
Spillover Effect Analysis of TPP's Global Value Chain Reorganization on Domestic Employment*

Nam-Suk Choi^a

^aDepartment of International Trade, Chonbuk National University, South Korea

TPP에 따른 글로벌 가치사슬 재편의 국내 고용 파급효과분석

최남석

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Abstract

This paper investigates the effects of TPP on Korean domestic employment. Using data from 1995-2011 obtained from the world input-output database (WIOD) and firm-level data, this paper attempts to identify changes in global value chain (GVC) structures involving Korea and TPP member countries in the Asia-Pacific region. Three stage least squares estimation is employed, and empirical findings show that there exists a statistically positive and significant causal relationship between GVC and domestic manufacturing employment. The positive impacts of TPP on Korean domestic employment suggest that Korea actively encourage TPP negotiation. TPP will bring positive domestic employment effects and opportunities for structural transformation in the manufacturing and services industries in Korea.

Keywords: TPP, Global Value Chains, Domestic Employment

JEL Classifications: F12, F15

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^a First Author, E-mail: namsuk.choi@jbnu.ac.kr

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I. Introduction

Japan-led Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), with 11 countries participating, was officially signed in Chile in March 2018. Excluded from intra-regional production networks, concerns over retreat of Korean manufacturing and service industries' role of intermediary suppliers in the Asia-Pacific region are growing. Eventually TPP-12's entry into force will facilitate foreign direct investment, commodity and service trade among countries in the region, so global supply chains (GVCs) in Asia Pacific will be reorganized around TPP. GVC is the production structure that creates added value according to each production activity, while various industries in different countries are put into production in order to produce the final goods. It internationally divides production processes from R&D to after-sales services.

President Trump ordered examination of the United States' return to the TPP on April 12, 2018. White House National Economic Council director Larry Kudlow ordered U.S. Trade Representative Robert Lighthizer to review TPP re-entry. Korean companies operating production corporation in TPP region and exporting to the US may become significantly less competitive than Japanese firms. When TPP-12 is effectuated, Japan and US-led new trade order in Asia-Pacific trade in services may possibly emerge.

Despite the increasing importance of global production-division networks of economic integration, not many studies are conducted to examine TPP-lead GVC reorganization and its effects on domestic employment. This paper chooses the "reorganization" expression to emphasize the reorganization of the existing GVC in the Asia-Pacific region due to the TPP effectuation. Korea will be incorporated

into the GVC, which is reformed due to TPP. This paper aims to analyze the current state of GVCs in the Asia Pacific region of Korea, and estimates the effects of the GVC reorganization on the industrial structure and domestic employment in Korean manufacturing and service industries.

The microeconomic study of the effect of the Korean companies GVC expansion on domestic companies' business activity invigoration is carried out in conjunction with the macroeconomic study of the industry-level GVC reorganization effect of the mega FTA. Using World Input Output Database(WIOD) International Industry Input Output Table data from 1995 to 2011, this paper identifies the GVCs of Asia Pacific region that is reorganized by TPP. Its main contributions to the existing research are to estimate the effect of TPP on domestic job creation using the financial data of Korean companies, and articulate the specific channels of positive relationship between TPP entry and domestic employment.

II. Related Literature

One strand of literature on the economic effects of TPP examines the effect of TPP on the US and Japan by using the CGE model (Sung Han-Kyoung, 2015). Others are qualitative analyses focusing on the textile industry regarding necessity of strengthening the production network in TPP by using GVC (Kwon Soon-Koog, 2014).

Another stand of literature is on domestic manufacturing impact of expansion of GVC participation. According to various papers, GVC participation can lead to productivity improvement and employment increase. Trade in tasks between domestic and foreign enterprises through expansion of the GVC promotes mutual complementarity between

domestic and overseas workers, while also raising the competitiveness and employment of domestic workers. Offshoring of multinational enterprises implies productivity enhancement and job displacement. When offshoring expands trade in tasks, it increases the productivity of domestic manufacturing industry (Grossman and Rossi-Hansberg, 2008).

As the complexity of tasks that is the accumulation of productive knowledge required to perform a specific task increases, labor productivity increases. As labor demand for this task increases, the number of domestic jobs in the knowledge-based industry increases (Ottaviano et al., 2013)

According to Korean literature on GVCs, the expansion of GVC participation contributes to the export of intermediate goods and the improvement of total factor productivity in domestic companies. Korea's trade liberalization promoted the expansion of GVC participation, while expanding intermediate goods exports of Korean companies (Chang Yong-Joon and Jo Mi-jin, 2015). In addition, offshoring results in an increase in total factor productivity of manufacturing companies (Cho Jang-hee and Huh Jeong, 2013)

In particular, the expansion of GVC participation in Korean manufacturing industry affects domestic industrial structure and productivity, resulting in the demand for high-skilled workers and redistribution of income. Ahn Sang-hoon (2006) and Choi Nak-gyun (2013) show that internationalization of production affects the industrial structure and productivity and changes the employment structure. Choi Nam-Suk (2015) shows that the expansion of multinational companies' participation in the GVC creates value added in the domestic knowledge-based manufacturing sector and increases the average labor productivity of SMEs belonging to the same industry.

The existing Korean studies at the macro level show that the increase in overseas final demand led to an increase in Korea's value-added exports, mainly in the form of supplying intermediate goods to overseas industries rather than direct exports, leading to GDP growth (Chung Sung-hoon, 2014). GVC participation of manufacturing industries measured by value added exports contributes to the growth of GDP in Korea. However, the service industry has a weak competitiveness in terms of the demand for overseas services.

In the service industry, the competitiveness of Korean service intermediate inputs is weak in the area of the demand for domestic services by the overseas industries. According to Chung Sung-hoon (2014), in case of Korean service industry, the intermediate demand of overseas industry for domestic service is smaller than the offshoring size of domestic service industry. If the GVC is formed in the service sector excluding Korean companies due to TPP, Korean companies are less competitive in the service sector as they are less able to participate in GVC of services in Asia Pacific region.

There is no previous study that examines the effects of structural changes on domestic industries caused by the expansion and upgrading of Korea's GVC participation following the reorganization of the GVC in the Asia-Pacific region. Moreover, no rigorous empirical paper estimates TPP's effect on domestic employment using firm level data. Thus this paper attempts to analyze the bilateral value added trade structure in order to estimate the effect of GVC reorganization in Asia Pacific region under TPP conclusion.

This paper separately analyzes it by dividing the cases of GVC organized by Korean manufacturing industry and GVCs organized by TPP manufacturing industries where

Table 1. TPP Negotiation Trends

Year	Progress Trend
'06	May, P4 Agreement Effectuated (4 Countries: Singapore, New Zealand, Chile, Brunei) July, 18th Negotiation, Participation of Japan (12 countries).
'13	[Korea] Domestic public hearing on Nov, 15. Express interest of participation in negotiation on Nov, 29. Initiation of preliminary bilateral consultation, WTO ministerial meeting on Dec, 3 November, TPP Summit.
'14	[Korea] Continue preliminary consultations with 12 countries. April 28, public hearing on seeking TPP response strategy in National Assembly industry committee
'15	TPP concluded on October 5
'17	January 23, U.S. withdrawal from TPP November 11, APEC Summit, Agreement with 11 CP-TPP Countries - Of the existing TPP provisions, 20 were "suspended" (frozen)
'17	- Elimination of customs duties between countries, allowing data distribution for e-commerce: Expansion of exports such as automobiles, reduction of production costs, and easy access to IT companies in Asia are expected.
	January 22-24 Tokyo Conference, 22 provisions freeze. Restarted when U.S returns. On March 8, CPTPP signed in Chile.
'18	On April 12, President Trump ordered director of the White House National Economic Council, and USTR Representative to review the TPP (TPP11 is organized and can be negotiated for further negotiation) April 13, Prime Minister Abe proceeds the agenda of U.S. return to TPP at the April 17-18 scheduled the U.S-Japan summit.

Source: Author's collection from the various sources such as Ministry of Trade, Industry and Energy of Korea, Korea International Trade Association, and Korean Media Press Releases.

Korean manufacturing industry participates in. The value of this paper is providing empirical evidence of the effect of Korea's TPP entry on strengthening domestic labor productivity of manufacturing and service sectors.

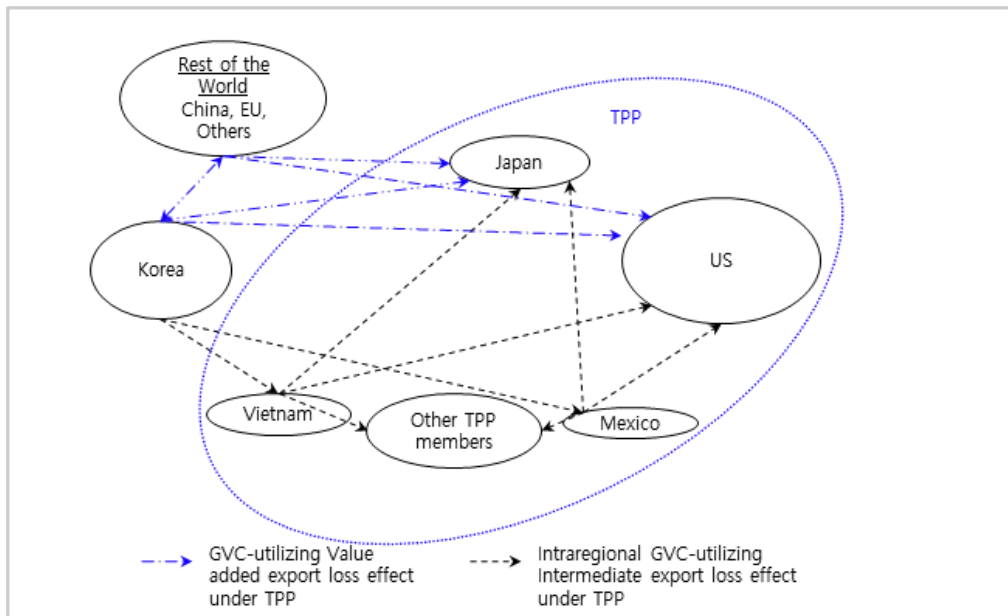
III. Structural Changes of Global Value Chains with TPP

1. TPP Status of Implementation

Japan hopes that US would return to TPP-12. The US and Japan account for roughly 80% of the GDP of the 12 member states of the Asia-Pacific region. However, the market shrank sharply to 1/3 due to the withdrawal of the US. Following the with-

drawal of the US from TPP in January 2017, Japan-led TPP renegotiation in 11 countries was promoted.

As shown in (Table 1), official signing of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) agreement was help in Chile in March, 2018. It will be coming into force in 2019. Eleven CPTPP countries account for 13% of world GDP. When the US returns to the TPP, it will be 40% of world GDP. On April 12, 2018, President Trump ordered examination to the White House NEC director and USTR representative on US reentry to TPP. TPP-12 will gain momentum again since Japan intends to effectuate the US-absent TPP at first, and then induce the US to return to the TPP in the near future. Meanwhile, Korea held public

Fig. 1. Effects of the Asia-Pacific GVC Reorganization on Korean Exports

Source: Author's own drawing.

hearing and preliminary consultation in 2014, however now Korea temporarily suspended TPP joining process.

2. Structural Changes of GVC income and GVC employment

〈Fig. 1〉 Shows that how TPP-12 will reorganize Asia-Pacific GVCs centering on Japan and US. Without entry into TPP, Korea will get losses of value-being added exports. First, direct GVC utilizing value-added export may decrease. Second, indirect intra-regional GVC utilizing exports of intermediate inputs could decrease.

1) Changes in Domestic Industrial Structure with GVC reorganization

This paper uses WIOD's World Industrial Input Output Table. Applying Timmer et

al.(2013), Johnson and Noguera(2012)'s GVC estimation method into WIOD database, we estimate GVC income and GVC employment. International input-output table for 35 industrial sectors in 41 countries between 1995 and 2011 are considered. The amount of Korean bilateral value-added imports and exports and value-added inputs with TPP major trading partners are estimated.

GVC income is estimated by consolidating 1435 by 1435 square matrix. It consists of 35 industries in 41 countries. As shown in 〈Table 2〉, we also group them into 3 industries in 3 countries. 3 countries are Korea(KOR), TPP, and the Rest of World(ROW). 3 industries are Agriculture, Fishery and Mining(AGR), Manufacturing (MFR), and Services(SVC).

GVC income of any particular final product is the value added of the final product. The value added of a final product is the val-

Table 2. GVC Income Structure of World Input Output Data

		Final Producer's GVC									GDP
		KOR			TPP			ROW			
		AGR	MFR	SVC	AGR	MFR	SVC	AGR	MFR	SVC	
GVC income (GVC members)	AGR										
	KOR	MFR									
		SVC									
	TPP	AGR									
		MFR									
		SVC									
	ROW	AGR									
		MFR									
		SVC									
Gross Final Output Value											World GDP

Note: Author's restructuring for the WIOD data structure. This table is an example of the input and output structure on the World Input-Output Table. Since showing the structure as an example is the purpose, the contents of each cell are not included.

ue added by all labor and capital employed in any stage of production. Each column in <Table 2> represents final product of a global value chain, identified by a particular country and industry. The column of KOR and MFC stands for the Korea-organized GVC in the manufacturing industry. The row of KOR and MFC stands for Korean manufacturing industry's participation in the GVCs of final producers of Korea, TPP and the rest of the world.

2) Asia-Pacific Regional GVC's Income Structure

<Table 3> shows that Korean GVC income share of Korea-organized GVC is 76.3% in the whole industry, and foreign GVC income share of Korea-organized GVC is 23.7%. Among the foreign GVC income share of Korea-organized GVC, the US has the largest share of 11.5%. Korean GDP is 1.1 trillion

dollars which is calculated by summing up GVC incomes in the Korea participating GVC.

In the manufacturing industry, GVC income share of TPP is at 31.8% of the foreign GVCs. The US, Japan, and Vietnam's share among foreign GVC income is at 11.5%, 18.8%, 1.3% respectively. Japan has greater GVC income share than US in the Korea-organized manufacturing GVC.

Korean GVC income share of US-organized GVC is 0.2%, and foreign GVC income share of US-organized GVC is 7.9%. Among the foreign GVC income share of US-organized GVC in the whole industry, Mexico has the largest share of 0.6%, Japan of 0.4%. In the manufacturing industry, GVC income share of TPP is at 13.0% of the foreign GVCs. Korea, Japan, and Mexico, Vietnam's share among foreign GVC income is at 0.6%, 1.1%, 1.2%, 0.1% respectively. Mexico has greater GVC income share than Japan in the US-organized manufacturing GVC.

Table 3. Asia-Pacific Regional GVC Income Structure of Korea-organized GVC in All industries

(Unit: Billion Dollars)

Year	Industries	Korea	US	Japan	Vietnam	Mexico	TPP major members	Foreign	World
Korea-organized GVC	All industries	840.8	29.97	24.37	3.40	1.18	58.14	261.48	1,102.3
	Country share of the world	76.3%	2.70%	2.20%	0.30%	0.10%	5.30%	23.70%	100%
	Country share of foreign country		11.5%	9.30%	1.30%	0.50%	22.20%	100%	
	Manufacturing	207.4	9.0	14.73	1.02	0.417	24.93	78.30	285.69
	Country share of the world	72.6%	3.20%	5.20%	0.40%	0.10%	8.70%	27.40%	100%
	Country share of foreign country		11.5%	18.8%	1.30%	0.50%	31.80%	100%	
US-organized GVC	All industries	24.39	14,118	56.35	6.08	89.80	152.23	1,216.1	15,334.2
	Country share of the world	0.2%	92.1%	0.4%	0.0%	0.6%	1.0%	7.9%	
	Country share of foreign country	2.0%		4.6%	0.5%	7.4%	12.5%		
	Manufacturing	7.22	1,047	13.66	0.78	13.85	28.29	156.8	1,203.9
	Country share of the world	0.6%	87.0%	1.1%	0.1%	1.2%	2.3%	13.0%	
	Country share of foreign country	4.6%		8.7%	0.5%	8.8%	18.0%		

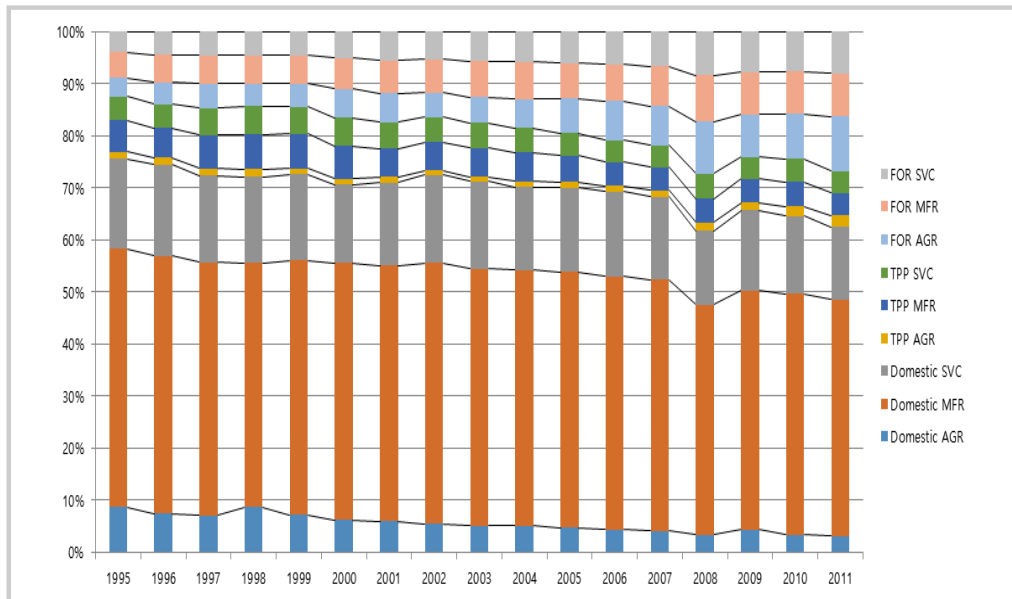
Note: Calculated using WIOT data of WIOD. All industries include manufacturing and services sectors. Vietnam is not included in 41 countries of WIOT. Therefore, the share of Vietnam in OECD / TiVA's domestic value-added in foreign final demand, partner share, is used. GVC income from Korean industries participating in the Vietnam GVC is estimated by multiplying Vietnam's share (All industries; Korea (1.3%), USA (0.3%) and Japan (0.8%), manufacturing industries; Korea (1.3%), USA (0.3%) and Japan (0.9%)) with the GVC income of Korean industries participating in the foreign GVC.

3) Changes of GVC Income and GVC Employment

〈Fig. 2〉 shows how Korea-organized GVC income of manufacturing industry has been changed over time period of 1995 and 2011. First, the GVC income of Korean domestic industries has been decreasing. It was about 75% of GVC income in 1995 and continually

substituted with TPP and foreign GVC income. As of 2011, domestic GVC income is reduced to about 62%. Second, TPP's GVC income share are maintained over the period and foreign country (FOR)'s GVC income is increasing on all industries.

〈Fig. 3〉 shows the changes of Korea-organized GVC's employment between 1995 and 2011. In 1995, Korean GVC of manu-

Fig. 2. GVC Income of Korean Manufacturing Industry: Korea-organized GVC

Note: Industry level GVC income shares (in %).

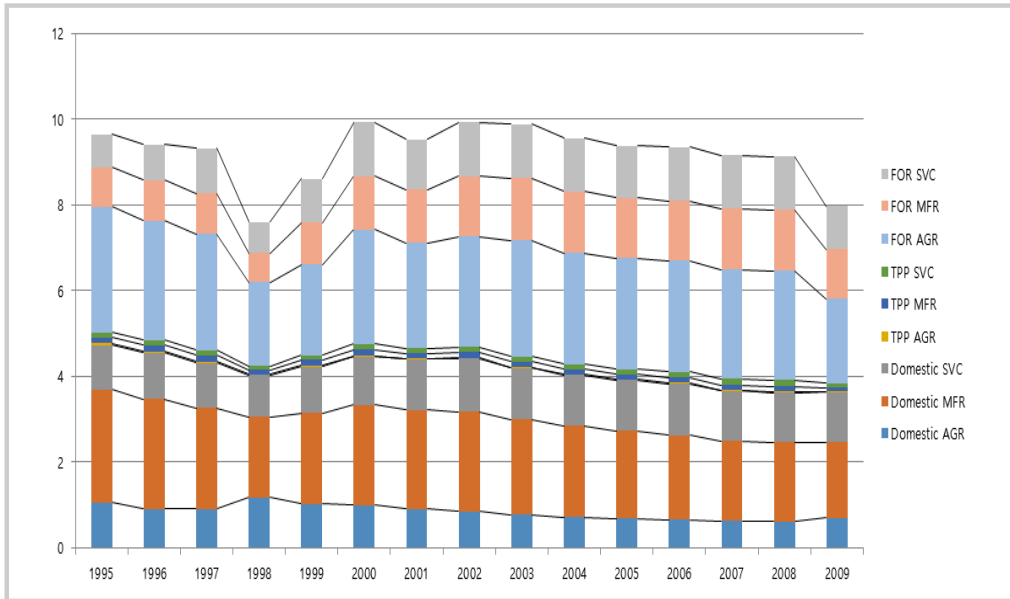
Source: Author's calculation using WIOD.

facturing industry creates about 9.6 millions jobs. It consists of 4.7 million domestic jobs. During Asian financial crisis in 1997 and 1998, GVC employment level decreased rapidly. Entering into the 2000s, Korean domestic employment has been continually decreased and reached under the 4 million jobs in 2009. Two factors are conjectured that the decreasing GVC domestic employment happens. First, GVC development in manufacturing industry may substitute domestic jobs with off-shore jobs. Second, domestic labor productivity may increase over the 2000s.

(Fig. 4) shows the change of Korea-participating GVC income. Two distinct patterns of Korea's GVC participation is noticed. First, Korean manufacturing industry increases GVC income by progressively participating in the world-organized GVC. In 1995, Korea exports about 25% of its intermediate inputs to the world GVC. Ever since 1995, the share

of GVC income from participating the world GVC has increase to about 42%. Second, Korean share of TPP-organized GVC has changed a little. Relative to the decrease in Korean domestic GVC income share, it is relatively large. However, Korean GVC participating to the rest of the world has increased very rapidly for the past decades.

(Fig. 5) shows that overall GVC employment of Korean manufacturing has been decreased over the period of 1995 and 2009. First, Korean domestic employment associated with Korea-organized GVC has decrease dramatically. Domestic jobs has been reduced from about 3.6 millions jobs to 2.7 millions jobs in participating Korea-organized GVC. Second, Korean GVC employment of TPP-organized GVC has decreased a little from 0.4 million to about 0.35 million jobs. Third, Korean GVC employment increase quite a lot from 0.8 million jobs to about 1.4

Fig. 3. GVC Employment of Korean Manufacturing Industry: Korea-organized GVC

Note: Number of GVC workers (in millions)

Source: Author's calculation using WIOD.

million jobs. In short, Korean domestic employment of GVC participation has increased particularly in foreign country-organized GVC.

IV. Empirical Analysis

This study investigates GVC structure of the TPP, and estimates its effects on the domestic firms' employment at Korean industrial level. Using Korean corporate financial data from 35 manufacturing and service industries between 2000 and 2011, this paper estimates the effect of changes in value-added exports by TPP on the average domestic employment, production, and invigoration of business activities. It quantitatively analyzes the effects of promoting global value chain formation in the manufacturing industry and service industry in Korea through effectuation of TPP on domestic employment,

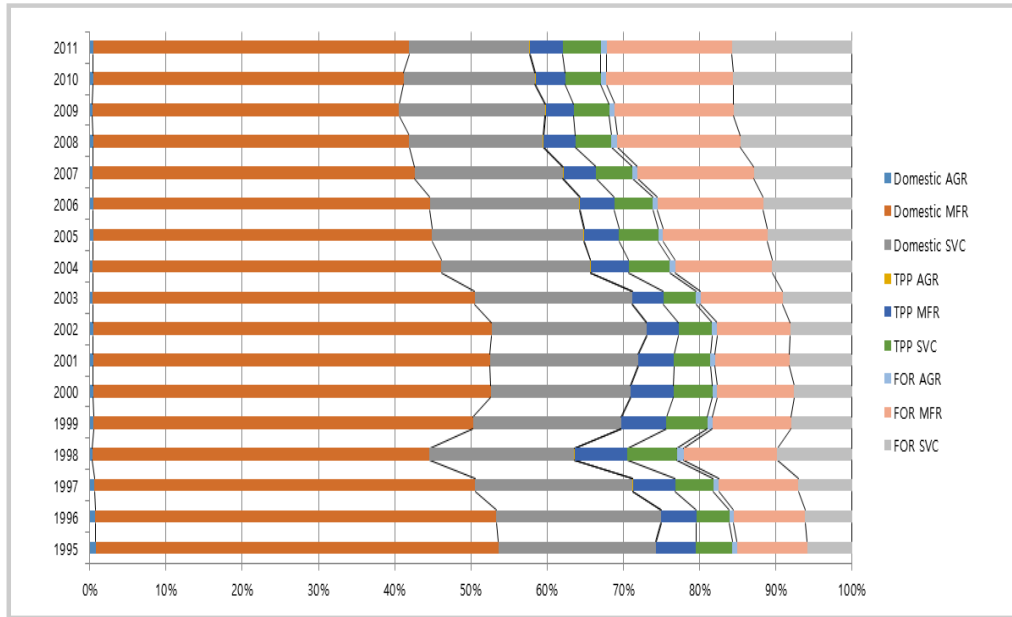
value-added creation, and productivity.

1. Empirical Model

When Korea's value-being added exports to Japan, the United States, Mexico, and Vietnam are affected by changes in the trade environment resulting from the TPP conclusion, it could affect the redistribution of the average employment, sales, and profits of firms at the corresponding domestic industry.

As the mega-FTA facilitates the formation of global value chains, it induces autonomous competition among domestic and foreign intermediate suppliers and consequently contributes to the specialization of domestic companies with comparative advantage in the downstream stage of creating high added values. Multinational corporations with high productivity in accordance with the productivity distribution of enterprises in the

Fig. 4. GVC income of Korean Manufacturing Industry: Korea-participating GVCs



Note: Industry level GVC income shares (in %).
 Source: Author's calculation using WIOD.

same industry directly organize the global value chain structure or participate in GVCs organized by overseas industries.

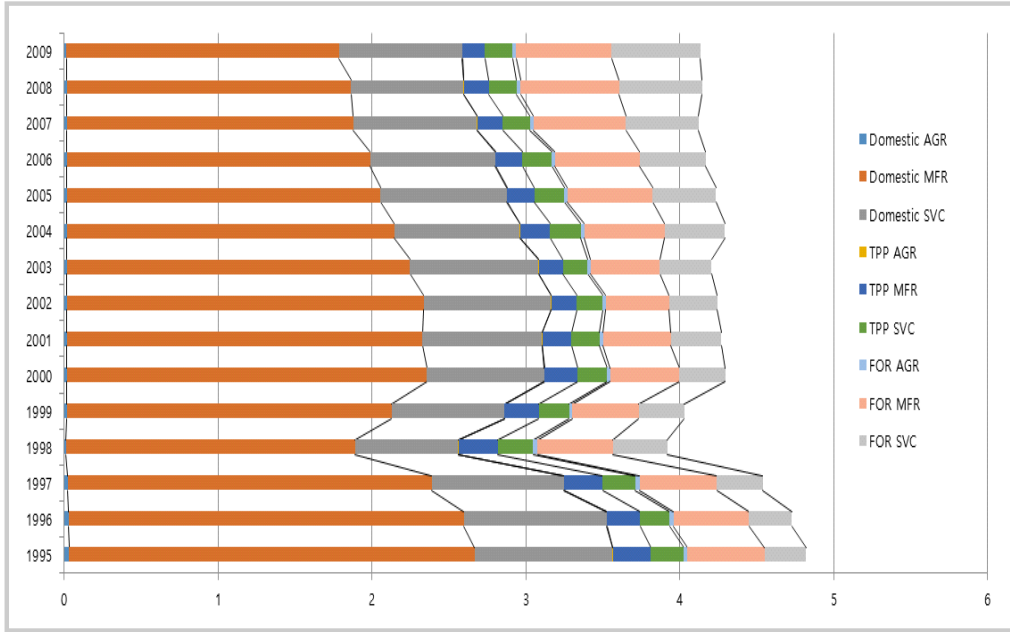
As global competition among domestic and foreign intermediate suppliers spreads, multinational companies can easily replace intermediary materials as they have a wider selection of intermediate products with high production efficiency (Grossman and Rossi-Hansberg, 2008). It is thus hypothesized that as GVC participation increases firm productivity and sales, the job creation and wage improvement are positively affected.

The effect of the GVC reorganization in the Asia-Pacific region under TPP on the business activities of domestic manufacturing and service industries is estimated by applying 3SLS estimation. This paper measures the impact of opening trade and investment by TPP conclusion on domestic companies

through promotion of global value chain formation. Under the assumption that the business activities of multinational corporations are balanced between GVC organizations and GVC participation, we employ 3SLS simultaneous equations model an estimation strategy. We analyze causality of TPP effectuation and domestic employment at the country and industry levels.

The estimation strategies are as follows. First, this paper estimates the impact on domestic companies when GVC income of TPP increases associated with Korea-organized GVC. For example, if the GVC income of the TPP increases in the industries organized by Korea (manufacturing and service industries), the cases that have a major impact on the domestic enterprises are analyzed through causal relationships.

Second, this paper estimates the impact on

Fig. 5. GVC Employment of Korean Manufacturing Industry: Korea-participating GVCs

Note: Number of GVC workers (in millions).

Source: Author's calculation using WIOD.

Korean companies when GVC income in Korea increases by participating in the GVCs organized by TPP. For example, if the GVC income in Korea increases in the industries organized by TPP (manufacturing and service industries), the cases that have a major impact on Korean firms are analyzed through causal relationships.

We empirically analyze that the Korea-participating GVC income increases as tariffs of TPP falls. Tariffs reduction in TPP Members are used as an instrumental variable for TPP effectuation. As an exogenous trade cost variable, average MFN tariffs of the United States, Japan, Mexico, Canada, and Australia among the TPP member countries are used against Korean GVC income. In service industry, OECD Service Trade Restrictiveness Index (STRI) in the 22 services sectors are used as a benchmark service trade barrier against

Korea. Similarly, Korean MFN tariffs and STRI index are used as a trade barrier against TPP member countries.

Empirical strategy of 3SLS are employed as in the estimation equations (1), (2), and (3). We estimate the impact of GVC income on domestic employment in the manufacturing and services industries. We use our newly estimated GVC income data for 35 manufacturing and services industries, and combine GVC income with tariffs and STRI. Finally, we infer its causal effects on firm level domestic employment.

$$\begin{aligned}
 GVC\ Participation_{kct} = & \\
 & \beta_{10} + \beta_{11} TPP_{kct} + \beta_{12} \log(\tilde{K}intensity)_{ikt} \\
 & + \beta_{13} \log(RDintensity)_{ikt} \\
 & + \beta_{14} Firm\ heterogeneity_{kt} + Industry_k \\
 & + Year_t + \epsilon_{1ikt}
 \end{aligned} \quad (1)$$

$$\begin{aligned}
& Firm\ Business\ Activity_{ikt} = \\
& \beta_{20} + \beta_{21} GVC\ participation_{kct} \\
& + \beta_{22} \log(Kintensity)_{ikt} \\
& + \beta_{23} \log(RDintensity)_{kt} \\
& + \beta_{24} Firm\ heterogeneity_{kt} + Industry_k \\
& + Year_t + \epsilon_{2ikt}
\end{aligned} \quad (2)$$

$$\begin{aligned}
& Industry\ Invigoration_{kt} = \\
& \beta_{30} + \beta_{31} Firm\ Business\ Activity_{kt} \\
& + \beta_{32} \log(Kintensity)_{ikt} \\
& + \beta_{33} \log(RDintensity)_{kt} \\
& + \beta_{34} Firm\ heterogeneity_{kt} \\
& + Industry_k + Year_t + \epsilon_{3ikt}
\end{aligned} \quad (3)$$

In the empirical model of Eqs. (1) to (3), GVC Participation_{kct} is the GVC income of value added exports belonging to the k industry in the period t to country c. TPP_{kct} is the average import tariffs for the goods in the k industry that are imported from the c country (or the service industry restrictiveness index for service industries). It is the average tariffs of the TPP concluding countries (MFN average tariffs of the U.S., Japan, Canada, Mexico, and Australia). log(K intensity)_{ikt} is the log of the capital intensity of firm i in the k industry at time t. log(RD intensity)_{kt} is the log of R&D expenditure relative to the gross sales of k industry at time t. Firm heterogeneity_{kt} is the productivity distribution of firms belonging to the same k industry at time t. Industry_k is industry fixed effect only in k industry which does not change with time. Year_t is year fixed effect that appears only in a particular year t. In order to control the effect of each sub-industry's unique characteristics and year-specific characteristics on industrial structure invigoration, they are included as explanatory variables. ϵ_{ikt} is the error term of firm i in the industry k to the country c at time t. Firm Business Activity_{ikt} is the logarithm of average employment (or productivity) of firms in

the k industry at time t. Industry invigoration_{kt} is the logarithm of the total employment (or productivity) of all firms (except the i company) belonging to the k industry in period t.

The GVC income of Korean multinational enterprises (MNEs) should be fully taken into account when distinguishing between the GVCs organized by the domestic manufacturing industry and the GVCs organized by the foreign MNEs in which the domestic manufacturing industry participates. Comparing the GVC income of Korean manufacturing industry obtained by participating in overseas GVCs with the GVC income of foreign manufacturing industries gained by participating in Korea-organized GVC, we examine its effects on domestic employment. When TPP effectuation exogenously affects GVC income of Korea, it affects firm's domestic employment and the firm's employment also bring spillover effect to the same industry.

The structural causality among Eqs. (1) to (3) is balanced at the same time. Thus 3SLS estimation technique is applied to estimate the domestic industry spillover effects of business activity invigoration (sales, employment, labor productivity) caused by Korea's entry into TPP.

We consider the order condition for the identification of this paper's simultaneous equations model. In the estimation equation, the number of excluded exogenous variables is at least as large as the number of right-hand side endogenous variables. In Eq. (1), all the explanatory variables are exogenous variables and can be identified. In Eq. (2), endogenous explanatory variable is one, and excluded exogenous variable is only one as well. In Eq. (3), the endogenous explanatory variable is one and excluded exogenous variable is one. Thus it is just identified. Moreover, considering the rank

Table 4. Variable Definitions, Data Sources, Classification and Correspondence

Variables	Variable Definitions	Data (Sources)	Data Classification Correspondence
GVC Participati onkct	GVC income of value added exports belonging to the k industry in the period t to country c	GVC income and GVC employment (WIOD and author's calculation)	WIOD 44 industries are corresponded with Korean KSIC middle level manufacturing and services industries.
TPPkct	average import tariffs for the goods in the k industry that are imported from the c country	MFN average tariffs of the U.S., Japan, Canada, Mexico, and Australia on Korea. Or Korea's MFN tariffs (WTO)	HS-2 digit classification are linked with KSIC middle levels.
log(K intensity) _{ikt}	log of the capital intensity of firm i in the k industry at time t.	Firm level financial data (KISLINE)	Korean KSIC middle level manufacturing and services industries are linked with HS2 digit level and WIOD 44 industry levels.
log(RD intensity) _{ikt}	log of R&D expenditure relative to the gross sales of k industry at time t.	Firm level financial data (KISLINE)	Korean KSIC middle level manufacturing and services industries are linked with HS2 digit level and WIOD 44 industry levels.
Firm heterogeneity _{ikt}	the productivity distribution of firms belonging to the same k industry at time t.	Estimates of regression of firm ranks on firm size (KISLINE data)	Korean KSIC middle level manufacturing and services industries are linked with HS2 digit level and WIOD 44 industry levels.
Industry _{kt}	industry fixed effect only in k industry which does not change with time.	Industry dummy variables (KSIC middle level classification)	Korean KSIC middle level manufacturing and services industries are linked with HS2 digit level and WIOD 44 industry levels.
Year _t	year fixed effect that appears only in a particular year t.	Year dummy variables	
Firm Business Activity _{ikt}	logarithm of average employment (or productivity) of firms in the k industry at time t.	Firm level Employment (KISLINE)	Korean KSIC middle level manufacturing and services industries are linked with HS2 digit level and WIOD 44 industry levels.
Industry invigoratio n _{kt}	logarithm of the total employment (or productivity) of all firms (except the i company) belonging to the k industry in period t.	Total Industry level Employment (KISLINE)	Korean KSIC middle level manufacturing and services industries are linked with HS2 digit level and WIOD 44 industry levels.

condition for identification applied in the binary simultaneous equation as a sufficient condition, the estimate of the parameter of TPPkct of the Eq. (1) should not be zero. Estimation results show that the parameter of TPPkct was estimated to be non-zero. Therefore, the estimation equation is just identified.

〈Table 4〉 shows variable definitions, data sources, classification and correspondence.

2. Data

WIOD of 2013 is used. ISIC revision 3 industrial classification is used for 35 industries for 41 countries. This paper calculate GVC income and GVC employment statistics of Timmer et al. (2013), and use them as proxies for changes in industrial structure. Available data for US, Japan, Canada, Mexico and Australia are used as major member countries of TPP. TPP-organized GVC income and GVC employment and Korea-organized GVC income and GVC employment are used for proxies of GVC reorganization.

This paper uses Korean firm level data between 2000 and 2011 from the KISLINE database of NICE evaluation information. Its Korean Standard Industrial classification is linked to ISIC rev. 3, of WIOD. We estimate the GVC of TPP by linking GVC income with Korea's manufacturing/service corporate financial data. The firm's capital intensity is the tangible asset of an individual firm, R&D intensities are calculated by dividing R&D cost with gross sales at the industry level. The firm heterogeneity data in the industry are the values of the coefficients estimated by using the industry rankings and firm size data. It is dispersion of firm production in the industry and measured by regressing firm's ranking on the firm's size (Melitz, 2003). The number of domestic employees is used as

employment, and the sales divided by the number of employees in Korea are used as firm's labor productivity.

3. Results

1) Initial Estimates

Domestic employment effect of Korea-organized GVC is estimated in 〈Table 5〉. Estimation model (1) shows that when the trade barrier of Korea is eliminated after effectuation of TPP, Korea-organized GVC income increases. This effect is statistically significant at the 10 percent significance level. Estimation model (2) shows that the positive increase in GVC income negatively affects average domestic employment of the domestic firms. However, this effect is statistically insignificant. In model (3), the negative effect on domestic employment affects the industry total employment. Its effect is neither statistically significant. This causal relationship is simultaneously determined at the manufacturing sector.

Estimation models of columns (4) to (6) shows the estimates of TPP effectuation on Korean services industry. And the results shows that there are positive effects on Korean service employment at the individual firm and at the industry level. However, its effects are statistically insignificant. The estimation results at least confirms that the elimination of trade barrier on TPP member countries will increase Korean GVC income. On the other hand, the improvement of GVC income may negatively affects the employment of manufacturing industry and positively affects that of service industry.

〈Table 6〉 shows that estimates on the domestic employment effect of TPP-organized GVC income on the Korean industries. Estimation models (1) to (3) show that there

Table 5. Domestic Employment Effect of Korea–Organized GVC: TPP Participation

VARIABLES	Manufacturing Sector			Service Sector		
	(1) log(Korea– organized GVC income)	(2) log(Empl oyment)	(3) log(Ind– Empl ment)	(4) log(Korea –organize d GVC income)	(5) log(Empl oyment)	(6) log(Ind– Empl ment)
log(KOR_barrier)	–0.726* (0.396)			–20.42** (10.39)		
log(Korea–organize d GVC income)		–0.039 (0.121)			0.061 (0.220)	
log(Employment)			–2.068 (9.571)			4.107 (13.83)
log (capital intensity)	0.545*** (0.151)	0.488*** (0.075)	1.330 (4.463)	0.035 (0.070)	0.235*** (0.032)	–0.944 (3.294)
log(RD_intensity)	6.2e ^{–10} (5.1e ^{–09})	9.5e ^{–11} (1.1e ^{–09})	–1.5e ^{–10} (3.6e ^{–09})	3.4e ^{–07} (6.2e ^{–07})	5.3e ^{–07**} (2.5e ^{–07})	–2.1e ^{–06} (7.4e ^{–06})
Firm Heterogeneity	0.924** (0.398)	0.00187 (0.142)	–0.0304 (0.424)	0.681 (0.718)	–0.311 (0.377)	1.240 (3.615)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	–2.801 (2.581)	–2.59*** (0.797)	0.866 (22.89)	5.108*** (1.801)	0.464 (0.618)	8.708 (8.316)
Observations	165	165	165	132	132	132
Adjusted R–squared	0.981	0.910	0.975	0.935	0.970	0.676

Note: Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

exist positive and significant causal relationship between Korean firm participation in TPP-organized GVC and Korean domestic employment. Column (1) shows that the lower the TPP barriers on Korean valued-added exports to TPP, the greater the Korea's GVC income. Column (2) shows that the increase of Korean manufacturing firms GVC income positively affects domestic employment of the firms. This effect is statistically significant at the 5% significance level. Simultaneously, the positive effect on do-

mestic employment also positively affects industry level total employment. It is statistically significant at the 1% significance level. This empirical evidence confirms the related literature on GVC participation and the improvement of complementarity between domestic tasks and offshore tasks (Grossman and Rossi-Hansberg, 2008).

In the service sector, estimation models of (4) to (6) shows that the increasing service trade barriers on TPP member countries pos-

Table 6. Domestic Employment Effect of TPP-Organized GVC: Korean Participation

VARIABLES	Manufacturing Sector			Service Sector		
	(1) log(TPP-organized GVC income)	(2) log(Empl oyment)	(3) log(Ind- Employment)	(4) log(TPP-o rganized GVC income)	(5) log(Empl oyment)	(6) log(Ind- Employment)
log(TPP_barrier)	-0.715* (0.425)			18.98* (10.84)		
log(TPP-organized GVC income of Korea)		0.405** (0.204)			-0.330 (0.409)	
log(Employment)			1.27*** (0.288)			0.126 (0.435)
log (capital intensity)	0.586*** (0.171)	0.185 (0.147)	-0.22* (0.135)	-0.078 (0.053)	0.218*** (0.045)	-0.0558 (0.104)
log(RD_intensity)	1.31e ⁻⁸ ** (5.75e ⁻⁰⁹)	-4.2e ⁻⁹ (3.0e ⁻⁹)	-6.1e ⁻¹⁰ (1.1e ⁻⁹)	-6.51e ⁻⁷ (4.3e ⁻⁷)	3.18e ⁻⁷ (4.1e ⁻⁷)	-2.80e ⁻⁸ (2.54e ⁻⁷)
Firm Heterogeneity	1.091** (0.441)	-0.456* (0.255)	0.0902 (0.087)	1.273** (0.540)	0.250 (0.722)	0.0048 (0.170)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-3.848 (3.139)	0.689 (1.688)	8.782*** (0.798)	0.370 (2.190)	1.912 (1.715)	11.70*** (0.314)
Observations	168	168	168	132	132	132
Adjusted R-squared	0.979	0.735	0.997	0.969	0.954	0.996

Note: Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

itively affects GVC income of service exports to TPP. However, this effect are not leading to the statistically significant causal relationship on domestic firm - and industry - level employment.

〈Table 7〉 shows that Korea's manufacturing industry entry into TPP will increase domestic labor productivity at the firm level and at the industry level. Estimation models of (1) to (3) confirms the positive causal relationship between Korea-organized GVC income

and domestic labor productivity. It is statistically significant at the 5% significance level. In line with the estimation results of 〈Table 4〉, this results may reflect the possibility of association between lowering domestic employment and rising labor productivity. In other words, when Korea-organized GVC uses TPP member countries' intermediate inputs, it may reduce job opportunities of relatively less competitive domestic workers. As a result, it would increase average labor pro-

Table 7. Domestic Labor Productivity Effect of Korea–Organized GVC: TPP Participation

VARIABLES	Manufacturing Sector			Service Sector		
	(1)	(2)	(3)	(4)	(5)	(6)
	log(Korea–organized GVC income)	log(labor Productivity)	log(Industry labor Productivity)	log(Korea–organized GVC income)	log(labor Productivity)	log(Industry labor Productivity)
log(KOR_barrier)	–0.131*** (0.005)			–0.515*** (0.028)		
log(Korea–organized GVC income)		0.613*** (0.118)			–3.35*** (0.262)	
log(labor Productivity)			0.036* (0.02)			0.085*** (0.010)
log(Employment)	0.0029*** (0.0007)	0.09*** (0.002)	–0.002 (0.002)	–0.005*** (0.0006)	0.021*** (0.0031)	–0.004*** (0.001)
log(capital intensity)	–4.6e ^{–10} *** (1.6e ^{–10})	2.2e ^{–9} *** (4.9e ^{–10})	1.8e ^{–10} *** (6.3e ^{–11})	4.67e ^{–08} *** (1.219e ^{–8})	–9.9e ^{–8} * (5.66e ^{–8})	–1.3e ^{–7} *** (7.57e ^{–9})
log(RD_intensity)	0.556*** (0.0136)	0.45*** (0.076)	–0.03* (0.02)	1.305*** (0.0225)	5.099*** (0.322)	–0.26*** (0.018)
Firm Heterogeneity	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.387*** (0.0213)	9.17*** (0.353)	17.5*** (0.22)	3.256*** (0.016)	23.23*** (0.819)	18.63*** (0.131)
Observations	76,047	76,047	76,047	50,060	50,060	50,060
Adjusted R-squared	0.977	0.134	0.988	0.894	–0.393	0.976

Note: Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

ductivity of the same industry. It is partly supported by the complementarity of the least skilled domestic workers and the most skilled offshore worker in the international outsourcing (Grossman and Rossi-Hansberg, 2008).

V. Conclusions

This study is different from the previous research such that it analyzes the effect of

mega FTA such as TPP on the employment of Korean domestic manufacturing and service industries in connection with changes in GVC income and GVC employment structure. This paper analyzes impacts on employment and labor productivity structure of domestic manufacturing and service industries when global value chain is reorganized according to TPP effectuation.

The empirical analysis is conducted to examine the domestic employment effect of

TPP manufacturing industry's participation on Korea-organized GVC. The results show that when Korea eliminates trade costs such as tariffs and service trade restrictiveness on TPP members, Korean GVC income increases. And it reduces Korean manufacturing firm's domestic employment, and the industry employment eventually decrease. This result indicates that when Korean entry into TPP enhances Korea-organized GVC by integrating TPP's production division networks, it will replace Korean domestic jobs and cause negative employment spillover effects on domestic manufacturing industry. However, we conjecture that the decrease in domestic jobs are concentrated on less skilled tasks. Simultaneously, the decrease in domestic employment increases Korean domestic labor productivity since difficult tasks are remained, and they are conducted by more skilled domestic workers.

Moreover, this paper examines Korean firms' participation on TPP-organized GVC networks. The empirical results of TPP's elimination of tariffs against Korea indicates that Korea's GVC income in TPP-organized GVC would increase. And it positively and statistically significantly increase Korean domestic employment and industry employment.

The empirical results suggests some policy implications. First, the positive domestic employment effect of Korea's entry into TPP is identified by the channels of Korea's partic-

ipation on TPP-organized GVCs. Second, TPP members participation on Korea-organized GVC may reduce Korean domestic manufacturing employment. However, Korea-organized GVC and TPP's participation on it will increase labor productivity of the Korean manufacturing industry.

This paper lacks the identification of specific industries that may have positive effects on domestic employment. Sophisticating estimation strategies of industry specific estimation for pacific-regional GVC dependent exporting industries would provide more useful empirical evidence to verify the spillover effect of TPP's GVC reorganization. These shortcomings are postponed to the future research.

Due to the limitations of WIOD's international input-output data, the empirical findings do not fully reflect current industrial structure. For the future studies, WIOD 's updated data of the international input-output table and domestic companies' data should be obtained by 2014 and empirical analysis should be further conducted. Furthermore, panel dynamic estimation analysis is required to control cross-sectional time series variations.

Given the CPTPP's positive economic effects, US is likely to return to the TPP-12. Korea thus needs to consider joining the TPP. Korea needs to seek strategic partnership with CPTPP members for the establishment of new trade rules in the Asia-Pacific region, expecting TPP-12.

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