings many benefits. Under the influence of coordinated economic policies, common regional markets can be created, to generate positive gains (Farrell, 2004); in large regional markets, the market expansion effect attracts foreign direct investment to member countries (Li et al., 2016), and an increased FDI will lead to the accumulation of capital to finance research and development for manufacturing enterprises. In addition to the impact on investment, the market size effect also influences the geography of economic activity (Acemoglu & Linn, 2004; Sato et al., 2012) and affects economies of scale. On the other hand, different countries have different factor and resource endowments, and the establishment of FTAs realizes each country's factor endowment advantages. Capital, labour and technology can move more freely within the region. Different factor endowment has its role in RVC. Some countries have comparative advantages in downstream production stages, while others have comparative advantages in upstream stages (Johnson & Moxnes, 2013), and the regional market formed by regional integration makes the factors flow freer, which brings the optimal allocation of factors. For countries with weak natural endowments, the flow of factors can improve their productivity and welfare. Under regional factor endowments and regional markets, countries gain comparative advantages that can transform the final product structures of member states' exports, thus driving the change in added value.

Fourth, market liberalization increases competition (Pawitan, 2012) and innovation incentives. Regional markets create a demand for goods and services, giving an incentive to a high-skilled workforce to participate in entrepreneurial activity (Zheng & Du, 2020). Exposure to new potential markets can lead to technology spillover, innovation, and competition. In the integration process, technology can help firms become more competitive by integrating new processes and methods (Farrell, 2004). Technological externalities exist in international trade and can be achieved by exporting or imitating imported intermediate products (Basant & Fikkert, 1996). In an FTA, the prerequisites already exist, and enterprises need to increase the value-added of their products. If an enterprise wants to occupy a higher position in the regional

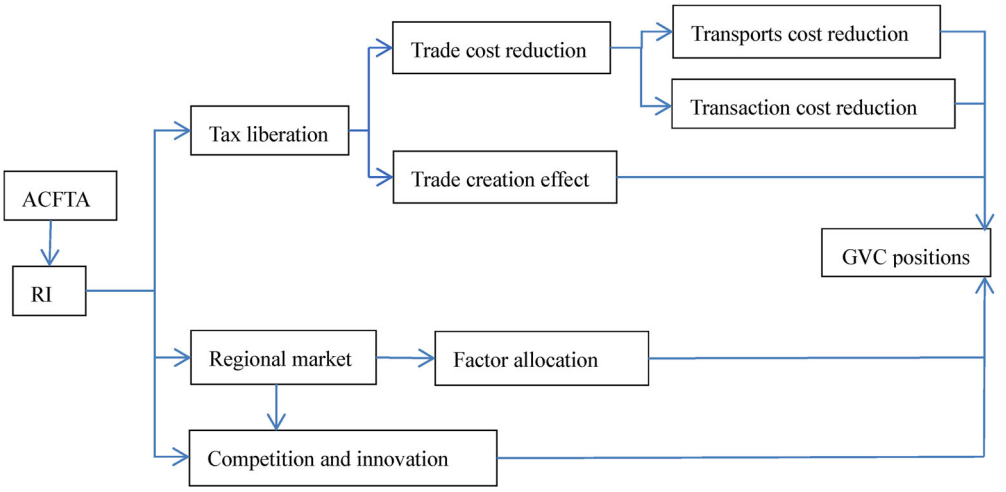


Figure 1. Framework for RVC and GVC.
Source: Authors' summary based on the literature review.

value chain, it must improve the technological level and innovation level of its products. Potential competition in regional markets could stimulate technological innovation. Generally, regional markets will provide strong competition, forcing enterprises to continuously improve their own technological level. The improvement of technological level will enable enterprises to produce more value-added products. Least-developed countries can improve their competitiveness by building the capacity of their firms, capturing more value and increasing domestic content in exports (Flento & Ponte, 2017). In total, this technological innovation can effectively increase the domestic value-added of exports and enhance GVC positions. Under these analyses, Hypothesis 1 is proposed as follows.

Hypothesis 1. RVC participation may enhance country's positions in the GVC (As shown in Figure 1).

In the fragmentation process of international production, there are many indicators that can measure a country's participation in GVCs, not limited to participation degrees and positions. To measure the relative position of the GVC where the production links are located, Fally (2011) proposed the upstream and downstream degree index. Koopman et al. (2010) used forward linkages and backward linkages to construct GVC degree and position indexes. These two kinds of participation in the RVC may have different influences on GVC positions.

First, as we have analysed above, the establishment of an FTA enlarges the market potentiality and market demand of member countries' manufacturing enterprises. This change requires higher productivity, and in turn requires technological innovation by its manufacturers, which will lead to an improved position in the GVC. It doesn't matter if a country has FTAs with developed countries or developing countries and is involved in the upstream or downstream in the RVC, FTAs will provide regional markets for it and expand interregional trade, which helps this country to continuously obtain added value. However, in most cases, being in the downstream link of the value chain is not conducive to the development of technology. For

instance, in GVCs, China gains from the technology spillover effect from developed countries, but in turn is often locked in the low-end link by developed countries. Njikam and Leudjou (2019) find that the downstream sectors of Cameroonian firms have both positive and negative correlation effects with the productivity spillover effect of different countries, which is mainly related to the absorption capacity of these firms. According to Kee and Tang (2016), the decline of imported materials will lower the rate of domestic value-added of enterprises. If a country has FTAs with less developed countries and is also located downstream in the RVC, this indicates that it is difficult to obtain high value-added from the RVC. Therefore, we believe that participation upstream in an RVC can promote the improvement of GVC positions, while participation downstream in an RVC depends on specific situations.

Second, participation downstream in an RVC is not conducive to the improvement of labour quality, while participation upstream in an RVC would make it possible. Generally, upstream industries require a higher quality labour force and more high-skilled activities, while downstream industries are simple assembly and processing activities, with fewer requirements for workers' skills. On the one hand, as a factor of production, labour is also one of the sources of added value. If low-skilled labour occupies the downstream production links, it is difficult for enterprises to obtain high value-added. On the other hand, high-quality workers can contribute to the innovation of technology and products, promote the upgrading of technology to enhance the value of products, and help to the improvement of product competitiveness. In RVCs, manufacturers involved upstream will increase the demand for high-quality personnel or increase the demand for the improvement of labour quality. This demand will facilitate the technological transformation of companies and improve their position in the GVC. Therefore, we consider that participation upstream in RVCs can increase the demand for high-quality workers and thus promote a country's positions in the GVC, while participation downstream in RVCs is vice versa. Based on the above two points, we propose Hypothesis 2 and Hypothesis3 as follows.

Hypothesis 2. Participation upstream in RVCs may enhance a country's positions in GVCs.

Hypothesis 3. The impact of RVC downstream participation on GVC positions is uncertain.

3. Data

This paper uses the newest global interregional input-output table from the TiVA database compiled and released by the OECD in 2018 for both RVC and GVC indicators, covering the period from 2005–2015. There are 64 major countries (including 36 OECD members and 28 non-OECD economies) and one composite category representing the rest of the world (ROW) included in the OECD-ICIO. This paper mainly focuses on the influence of China's participation in the ASEAN-China RVC on its position in GVCs from 2005 to 2015. Specifically, the degree of China's participation in the RVC is calculated according to the input-output table published by the OECD. The GVC positions data come from UIBE GVC indicators, and the final data,

which are names complex GVC activities, are measured by the research team of the University of International Business and Economics[2].

It should be noted that when calculating the degree of China's participation in the ASEAN-China RVC, OECD-ICIO includes data from eight ASEAN countries, namely Brunei Darussalam, Cambodia, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam. The gross domestic product (GDP) of these eight countries in the past decade (2010–2019) represents 97% of the GDP of the ten ASEAN countries[3]. Moreover, these eight countries accounted for 98% of the ASEAN's total imports and exports in 2019, which is quite representative[4]. Laos and Myanmar, which are missing from the TiVA database, are small in size. Therefore, using data from these eight countries to replace the data of ten ASEAN countries is feasible.

4. Empirical analysis

4.1. The influence of the degree of RVC participation on the GVC position of China's manufacturing industries

As mentioned above, overall participation in RVCs and upstream participation contribute to the improvement of positioning in GVCs, while the influence of downstream participation is not clear. To test whether our hypothesis is correct, the following econometric models are established in this paper:

$$\mathrm{GVC\_PO_{it}} = \alpha_0 + \beta \mathrm{TOTAL_{it}} + \sum \gamma_j \mathrm{x_{ijt}} + \mathrm{u_i} + \varphi_t + \varepsilon_{it} \quad (1)$$

$$\mathrm{GVC\_PO_{it}} = \alpha_0 + \beta \mathrm{UP_{it}} + \sum \gamma_j \mathrm{x_{ijt}} + \mathrm{u_i} + \varphi_t + \varepsilon_{it} \quad (2)$$

$$\mathrm{GVC\_PO_{it}} = \alpha_0 + \beta \mathrm{DOWN_{it}} + \sum \gamma_j \mathrm{x_{ijt}} + \mathrm{u_i} + \varphi_t + \varepsilon_{it} \quad (3)$$

Where subscript i denotes industry, and t denotes year. $\mathrm{GVC\_PO}_{it}$ denotes China's manufacturing industry participation in the GVC[5]. $TOTAL_{it}$, UP_{it} and $DOWN_{it}$ are the core explanatory variables of equations (1) (2) and (3), respectively, denoting the total participation, upstream participation and downstream participation in the RVC[6]. x_{ijt} denotes other control variables, which will be introduced in the appendix. u_i denotes industry individual effect. φ_t denotes time effect. ε_{it} is a random disturbance term.

4.2. Empirical results and discussion

In this subsection, we plan to study the empirical impact of ASEAN-China RVC participation on GVC positions in manufacturing industries. Using OLS may provide biased results, because there are differences in the participation of different manufacturing industries. In addition, the different technological content of different manufacturing industries may also lead to biased results. For example, the high participation of high-tech manufacturing industries is more likely to lead to a rise in GVC positions. Therefore, it is necessary to control for the industry fixed effects to

minimize the influence of differences of participation and technology on empirical results.

In addition, special events of some years may also affect the empirical results. For example, the financial crisis occurred in 2008, which had a great impact on the global economy. Therefore, it is necessary to control for the year fixed effects to deal with the unanticipated impacts that may occur each year. Furthermore, the potential cross-sectional dependence also indicates that the fixed effects should be controlled. Meanwhile, robust and cluster robust standard errors are estimated[7] to deal with the possible problem of heteroskedasticity.

Columns (1) to (2) show the regression results of industry and year fixed effects on equation (1), respectively, and column (3) shows the industry and year fixed effect on equation (1). Coefficient of *TOTAL* is positive in columns (1) to (3) and passes the significance test of 1%, which indicates that China's participation in the ASEAN-China RVC is beneficial to its promotion in the GVC. This means that China's manufacturing participation in the supply of raw materials and input of intermediate products in the ACFTA will enhance its position in the GVC. In total, China's manufacturing industries are more embedded in the ASEAN-China RVC, and they can rely on the advantages of geographical location and the policy convenience provided by the government. As a result, the 'cost effect' and 'innovation incentive effect' bring more opportunities for enterprises to obtain higher value-added to improve their position in the GVC.

Columns (4) to (6) show the regression results on equation (2) and columns (7) to (9) show the regression results on equation (3). Coefficient of *UP* is positive in columns (4) to (6) and passes the significance test of 1%, indicating China's manufacturing industries move up to more upstream in the ASEAN-China RVC actually beneficial to their GVC positions. In a commodity production chain, countries more upstream tend to obtain more value-added because they control the core technology of production. In terms of the ASEAN-China RVC, China's manufacturing industries mostly lie upstream, which provides very favourable conditions for manufacturing industries to obtain value-added. The coefficient of *DOWN* is positive in columns (7) to (9), with failing to pass statistically significant, which indicates that China's participation in the downstream activities of the ASEAN-China regional value chain may lead to the rising of its GVC positions in the long run. With the participation in GVCs, China's manufacturing industries participate in more backward linkages and acquire technological innovation by imitating product manufacture from developed countries. RVC participation is different from GVC participation, however. Most countries in the ASEAN-China FTA are developing countries with a low level of economic development, which makes it difficult for Chinese enterprises lying downstream to realize the 'learning and innovation effect' and to improve the quality of the labour force. Therefore, high value-added activities are difficult to achieve by industries involved in backward linkages. In summary, Hypothesis 1, Hypothesis 2 and Hypothesis 3 are correct, as suggested by the fixed-effect regression results.

In addition to the three main explanatory variables of total participation, upstream degree and downstream degree, the control variables are also worth investigating. Regression results are shown in Table 1. In columns (1) to (9), coefficients of *Debt-*

Table 1. Impact of RVC participation on GVC position.

VARIABLES	(1) GVC_PO	(2) GVC_PO	(3) GVC_PO	(4) GVC_PO	(5) GVC_PO	(6) GVC_PO	(7) GVC_PO	(8) GVC_PO	(9) GVC_PO
TOTAL	0.672***	0.807***	0.665***						
	(0.193)	(0.202)	(0.190)						
UP				1.496***	1.379***	1.094***			
				(0.300)	(0.325)	(0.309)			
DOWN							0.283	0.434*	0.391
							(0.244)	(0.262)	(0.245)
Debt-to-assets ratio	0.000744	−0.0122	−0.00270	−0.0327	−0.0200	−0.0131	0.0239	0.0160	0.0196
	(0.0315)	(0.0331)	(0.0311)	(0.0334)	(0.0332)	(0.0318)	(0.0314)	(0.0336)	(0.0314)
Industry openness	−0.264***	−0.413***	−0.282***	−0.207***	−0.352***	−0.226***	−0.190***	−0.346***	−0.217***
	(0.0536)	(0.0481)	(0.0551)	(0.0454)	(0.0408)	(0.0476)	(0.0515)	(0.0489)	(0.0547)
R&D investment	1.022*	1.983***	1.182**	0.782	1.295**	0.766	1.010*	1.981***	1.220**
	(0.539)	(0.549)	(0.574)	(0.529)	(0.550)	(0.577)	(0.561)	(0.594)	(0.604)
Institutional factor	0.143**	0.00770	0.308***	0.0344	−0.00870	0.319***	0.136*	−0.0546	0.261***
	(0.0708)	(0.0628)	(0.0970)	(0.0577)	(0.0609)	(0.0974)	(0.0764)	(0.0634)	(0.0992)
Financial crisis	0.0742***	0.0198***	0.0991***	0.0561***	0.0150***	0.101***	0.0842***	0.0197***	0.102***
	(0.0139)	(0.00484)	(0.0177)	(0.0125)	(0.00482)	(0.0177)	(0.0147)	(0.00517)	(0.0183)
Intensity of FDI	−0.0438	−0.0875*	0.0776	−0.0813	−0.110**	0.100	0.00590	−0.0661	0.0965
	(0.0679)	(0.0453)	(0.0765)	(0.0614)	(0.0458)	(0.0758)	(0.0712)	(0.0471)	(0.0792)
Asset structure	0.00403	0.0207*	0.0112	0.000216	0.0127	0.00304	−0.00415	0.00938	0.00364
	(0.0121)	(0.0124)	(0.0132)	(0.0112)	(0.0117)	(0.0127)	(0.0123)	(0.0127)	(0.0136)
Constant	−0.0398	0.113	−0.106	0.0916	0.137	−0.0875	−0.134	0.0354	−0.177
	(0.121)	(0.124)	(0.119)	(0.127)	(0.124)	(0.120)	(0.121)	(0.128)	(0.121)
Year fixed effects	YES	NO	YES	YES	NO	YES	YES	NO	YES
Industry fixed effects	NO	YES	YES	NO	YES	YES	NO	YES	YES
R-squared		0.679	0.755		0.683	0.755		0.650	0.737

Notes: Standard errors in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.
Source: Authors estimation.

to-assets ratio are uncertain with failing to pass statistically significant all. Specifically, the higher the debt ratio to assets, the higher the risk of the enterprise facing bankruptcy, the appropriate debt-to-assets ratio is conducive to the long-term development of the enterprise. Coefficients of *Industry openness* are negative, with all passing the statistically significant. It means within the production process, China's manufacturing industries participate more actively causing their decrease in GVC positions. R&D investment is significantly positively correlated with the positions in the GVC. The empirical results show that investment in R&D does bring the upgrading of science and technology, which will improve the positions in the GVC as mentioned above. Similarly, *Institutional factor* is mainly positively correlated with GVC position. With the increase of ratio of state ownership to non-state ownership, scale economy and steady economy growth ensure the rise of Chinese enterprises' positions in the manufacturing industry. Coefficient of *Financial crisis* is significantly positive, indicating China's manufacturing industries have seized the opportunity brought by the financial crisis to enhance the competitiveness of their products. *Intensity of FDI* is positively correlated in industry and year fixed effect models, with failing to pass statistically significant, showing that FDI intensity is mostly concentrated in low-technology industries, high value-added production processes are still concentrated in the home country of the FDI, and China's manufacturing positions in the GVC have not been improved. Similarly, coefficient of *ASSET structure* is positive, with failing to pass statistically significant partly. The ratio of non-fixed assets to fixed assets does not reach a balance, help enterprises to operate healthily and improve their competitiveness.

4.3. Heterogeneity analysis of manufacturing enterprises

We propose the classification of the 15 manufacturing industries into three types to test the relationship between the RVC and GVC of heterogeneous enterprises (labour-intensive, capital-intensive and knowledge-intensive)[8]. The results are shown in Table 2. In Table 2, columns (1) to (3) are the estimated results for labour-intensive manufacturing, columns (4) to (6) are for capital-intensive manufacturing, and columns (7) to (9) are for knowledge-intensive manufacturing.

As shown in Table 2, each variable is basically consistent with the overall analysis. Regardless of which industry is involved in the upstream activities of the ASEAN-China RVC, it will be helpful for China's manufacturing enterprises to move up in the GVC. In columns (1) to (3) of Table 2, the participation of labour-intensive industries in the ASEAN-China RVC has a positive correlation with the improvement of China's manufacturing enterprises' position in the GVC. Among them, the coefficient of *UP* is significantly positive and the coefficient of *DOWN* does not pass the significance test. In the RVC, the trade creation effect can bring about an increase in employment in China. The technical level required by upstream participation in the RVC can promote the improvement of the quality of the labour force in China's manufacturing enterprises, increase employees' talent, which in turn leads to the innovation incentive effect. Columns (4) to (6) of Table 2 show that capital-intensive manufacturing industry participation in upstream industries can also lead to the

Table 2. Heterogeneity analysis of enterprises.

VARIABLES	(1) GVC_PO	(2) GVC_PO	(3) GVC_PO	(4) GVC_PO	(5) GVC_PO	(6) GVC_PO	(7) GVC_PO	(8) GVC_PO	(9) GVC_PO
TOTAL	1.738**			0.762*			0.119		
	(0.767)			(0.418)			(0.185)		
UP		2.033**			1.500***			1.441**	
		(0.719)			(0.468)			(0.674)	
DOWN			−1.685			−0.976			0.0294
			(2.261)			(0.763)			(0.213)
Debt-to-assets ratio	0.0869	0.128	0.0798	−0.0999	−0.127**	−0.0437	0.128	0.0967	0.161
	(0.108)	(0.103)	(0.130)	(0.0600)	(0.0563)	(0.0560)	(0.158)	(0.140)	(0.159)
Industry openness	0.253	0.216	0.525	−0.102	−0.109	−0.00969	−0.0593	−0.145	−0.0367
	(0.305)	(0.283)	(0.326)	(0.0902)	(0.0820)	(0.0891)	(0.116)	(0.114)	(0.113)
R&D investment	10.89	9.834	18.26**	4.241**	3.854**	4.141**	0.424	−0.0313	0.512
	(7.741)	(7.181)	(8.161)	(1.608)	(1.524)	(1.639)	(1.149)	(1.104)	(1.149)
Institutional factor	0.421	0.438*	0.279	0.0983	0.162	−0.0180	0.351*	0.369**	0.365*
	(0.260)	(0.241)	(0.292)	(0.189)	(0.179)	(0.185)	(0.190)	(0.177)	(0.192)
Financial crisis	0.207***	0.209***	0.212***	0.0719**	0.0641**	0.0660*	0.156***	0.147***	0.162***
	(0.0407)	(0.0379)	(0.0472)	(0.0331)	(0.0313)	(0.0338)	(0.0454)	(0.0417)	(0.0455)
Intensity of FDI	0.215*	0.272***	0.383**	0.0896	0.0591	0.125	0.240	0.261	0.260
	(0.101)	(0.0845)	(0.132)	(0.167)	(0.158)	(0.169)	(0.170)	(0.156)	(0.172)
Asset structure	0.0669**	0.0538*	0.0504	0.0475	0.0531*	0.0143	−0.00541	−0.00693	−0.00674
	(0.0275)	(0.0256)	(0.0352)	(0.0321)	(0.0293)	(0.0312)	(0.0206)	(0.0193)	(0.0208)
Constant	−0.977**	−1.087**	−0.965*	0.200	0.283	0.0703	−0.812	−0.680	−0.964
	(0.408)	(0.384)	(0.481)	(0.201)	(0.190)	(0.194)	(0.689)	(0.605)	(0.690)
Fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.968	0.972	0.957	0.679	0.715	0.669	0.868	0.883	0.867

Notes: Standard errors in parentheses.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.
Source: Authors estimation.

improvement of GVC positions. The construction of ACFTA brings about an increase in the investment of both China and ASEAN. There is clear agreement on that the construction of international logistics infrastructure in the free trade area agreements brings opportunities for the development of China's capital-intensive industries. Based on this, the improvement of logistics infrastructure reduces the cost of the cross-border flow of goods, providing a favourable external environment for China's manufacturing enterprises to increase their products' value-added and climb the GVC. In columns (7) to (9) of Table 2, the upstream participation of knowledge-intensive industries in the RVC leads to improvement in GVC position. The development of knowledge-intensive industries leads to the improvement of technology, which provides a higher level of value-added to China's products. However, the coefficients of *TOTAL* and *DOWN* in columns (7) to (9) of Table 2 do not pass the significance test. The fact that knowledge-intensive industries take part in more downstream in the ASEAN-China RVC is not conducive to technological innovation and upgrading of manufacturing enterprises, and will restrain the climb of enterprises in the GVC. Therefore, we believe that the participation of knowledge-intensive industries should increase, especially upstream in the RVC.

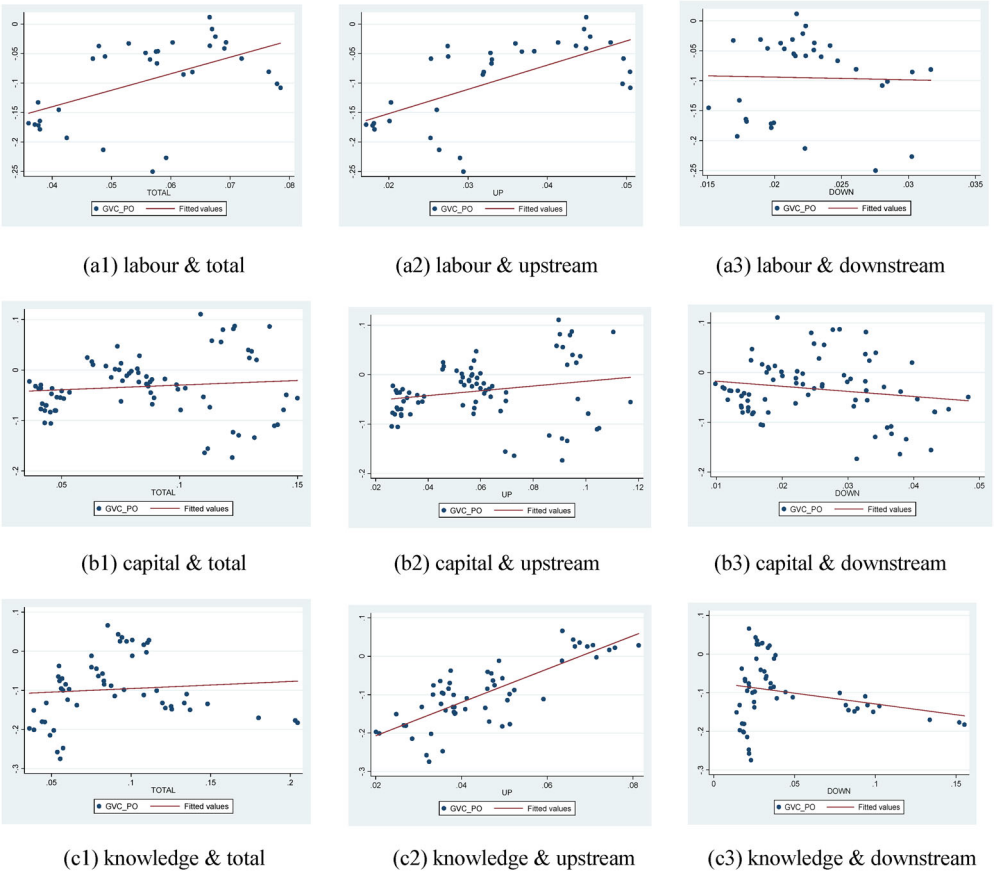
In the heterogeneity analysis, the results of several control variables are inconsistent with the overall results. Different from the overall analysis, the *Debt-to-assets ratio* coefficients of labour and knowledge-intensive industries are positive, while that of capital-intensive industries is negative. In the process of capital-intensive industries participating in the upstream in RVC, the decrease of debt-to-assets ratio will result in a significant rise of GVC positions. Capital-intensive industries can improve their competitiveness by adjusting financial leverage. Besides, coefficients of *Intensity of FDI* in labour-intensive industries pass the significant test, means that the increase of FDI in labour-intensive industries is conducive to improving the competitiveness of their products.

To provide more intuition on the relationship between RVC participation and the GVC position of heterogeneous enterprises, we draw nine graphs, as shown in Figure 2. Labour-intensive, capital-intensive and knowledge-intensive correspond to a, b and c, respectively. Then, the regional total, upstream and downstream participation of the three industry types are compared with the positions in the GVC, corresponding to 1, 2 and 3, respectively.

In summary, the participation of three types of manufacturing in the RVC can promote the improvement of GVC position. It is worth noting that in the comparison of a2, b2 and c2, the straight line in C2 is steeper, which indicates that the participation of knowledge-intensive industries in the RVC will result in a significant improvement in the GVC. At the meantime, compared with a3 and b3, there is the highest absolute slope in c3, meaning that the participation of knowledge-intensive industries in the RVC is not conducive to the GVC. Based on these analyses, we deem that it is important for knowledge-intensive industries to participate in the upstream in the ASEAN-China RVC.

4.4. Robustness test

Wang et al. (2017) not only measured the complex GVC activities but also calculated the simple and overall GVC activities, and the results were uniformly obtained from



(a1) labour & total (a2) labour & upstream (a3) labour & downstream

(b1) capital & total (b2) capital & upstream (b3) capital & downstream

(c1) knowledge & total (c2) knowledge & upstream (c3) knowledge & downstream

Figure 2. Relationships between RVC and GVC in different industries.
Source: Authors estimation.

the UIBE GVC indicators. To test the robustness of the results in this paper, we replace the explained variables with aggregated GVC position data.

We use fixed effect model to perform the empirical test, and the empirical results are shown in Table 3. Columns (1) to (3) of Table 3 are regressions based on Wang et al. (2017) total GVC forward participation and backward participation.[9]

As shown in Table 3, after the reconstruction of the GVC embedding position index, the results are basically consistent with the above results. Simple GVC activities mean that value-added embedded in intermediate exports is directly absorbed by the importing country for the production of final products, while complex GVC activities refer to the export of final products to a third country. Therefore, in fact, complex GVC activities are what we focus on, simple GVC activities are not considered separately.

It is likely that the change of China's manufacturing industries in the GVC positions may affect their participation in the RVC, which implies that there may be a bidirectional causal relationship between the explained variables and the core explanatory variables, leading to endogeneity problems. In order to alleviate this problem, the present paper uses the one period lag of the core explanatory variable as an instrumental variable, and conducts a two-stage least squares (2SLS) regression. The

Table 3. Robustness test.

VARIABLES	(1) GVC_PO2	(2) GVC_PO2	(3) GVC_PO3
TOTAL	0.632**		
	(0.244)		
UP		0.893**	
		(0.398)	
DOWN			0.121
			(0.227)
Constant	0.580***	0.584***	0.564***
	(0.151)	(0.153)	(0.111)
Control variables	Yes	Yes	Yes
Observations	165	165	165
Fixed effect	YES	YES	YES
R-squared	0.572	0.568	0.448
Number of id	15	15	15

Notes: Standard errors in parentheses.
***p < 0.01.
**p < 0.05.
*p < 0.1.
Source: Authors estimation.

Table 4. Robustness test.

VARIABLES	(1) first TOTAL	(2) second GVC_PO	(3) first UP	(4) second GVC_PO	(5) First DOWN	(6) Second GVC_PO
TOTAL		1.252***				
		(0.204)				
L.TOTAL	0.908***					
	(33.62)					
UP				3.115***		
				(13.98)		
L.UP			0.946***			
			(0.0283)			
DOWN						−0.347
						(-1.00)
L.DOWN					0.871***	
					(0.0233)	
Constant	0.015	0.0463	0.0146	0.286*	0.00724	0.078
	(0.46)	(0.229)	(0.0232)	(1.65)	(0.0200)	(0.30)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150	150	150	150	150	150
R-squared	0.962	0.614	0.960	0.782	0.966	0.500

***p < 0.01.
**p < 0.05.
*p < 0.1.
Source: Authors estimation.

regression results are shown in Table 4. The results are basically consistent with the fixed effect regression results, which proves the robustness of the conclusions of this study to a certain extent.

Since System Generalized Method of Moments (GMM) method is also an effective tool to deal with the problem of endogeneity, we adopt the System GMM method to estimate equations (1) to (3) for further robustness test. In this paper, we introduce the GVC positions lagged by one period into the regression equation as an explanatory variable (see equations (4) to (6) for details). The results are shown in Table 5, which shows that the p values of AR (1) is less than 0.1, and p values of AR (2) and Sargan test are greater than 0.1, indicating that there is only first-order sequence

Table 5. Robustness test.

VARIABLES	(1) GVC_PO	(2) GVC_PO	(3) GVC_PO
L.GVC_PO	0.583**	0.498*	0.625***
	(0.259)	(0.291)	(0.238)
TOTAL	1.144*		
	(0.687)		
UP		1.965**	
		(0.860)	
DOWN			6.014
			(3.751)
Constant	0.881*	0.669	0.181
	(0.493)	(0.553)	(0.379)
Control variables	Yes	Yes	Yes
AR(1)	0.097	0.065	0.000
AR(2)	0.356	0.462	0.100
Sargan	0.236	0.147	0.145
Number of id	15	15	15

Notes: (1) The value in parentheses below the coefficient is the standard error. (2) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (3) The results of the AR (1), AR (2), and Sargan are values of p.
Source: Authors estimation.

correlation but no second-order sequence correlation. After considering the dynamic effects of the model, it can be seen that the results of the model are still significant. The participation of China's manufacturing industries in the upstream in RVC will significantly improve their GVC positions. China's participation in ASENA-China RVC can bring more value-added to products and improve the competitiveness of its products.

$$\mathrm{GVC\_PO_{it}} = \alpha_0 + \alpha_1 \mathrm{GVC\_PO_{i(t-1)}} + \beta \mathrm{TOTAL_{it}} + \sum \gamma_j x_{ijt} + u_i + \varphi_t + \varepsilon_{it} \quad (4)$$

$$\mathrm{GVC\_PO_{it}} = \alpha_0 + \alpha_1 \mathrm{GVC\_PO_{i(t-1)}} + \beta \mathrm{UP_{it}} + \sum \gamma_j x_{ijt} + u_i + \varphi_t + \varepsilon_{it} \quad (5)$$

$$\mathrm{GVC\_PO_{it}} = \alpha_0 + \alpha_1 \mathrm{GVC\_PO_{i(t-1)}} + \beta \mathrm{DOWN_{it}} + \sum \gamma_j x_{ijt} + u_i + \varphi_t + \varepsilon_{it} \quad (6)$$

5. Conclusions

This paper analyses the influence of total participation, upstream participation and downstream participation in the ASEAN-China regional value chain on the positions of China's manufacturing industries in the GVC. The research results show that the participation of three heterogeneous activities in upstream activities of RVC will bring about the improvement of GVC positions, especially in knowledge-intensive manufacturing industries, which are in line with the theories. Furthermore, the empirical results show that the participation of China's manufacturing industries in the RVC is conducive to the improvement of GVC positions and that upstream participation can indeed promote GVC positions. However, the downstream degree coefficient is not significant, which means that the influence of China's downstream participation in the ASEAN-China regional value chain on its GVC positions is still unclear.

Based on the above results, the main contribution of this paper is to confirm that RVC participation does play an important role in the promotion of GVC positions, which is mainly consistent with Baldwin (2006) and Ruta (2017). We improve the measurement of RVC participation index and then study the effects of different participation modes of RVC and different intensity of manufacturing factors on GVC positions. In summary, the conclusions of this paper can provide more explanations for developing countries to participate in GVC and RVC, and to engage in South-South cooperation.

Our findings have some policy implications. Firstly, policy makers can promote the cooperation between China and ASEAN countries by introducing policies that can lower the market access threshold for small and medium sized enterprises, and thus can promote the further development of trade. Secondly, our findings suggest that manufacturing enterprises (especially the knowledge-intensive ones) can grasp the opportunities brought by regional trade liberalization and participate in the upstream of RVCs by constantly improving the technical complexity of export products. Thirdly, our findings imply that for other developing countries, such as Brazil, African countries, and other Asian ones, comparative advantages can be explored by actively engaging in RVCs, so that they can participate the GVCs in a more productive way.

A shortcoming of this paper is that it is mainly limited by the specific region and country. This paper only studies the influence of China-ASEAN RVC participation on GVC positions, and only studies China's manufacturing industries. Future research can be extended to cover the comparison of multiple regions and considers the different influences of RVC participation across different member countries.

Notes

1. http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx
2. https://v2.fangcloud.com/share/a26979974d538c7e5aeb24b55a?lang=en
3. http://data.aseanstats.org/indicator/AST.STC.TBL.5
4. http://data.aseanstats.org/trade-annually
5. See Appendix A for GVC positions calculation.
6. See Appendix B for the calculations of RVC total participation, upstream participation and downstream participation.
7. See Appendix C.
8. Specific manufacturing categories are derived.
9. Value-added embodied in intermediate goods is absorbed by direct importers, which means simple GVC activities. Value-added embodied in intermediate goods is absorbed by importers then re-exported to third countries, which means complex GVC activities. The sum of simple and complex GVC activities is the aggregate GVC activities.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A. Measuring GVC positions

Wang et al. (2017) construct indices to measure GVC positions by dividing the production length into forward linkages and backward linkages. Through the decomposition of upstream and downstream production sectors, the position index of GVC can be expressed as follows:

$$\mathrm{GVC\_PO} = \mathrm{LN}\left(1 + \frac{\hat{V}LA^{F}(BY - LY^{D})}{Va'}\right) - \mathrm{LN}\left(1 + \frac{VLA^{F}\left(B\hat{Y} - L\hat{Y}^{D}\right)}{Y'}\right)$$

Where $\frac{\hat{V}LA^{F}(BY-LY^{D})}{Va'}$ is forward linkage of complex GVC activities; $\frac{VLA^{F}\left(B\hat{Y}-L\hat{Y}^{D}\right)}{Y'}$is backward linkage of complex GVC activities.

Appendix B. Measuring RVC participation

At present, interest in the study of regional value chains is rising to catch up with the interest in the relatively developed measurement of global value chains. We use the degree of China's participation in the regional value chain to represent the level of China's regional integration participation in the ACFTA, and measure China's GVC and RVC participation both from the perspective of value added. We start our work from the input-output model of Leontief (1936) to decompose the trade in value added. Wang et al. (2013) breakdown a country's total gross exports into four buckets, namely (1) domestic value-added (DVA) absorbed abroad from exports; (2) DVA returned home; (3) foreign value-added (FVA); and (4) pure double counted terms (PDC). Koopman et al. (2014) further decomposed the total gross trade flow in more detail at a disaggregated level. The formula is as follows:

$$
\begin{aligned}
\mathrm{uE}_{s*} = & \left\{ V_s \sum_{r\neq s}^{G} B_{ss} Y_{sr} + V_s \sum_{s\neq r}^{G} B_{sr} Y_{rr} + V_s \sum_{r\neq s}^{G} \sum\nolimits_{t\neq s,\, r}^{G} B_{sr} Y_{rt} \right\} \\
& + \left\{ V_s \sum_{r\neq s}^{G} B_{sr} Y_{ss} + V_s \sum_{s\neq r}^{G} B_{sr} A_{rs} (I - A_{ss})^{-1} Y_{ss} \right\} + V_s \sum_{s\neq r}^{G} B_{sr} A_{rs} (I - A_{ss})^{-1} E_{s*} \\
& + \left\{ \sum_{t\neq s}^{G} \sum\nolimits_{r\neq s}^{G} V_t B_{ts} Y_{sr} + \sum_{t\neq s}^{G} \sum\nolimits_{r\neq s}^{G} V_t B_{ts} A_{sr} (I - A_{rr})^{-1} Y_{rr} \right\} \\
& + \sum\nolimits_{t\neq s}^{G} V_t B_{ts} A_{sr} \sum\nolimits_{r\neq s}^{G} (I - A_{rr})^{-1} E_{r*} \qquad (1)
\end{aligned}
$$

We cite Koopman et al.'s (2014) total trade flow decomposition method at bilateral-sector level to extract the different sources of China's exports to ASEAN countries from a spatial dimension. They spilt a country's exports into 9 items. Among the items, the domestic value-added of a country's exports to the direct importing country finally absorbed by the third country (indirect value-added export) can be expressed as follows:

$$
\mathrm{RDVA\_INTREX}_{s*} = \mathrm{V}_s \sum_{r\neq s}^{G} \sum\nolimits_{t\neq s,\, r}^{G} \mathrm{B}_{sr} \mathrm{Y}_{rt} \qquad (2)
$$

The foreign value-added in a country's exports can be expressed as follows:

$$
\mathrm{RFVA}_{s*} = \sum_{t\neq s}^{G} \sum\nolimits_{r\neq s}^{G} \mathrm{V}_t \mathrm{B}_{ts} \mathrm{Y}_{sr} + \sum_{t\neq s}^{G} \sum\nolimits_{r\neq s}^{G} \mathrm{V}_t \mathrm{B}_{ts} \mathrm{A}_{sr} (\mathrm{I} - \mathrm{A}_{rr})^{-1} \mathrm{Y}_{rr} \qquad (3)
$$

Since we want to build a regional value chain framework between China and ASEAN, country S represents China, and R and T represent ASEAN countries.

Moreover, according to Koopman et al. (2010), the extent to which a country participates in the upstream links of value chain is the ratio of indirect value-added exports within region (RDVA_INTREX) to total exports, and the extent to which a country participates in the downstream links of value chains is the ratio of foreign value added within region (RFVA) to total exports. The sector's participation in the upstream activities of value chains reveals that the sector is mainly responsible for R&D, design, brand innovation, production and supply of key components and other activities, while its participation in the downstream activities of value chains means that the sector is mainly responsible for processing, assembly and so on. To increase its trade value-added, what a country, sector or enterprise should do is to enhance their position and strive to participate in the upstream links. The sum of a country's upstream and downstream participation is the total extent to which a country is embedded in value chains. From this, we define the index of participation degree of regional value chain as follows:

$$
\mathrm{RVC\_Participation} = (\mathrm{RDVA\_INTREX}_{\mathrm{IN}} + \mathrm{RFVA}_{\mathrm{IN}}) / \mathrm{E}_{\mathrm{IN-NET}} \qquad (4)
$$

Where $\mathrm{RDVA\_INTREX}_{IN}$ is the indirect value-added exports from China to ASEAN countries that are eventually absorbed by the third ASENA country; RFVA_{IN} refers to the value-added from ASEAN countries in China's exports to ASEAN countries; E_{IN-NET} refers to China's net exports to ASEAN countries. Not only China's export to non-ASEAN countries

should be excluded, but also value-added of China's exports to non-ASEAN countries should be excluded, and finally only China's net exports to ASEAN countries are retained.

Thus, the formula of the upstream degree of China's participation in the RVC is as follows:

$$\text{Upstream\_regional} = \text{RDVA\_INTREX}_{\text{IN}}/\text{E}_{\text{IN-NET}} \tag{5}$$

Los et al. (2015) decomposed FVA into regional foreign value added (RFVA) and global foreign value added (GFVA). Combining Los et al. (2015) and Koopman et al. (2010), we define the ratio of RFVA to total exports as China's downstream participation in the regional value chain:

$$\text{Downstream\_regional} = \text{RFVA}_{\text{IN}}/\text{E}_{\text{IN-NET}} \tag{6}$$

The relationship between the above three equations (4, 5 and 6) is as follows:

$$\text{RVC\_Participation} = \text{Upstream\_regional} + \text{Downstream\_regional} \tag{7}$$

Appendix C. Fixed effects estimates with robust and cluster robust SE

VARIABLES	(1) GVC_PO	(2) GVC_PO	(3) GVC_PO
TOTAL	0.67**	0.67**	0.67**
	(0.002)	(0.010)	(0.010)
Debt-to-assets ratio	−0.00	−0.00	−0.00
	(0.899)	(0.954)	(0.954)
Industry openness	−0.28***	−0.28***	−0.28***
	(0.000)	(0.000)	(0.000)
R&D investment	1.18*	1.18	1.18
	(0.021)	(0.128)	(0.128)
Institutional factor	0.31**	0.31**	0.31**
	(0.000)	(0.005)	(0.005)
Financial crisis	0.10***	0.10***	0.10***
	(0.000)	(0.000)	(0.000)
Intensity of FDI	0.08	0.08	0.08
	(0.063)	(0.237)	(0.237)
Asset structure	0.01	0.01	0.01
	(0.157)	(0.347)	(0.347)
N	165	165	165

Note: p-values in parentheses.
Source: Authors estimation.

Appendix D. Control variables description and data sources

Variables	Definition	Sources
Debt-to-assets ratio	Debt-to-assets ratio of enterprises above the scale is used and lnLEV is in logarithm form.	the China Industry Economy Statistical Yearbook
Industry openness	Industry's participation in GVCs is used to indicate its openness to the world	UIBE GVC indicators
R&D investment	The ratio of the internal expenditure on R&D of industrial enterprises above designated size to the main business income of industrial enterprises above designated size is used to measure R&D investment.	the China Industry Economy Statistical Yearbook and the China Statistical Yearbook on Science and Technology
Financial crisis	A dummy variable, and the value of 2008-2015 is assigned as 1, the value of 2005-2008 is 0	
Institutional factor	It is measured by the ratio of sales value of state-owned and holding enterprises to sales value of enterprises above designated size.	the China Industry Economy Statistical Yearbook
Asset structure	The ratio of nonfixed assets to fixed assets to express the asset structure.	the China Industry Economy Statistical Yearbooks
Intensity of FDI	The intensity of foreign direct investment is formulated by the ratio of the total investment assets of foreign investors, Hong Kong, Macao and Taiwan to the total assets of industries above designated size.	the China Industry Economy Statistical Yearbook

Source: Authors estimation.

Appendix E. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GVC_PO	165	-.067	.077	-.275	.111
UP	165	.05	.022	.017	.117
DOWN	165	.031	.023	.01	.155
TOTAL	165	.081	.035	.036	.205
Debt-to-assets ratio	165	4.039	.088	3.74	4.213
Industry openness	165	.57	.195	.198	.975
R&D investment	165	.008	.006	.001	.023
Financial crisis	165	.727	.447	0	1
Institutional factor	165	.175	.187	.012	.801
Asset structure	165	1.682	.598	.781	3.119
Intensity of FDI	165	.3	.129	.101	.698

Source: Authors estimation.

Appendix F. Unification of OECD and China manufacturing industry classification

ISIC Rev.4	OECD classification of manufacturing industries	Classification of manufacturing industries in China's national economy
C10-12	Food products, beverages and tobacco	Agricultural and sideline food products, food, wine, beverages, refined tea and tobacco (13-16)
C13-15	Textiles, textile products, leather and footwear	Textiles, textile products, clothing, leather, fur and feathers (17-19)
C16	Wood and products of wood and cork	Wood processing and wood, bamboo, rattan, brown, grass products (20)
C17-18	Paper products and printing	Paper products, printing, culture and education, industrial beauty, sports and entertainment products (22-24)
C19	Coke and refined petroleum products	Oil, coal and other fuels products (25)
C20-21	Chemicals and chemical products	Chemical raw materials, chemical, pharmaceutical and chemical fiber products (26-28)
C22	Rubber and plastics products	Rubber and plastics products (29)
C23	Other nonmetallic mineral products	Nonmetallic mineral products (30)
C24	Basic metals	Ferrous and nonferrous metals (31-32)
C25	Fabricated metal products	Fabricated metal products (33)
C26	Computer, electronic and optical equipment	Computers, communications, electronic equipment and instrumentation (39-40)
C27	Electrical machinery and apparatus, nec	Electrical machinery and equipment products (38)
C28	Machinery and equipment, nec	General and special purpose equipment products (34-35)
C29-30	Transport equipment	Automobile, railway, shipping, aerospace and other transportation equipment (36-37)
C31-33	Manufacturing nec; repair of machinery and equipment	Furniture, other products, waste resources, equipment repair (21 + 41-43)

Data source: OECD, ISIC Rev.4 and GB/T 4754-2017.