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Yuqing Xing

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National Graduate Institute for Policy Studies
7-22-1 Roppongi, Minato-ku,
Tokyo, Japan 106-8677

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Abstract

This paper argues that global value chains (GVCs) have functioned as a vehicle for "Made in China" products to enter international markets, especially the markets of high income countries. It identifies three spillover effects to Chinese firms participating in GVCs: brands, distribution networks and lead firms' technology innovations. By participating in GVCs, Chinese firms are able to bundle low skilled labor services with advanced technologies and globally recognized brands, and then sell their low value added services to the consumers of international markets. The competitiveness of China's processing exports is largely determined by more than 50% of foreign contents embedded in the exports. Using the panel data of bilateral processing exports covering more than 100 China's trade partners, it shows there exists a significantly positive correlation between the share of processing exports and the income of trading partners, implying that processing trade is an effective means for "Made in China" products to enter high income countries. The cross-country heterogeneity of processing exports also indicates China captures relatively more value added in its exports to low income countries than to high income countries.

Key Words: GVC, Export, China

JEL: F14; F23

* National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, Tokyo 106-8677 Japan. Email: Yuqing_xing@grips.ac.jp.

1. Introduction

After three and half decades of rapid economic growth, China has surpassed Germany, Japan and the US and emerged as the largest exporting nation. “Made in China” products are now ubiquitous in the markets of both developed and developing countries, ranging from labor-intensive products, such as T-shirts and shoes to high-tech products mobile phones and digital cameras. For some consumers outside of China, it seems even impossible to live without “Made in China” products (Bongiomi, 2008).

Why are China’s exports so competitive in the global market? What are major forces driving the worldwide expansion and diversification of its manufacturing exports? Many academic scholars and China observers have tried to answer the questions from various aspects. A plethora of articles analyzing the drastic growth of China’s exports have been published in academic journals, magazines and newspapers. According to these studies, fundamental factors determining the significant growth and worldwide expansion of China’s exports include: (1) abundant labor endowment and corresponding comparative advantage in labor-intensive products (Adams, Gangnes and Shachmurove, 2006; Wang 2006); (2) the reforms of domestic institutions, such as the transition to an market oriented economy, the adoption of export-led growth strategy and unilateral trade liberalization (Hu and Khan, 1997; Lin, Cai and Li, 2003); (3) improved market access for China’s exports through institutional arrangements, namely the WTO membership, bilateral and multilateral free trade agreements and the abolishment of multi-fiber arrangement (Branstetter and Lardy, 2006; Prasad, 2009); (4) the exchange rate regime adopted by the Chinese government and the undervalued currency (Naughton, 1996; Marquez and Schindler, 2007; Thorbecke and Smith, 2010); and (5) massive inflows of export oriented foreign direct investment (Zhang and Song, 2000; Whalley and Xin, 2010).

With a population of more than 1.4 billion, China is naturally endowed with comparative advantage in labor-intensive products. Assuming other factors determining global competitiveness are equal across countries, relatively low labor cost should grant Chinese exports an edge over its competitors. Without any doubts, trade liberalization since 1990s in terms of tariff reductions and trade facilitations has improved substantially the market access of Chinese exports. Comparative advantage and trade liberalization arguments, however, mainly emphasize production costs and barriers to cross-country flows of goods, fail to take into consideration of the critical role performed by the organization structure of modern trade in promoting China’s exports, in particular its successful penetration into high income countries. Those studies actually leave

many important questions unanswered. Without foreign brands, could “Made in China” products maintain the same competitiveness? Whenever Apple launches new cutting-edge products, the shipment of Apple products from China to the rest of the world increases and continues to grow along with rising popularity of Apple products. Whom should be given the credit to for the increase, the innovative American company Apple, or the assembler Foxcon, a Taiwanese company located in mainland China, which has been banking on cheap Chinese labor?

In the classic models of Ricardo and Heckscher-Ohlin, comparative advantage represents the sole factor determining competitiveness and trade patterns. Today’s trade, nonetheless, is not “wine for clothes”. The proliferation of global value chains has transformed trade in goods into trade in tasks (Grossman and Rossi-Hansberg, 2008). Many firms located in various geographic locations jointly deliver ready-to-use products to consumers of the global market. The comparative advantage of an individual country cannot decide the competitiveness of products manufactured along GVCs. Brands, global distribution networks and technology innovations perform far more important roles in determining winners and losers. GVCs are particular relevant to China’s exports, as about half of its manufacturing exports are assembled with imported parts and components, and most of so called “Made in China” products either carry brands owned by multinational enterprises (MNE) or are distributed by global retail giants such as Wal-Mart.

In this paper, we attempt to interpret China’s export boom in the context of value chains. We argue that GVCs have been functioning as a vehicle for Chinese exports entering international markets, especially the market of high income countries. By successfully plugging into GVCs, Chinese firms have been able to bundle their low skilled labor services with globally recognized brands and advanced technologies of MNEs, and then sell them to consumers of international markets. GVCs are actually a catalyst for “Made in China” products, strictly speaking, China’s value added embedded in its manufacturing exports, being bought and consumed in various nations. Continuous technology innovations, aggressive promotions on brand and the worldwide development of distribution networks by the lead firms of GVCs, constantly expand and create new demand, which in turn lifting the demand for tasks performed by Chinese firms integrated with supply chains and eventually enhancing China’s exports.

To establish the argument, we first examine tasks performed by Chinese firms in GVCs and domestic value added in its exports. The analysis starts with the case of the iPhone, of which has China been the exclusive exporter, then extends the coverage to high-tech products, where China was claimed the No.

1 exporter in the world (Meri, 2009), and further expand the scope to processing exports including both high-tech and ordinary manufacturing goods.

Following the descriptive analysis, we empirically analyze the intensity of processing exports in China's bilateral trade and its correlation with the income of destination markets. Processing exports refer to exports manufactured or assembled with imported parts and components. Assembly and processing are typical segments of value chains and belong to low value added tasks. Processing exports not only reveal tasks Chinese firms performed, but also provide a direct measure of exports due to the participation in value chains. The empirical investigation is based on a unique panel data set, covering China's processing exports to more than 100 economies from 1993-2013. We find China's processing exports mainly end up with high income countries and the intensity of processing exports, defined as the share of processing exports in bilateral exports has a significantly positive relation with the income of destination markets, implying that processing exports has functioned as an effective means for "Made in China" products to enter high income countries' markets. The expansion and sustained high growth of China's exports to high income countries benefit substantially from GVC's spillover effects associated with brands, distribution networks and technology innovations.

The rest of the paper is organized as follow. In section 2, we will briefly summarize spillover effects of GVCs to Chinese firms involving in supply chains. The analysis focuses on spillover effects of brands, distribution networks and technology innovations; section 3 will discuss roles and tasks performed by Chinese firms in exports manufactured and traded along GVCs. The discussion concentrates on representative products--the iPhone, high-tech products and processing exports; in Section 4, we will investigate the relative importance of processing exports in China's bilateral trade, and empirically analyze the correlation between the intensity of processing exports and the income of the trading partners; Section 5 summarizes main findings of the paper.

2. Spillover Effects of Global Value Chains

A global value chain comprises a series of tasks necessary for delivering a product from its inception to final consumers of international markets, including research and development, product design, manufacturing parts and components, assembly and distribution, which are carried out by firms located in various countries (Gereffi and Karina, 2011). According to governance structures, GVCs can be classified into producer-driven and buyer-driven value chains. Producer-driven chains are generally developed by technology leaders

in automobiles, aircraft, computers, semiconductors and other capital-intensive industries; buyer-driven chains are typically developed by large retailers, branded marketers and branded manufacturers (Gereffi, 1999). In the context of property-rights model, the characterization of ownership allocation along value chains can also depend on the incentive to integrate suppliers and the elasticity of demand faced by the final-good producer (Antràs and Chor, 2013).

Technology advancement, unprecedented liberalization in trade and investment and profit seeking behaviors of MNEs have been driving the emergence of GVCs in the last decades (OECD, 2013). Today, most of manufacturing commodities are actually produced and traded along value chains. GVCs have also extended into business process and management, such as software development and maintenance and voice services. Like an invisible hand, GVCs have interconnected national economies. The economic integration through value chains is fundamentally market driven and tends to be more stable and effective than the one led by institutional arrangements or defined by conventional arm-length trade. The theory of international trade suggests that specializations according to comparative advantage improve the efficiency of resource allocations and hence the welfare of trading nations. Compared with conventional specializations on industries or products, specializations on tasks defined by value chains further refine specializations among nations and enhance the efficiency of resource allocations, consequently raising the productivity and economy growth of all economies involved.

Here we would like to emphasize spillover effects of GVCs at micro-level and discuss how the spillover effects generated by intangible assets of lead firms, such as brands, distribution networks and technology innovations, help Chinese firms overcome entry barriers of international markets and achieve dramatic global expansion. Cheap labor is often addressed as comparative advantage of Chinese firms. It seems that as long as they could manufacture products competitive at costs, they would be able to sell their products and compete in the global market. As a matter of fact, the competition in the global market is much more complicated than this kind of simple reasoning. Production costs are just one of many factors deciding the success in international markets. As barriers to entry in manufacturing fall, intangible assets such as brands and global distribution networks have turned into major hurdles to the firms of developing countries striving to take part in the world market (Kaplinski, 2000).

Consumers of developed countries tend to be brand oriented and have high willingness to pay for particular brands. Brands are one of critical factors determining consumers' choices (Bronnenberg, Dube and Gentzkow, 2012). Due to asymmetric information, consumers regard brands as an assurance of

product quality. Switching costs may also undermine consumers' willingness to substitute preferred brands with new alternatives. Consumers' biases to particular brands grant advantage to incumbent producers and raise barrier to new entries. For instance, branded clothing constitute the majority of European clothing market with around 80% market share, only 20% left to private labels and non-branded clothing (Copenhagen Economics, 2013). Despite of more than three decades high growth, Chinese firms have not nurtured a significant number of globally recognized brands. So far only one Chinese brand Huawei is on the list of 2014 global brand chart. Creating and sustaining global brands require lavish advertising budget and global promotion campaigns, which is beyond the capacity of most Chinese firms at the early stage of their development. Owners of global brands usually lead buyer-driven value chains (Gereffi, 1999). By plugging into buyer-driven value chains as assemblers, part producers, or original equipment makers, Chinese firms are able to circumvent the disadvantage in brands and take the advantage of consumers' preferences towards international brands. Compared with non-branded products with equal or even lower costs, the labels of international brands strengthen the competitiveness of "Made in China" products and enhance their appeal to consumers. The preferences of brand-oriented consumers are implicitly transformed into the demand for "Made in China" products. Without any doubts, China's exports would fall substantially if foreign brands attached were taken off.

In addition, to a large extent, new and fast growing markets have been nurtured by technology innovations and product inventions. Revolutionary innovations in information and communication technology (ICT) have given rise to a variety of new products, such as laptop computers, smart phones and tablets, thus dramatically stimulating consumers' demand beyond traditional commodities. In 2012, ICT goods emerged as one of top products traded globally. The world imports of ICT goods rose to US$2 trillion, about 11% of world merchandise trade and exceeded trade in agriculture and motor vehicle (UNCTAD, 2014). If not all, most of intellectual properties of ICT products are owned by MNEs of developed countries. Compared with established MNEs, Chinese firms do not have comparative advantage in high-tech products. Constrained by limited human resources, insufficient investment in research and development, and relatively short learning-by-doing history, it would be very challenging for Chinese firms to market products with their own intellectual properties and compete with incumbent technology leaders. The global expansion of value chains, on the other hand, offers an alternative path for Chinese firms to participate in the markets of high-tech products and benefit fast growing demand of these products, regardless their disadvantages. By participating in the value chains of high-tech products and specializing on low value added

segments, such as assembly and the production of low-tech components, Chinese firms are able to join the value creation process of high-tech products and grow together with lead firms. The unit value added of the segment may be relatively small, for instance assembly adds only $6.5 per iPhone (Xing and Detert, 2010), the sheer size of the world market implies a huge growth potential and economies of scales. Being a part of value chains, Chinese firms can enjoy the spillover effect of lead firms' technology innovations of lead firms. It is imperative to clarify that the spillover emphasized here is not the one defined in the conventional literature on technology and productivity growth. It refers to opportunities of joining and benefiting from the markets of high-tech products, where Chinese firms have neither necessary intellectual properties nor comparative advantage. As a matter of fact, China's leading positions in exports of laptop computers, digital cameras, mobiles and other similar ICT products have been achieved via specializing on low value added task-assembly of those products rather than indigenous technology innovations.

Finally, selling products in world markets requires global distribution networks. The existence of basic marketing and distribution infrastructure is prerequisite for supply and demand to be interconnected with one another. The buyer-seller links between exporters and overseas buyers is an important channel for the diffusion of knowledge and information (Wgan and Mody, 1992). In any value chains, lead firms are buyers and responsible for marketing and distribution. They set up product standards and instruct suppliers at upstream of chains about what, how, when and where to be produced. Through such contacts suppliers learn the nature of potential market and lead firms exercises direct quality control, and often transfer valuable design packaging and production know-how to suppliers (Gereffi, 1999). Hence, the required buyer-seller relations for exporting commodities to foreign markets are naturally built in GVCs. For firms without their own global distribution networks, joining GVCs can mitigate information deficiency, reduce transaction costs and facilitate the market access. Taking advantage of GVC's spillover effects in distribution networks, Chinese firms involving in GVCs have not only entered the world market successfully, but also been free of concerns on distributing their products to consumers in dispersed geographic locations. For example, Wal-Mart, if counted as a "nation", is the 7th largest trading partner of China and importing more than $18 billion goods from China annually (Lee, Gereffi and Barrientos, 2011). The retail networks of Wal-Mart provide essential marketing and distributions infrastructure for "Made in China" products. The Chinese suppliers of Wal-Mart use the retail networks as a vehicle to reach consumers of the US and other foreign markets.

3. GVCs and the Global Expansion of China's Exports

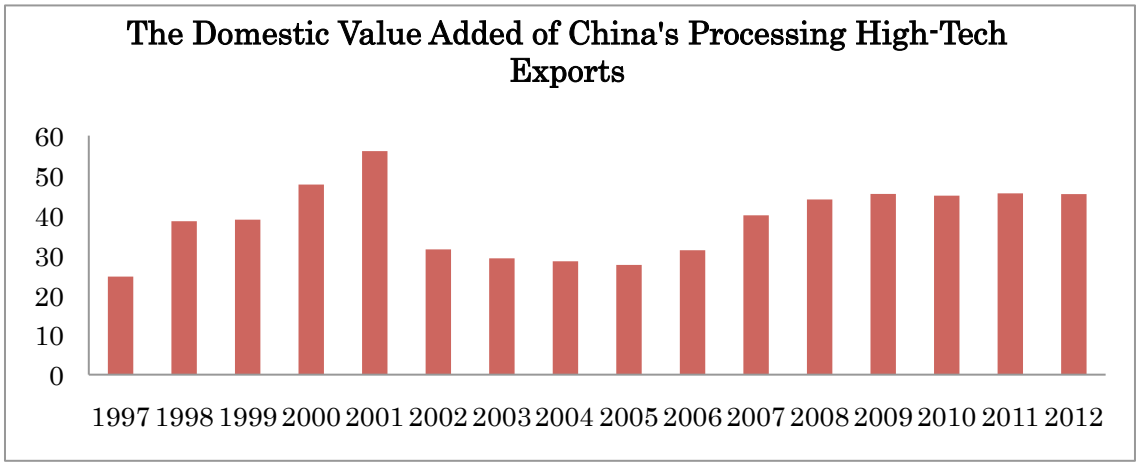
In this section, we will take a few representative goods as examples to intuitively illustrate the contribution of GVCs to the global expansion of Chinese exports. Since the launch of the first generation iPhone, China has been the exclusive exporter of the iPhone. In 2009, it exported 11.3 million iPhones valued at $2.0 billion to the US. In spite of rising wage and cumulative appreciation of the Yuan, China's iPhone export to the US continued to grow and surged to $8.5 billion, more than tripled in 2012. During the same period, Chinese Yuan appreciated 8.2% against the US dollar from $1 for 6.83 Yuan to 6.31 Yuan. The average annual wage of Chinese workers rose close to 50% from 34,000 Yuan to 50,000 Yuan. In terms of the exchange rate and wage, China's comparative advantage in labor cost actually deteriorated, thus cannot explain the drastic increase of the iPhone export.

Furthermore, that China exports the iPhone to the US, where the iPhone was invented, appears inconsistent with the classic theory of comparative advantage. The strange trade pattern, however, can easily be explained by GVCs. On the back of each iPhone, there is a statement "Designed by Apple in California Assembled in China" The message unambiguously reveals the actual task performed by China in manufacturing iPhones. Compared with other smart phones, the iPhone is the most expensive one with more than 60% gross profit margin (Xing and Detert, 2010). The value chain of the iPhone is governed by Apple. Therefore, the competitiveness of the iPhone and its fast global expansion should be attributed to technology innovations of Apple rather than China's comparative advantage—low labor cost. It is critical to emphasize what China exports via the iPhone is the services of low skilled labor but advanced technology. It is the iPhone supply chain that provides the opportunity for Chinese firms to sell labor services to all users of the iPhone. The international production fragmentation of the iPhone enables Chinese firms to be one of the beneficiaries of Apple's technology innovations.

The iPhone trade is not unique. Most of China's exports in high-tech products follow the same fashion. They are manufactured and delivered via various GVCs. In recent years, high-tech products have emerged as a major export item, accounting for about one third of China's total manufacturing exports. In 2012, China exported US$600 billion high-tech goods, more than ten times higher compared with in 2002. The exponential growth of high-tech exports has been driven by the extension of high-tech supply chains into China. To a great extent, it is the international fragmentations of high-tech manufacturing processes that bring Chinese firms into the game of exporting high-tech products. In order to utilize China's abundant labor, many high-tech MNEs have

relocated manufacturing facilities into China or outsourced low value added tasks to firms there. According to Xing (2014b), foreign invested firms produce more than 80% of China's high-tech exports. More importantly, about 80% of China's high-tech exports falls into the category of processing trade and has relatively low domestic value added. Domestic value added in exports measures the dependence of exports on foreign contents and the vertical integration of its industries with international production networks. Figure 1 shows the share of domestic value added of China's processing high-tech exports from1997 to 2012. It was as low as 25% in 1997 and gradually increased to 45% by 2012. Despite of the substantial increase in domestic contents, foreign value added remains above 50%, suggesting that processing high-tech exports are a result of GVC operations. Given that most of key components used in high-tech exports are imported and Chinese firms perform mainly low skilled tasks, the technology sophistication of China's high-tech exports is primarily determined by technology innovations of lead firms. In other words, the technology spillovers of GVCs raise the sophistication and the competitiveness of China's processing high-tech exports, thus eventually fostering its rapid expansion in the global market. Some researchers (e.g., Brenstterder and Lardy, 2006) argue that these products are not high-tech but commodities as they can be manufactured with large volume. We do not agree with the argument. These products still represent technology frontiers, but the tasks performed by Chinese firms, such as assembly and making non-core components are low skilled.

Figure 1

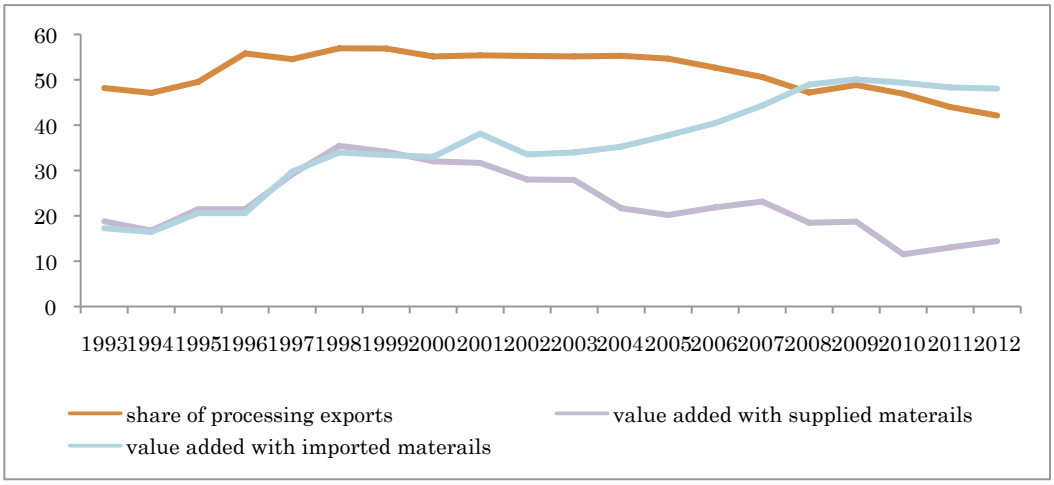


Source: Xing (2014a)

To investigate the critical role of GVCs beyond high-tech exports, we extend the discussion into processing exports, a subset of GVCs' activities. Since China adopted export-led growth strategy, processing exports has been promoted as

a major trade regime. In 2012, it amounted US$860 billion, about 42% of China's total exports. During the high growth period of 1997-2007, it grew faster than ordinary exports and generally exceeded 50% of China's total exports (Figure 2). Foreign invested firms play a dominant role in processing exports and responsible for more than 75% (Ma and Assche, 2011). The analysis on the geographic origins of processing imports—inputs used for producing exports and the destination markets of processing exports shows that, East Asian economies are the major origins while G-7 countries the main destination (Xing, 2010). The triangle trade pattern formed by processing trade outlines an aggregated GVC with China in the middle. Similar to processing high-tech exports, foreign value added accounts for a large portion of the value added in processing exports.

Figure 2: Processing Exports and the Domestic Value Added



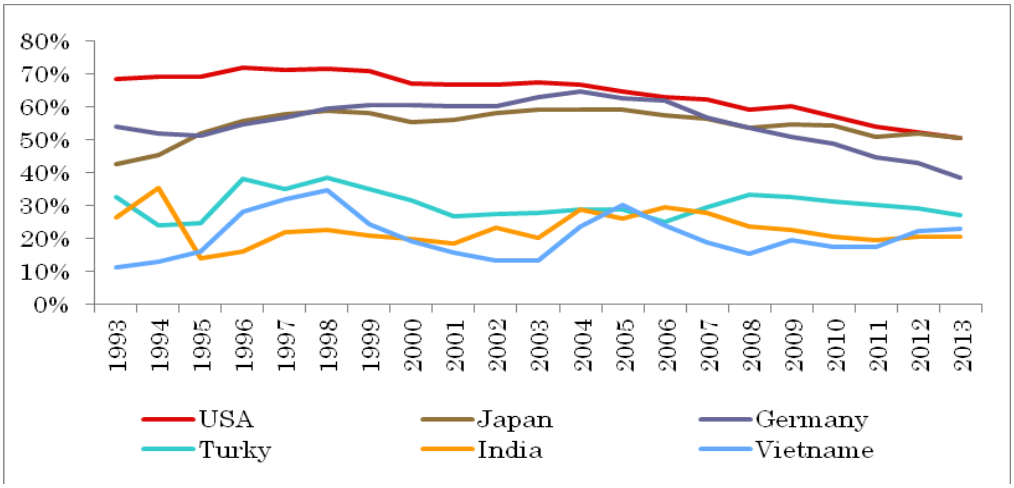
Source: Xing (2014a)

Figure 2 shows estimated domestic value added in two distinctive groups of processing exports: one with imported materials and the other with supplied materials by foreign contractors. In the former, the share of domestic content averaged 33% and the latter 23% during the period of 1993-2012. The significantly low share of domestic value added suggests the excessive dependence of processing exports on foreign contents and the high degree of vertical integration with foreign firms. In fact, in the case of processing exports with supplied materials, Chinese firms simply assemble supplied parts and components together and then send assembled products to foreign contractors, who are responsible for product designs, material procurements and marketing. Therefore, through different channels and at different fragments of GVCs, brands, distribution networks and technology innovations have all contributed to the rapid growth and impressive global expansion of China's processing exports.

4. Processing Exports and China's Exports to High Income Countries

China has turned into the largest import source of the US, Japan and European Union. The shares of China's exports in these markets are disproportionally high compared with its weight in the world economy. Generally the markets of high income countries tend to be more competitive and thus more challenging for firms of developing countries to enter and gain market shares. As argued above, firms participating in GVCs are able to benefit from brands, technology innovations and distribution networks, which are indispensable for competing in the global market. A few studies (e.g., Ma and Assche, 2011; Xing, 2012) show that China's processing exports mainly end up with the markets of the US, Japan and EU. By the definition, processing exports are synonymous with GVCs. The significant presence of processing exports actually underlines the vehicle role of GVCs in facilitating "Made in China" products to enter high income countries.

Figure 3. The Intensities of Processing Exports in China's Exports to Selected countries



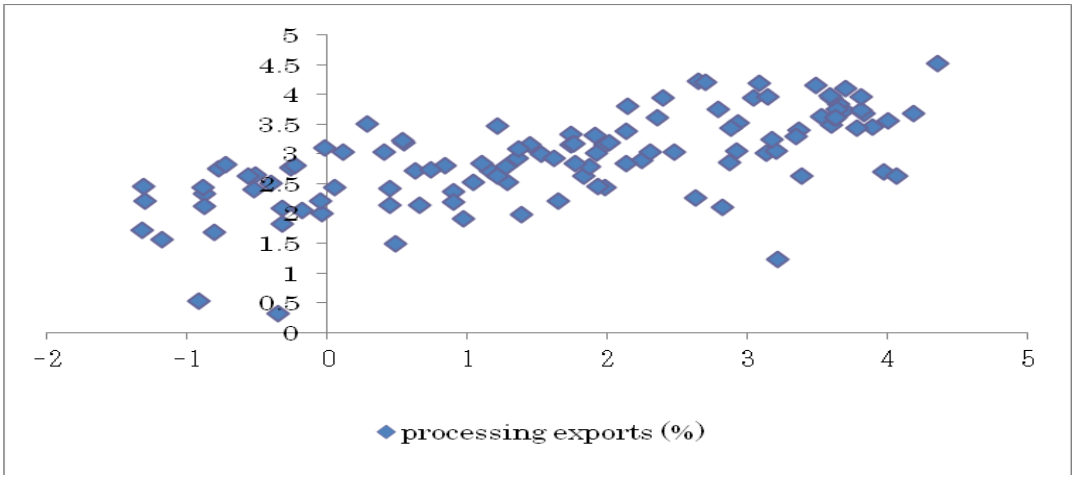
Sources: the authors' calculation

To empirically investigate the vehicle role of processing trade, we first calculate the share of processing exports in China's exports to six individual countries: the US, Japan, Germany, Turkey, India and Vietnam. All of them are important trading partners of China and represent high, middle and low income countries respectively. Figure 3 summarizes the results of 1993 to 2013. It is straightforward to see a divergence between high (the US, Japan and Germany) and low-income (India and Vietnam) countries. In the former, processing

exports accounted for more than 55% on average while in the latter about 20%. Specifically, processing exports comprised about 65% of China's exports to the US on average and even exceeded 70% during the period of 1996-1999. Before 2005, processing exports to both Japan and Germany grew rapidly, much faster than ordinary exports. As a result, the share of processing export to Japan rose to 59% in 2005 from 43% in 1993 while to Germany increased to 62% from 54%. In recent years, the share of processing exports gradually declined from the peak but remained more than 50% for the US and Japan.

In contrast, processing exports on average accounted for 30% of China's exports to Turkey, 23% to India and 21% to Vietnam during the period, much lower than to high income countries. The simple descriptive statistics implies that processing exports weight much more in China's exports to high income countries than to low income ones. To examine the stability of the correlation, we expand the sample size by including all of China's partners in processing exports in 2012. The sample consists of 115 countries. We use the sample to draw a scatter chart of the share of processing exports vs the income of the destination markets. Figure 4 shows the scatter chart, where the horizontal axis denotes the share of processing exports and the vertical axis GDP per capita. The logarithm of both variables is used in the chart. It unambiguously reveals a positive log-linear relation between the share of processing exports and the income, suggesting that the share of processing exports grows as the income rises and high income countries receive relatively more processing exports than low income countries.

Figure 4. The Correlation between the share of processing exports and the income of China's trading partners in 2012



Sources: the authors' calculation.

Figure 3 and 4 provide intuitive evidence on the possible correlation between the share of processing exports and the income of China's trading partners. Now we turn to the regression analysis of the relationship.

To formally test the correlation, we specify the model below:

$$Ln(p_{jt}) = \alpha + \beta_1 \ln(y_{jt}) + \beta_2 \ln(ex_{ust}) + \beta_3 EA + \beta_4 WTO + \beta_5 Epot + \beta_6 t + \mu_{jt}$$

where p_{jt} represents the share of processing exports in China's exports to country j, defined as the ratios of processing exports to total exports to country j in year t. The specified model can be considered as a derivative of two gravity equations, one is the gravity equation of processing exports and the other the gravity equation of total exports. Since GDP of China and its trading partners as well as geographic distance are usually included in gravity equations, these variables are assumed to be cancelled out in the ratio. y_{jt} denotes GDP per capita of country j. It measures preferences of foreign consumers to processing exports. As argued above, consumers of developed economies tend to have strong preferences toward branded and technology goods. Figure 3 and 4 intuitively suggest the correlation between the intensity of processing exports and the income level of China's trading partner. y_{jt} is the focus of the estimation. ex_{ust} represents the nominal exchange rate of the Yuan to the US dollar, calculated as the price of the US dollar in terms of Chinese Yuan. We use the exchange rate of the Yuan to the dollar rather than bilateral exchange rates because of two reasons. First, more than 80% of China's exports are priced and settled in the US dollar. Second, processing exports is a subset of GVC's activities. In general, only one currency, usually the US dollar, is used to settle transactions between firms involved in same GVCs.

EA is a dummy variable, proxying the impact of GVCs in East Asia. GVCs show significant regional bias. Chinese companies engaging processing exports mainly take part in the production networks in East Asia. It is necessary to include a dummy variable to capture the regional bias. EA takes 1 if j belongs to East Asia, zero otherwise. WTO is another dummy, testing the impact of China's entry to the World Trade Organization in 2001. It is equal to 1 after 2001, zero otherwise. Epot is also a dummy variable and identifies the trading partners serving as an entrport, where a substantial part of China's exports to these economies is re-exported to third countries. Hong Kong, Macao and Luxembourg are defined as entrepots in the estimation. The independent variable T is employed to capture the trend of processing exports.

Data used for the estimation is drawn from various sources. Statistics on bilateral processing exports and total exports covering 21 years from 1993-2013 are provided by the office of China Custom. GDP per capita and foreign exchange rates are downloaded from World Bank World Development Indicators and the International Financial Statistics of the International Monetary Fund. After preparing variables for estimation, there are 2401 observations. We test the stationarity of the dependent variable $Ln(p_{jt})$ and the result shows that it is stationary. Table 1 reports estimation results based on ordinary least squared (OLS) and the fixed effect model. The estimates of the OLS are listed as references. Here we only explain the estimates of the fixed effect model.

The R-squared shows that the fixed effect model can explain 72% of the variation of the dependent variable. The coefficient of GDP per capita y is 0.705 and statistically significant at 1%, implying that the share of processing exports to high income countries is larger than that to lower income countries. It supports our hypothesis that processing exports function as an effective vehicle for Chinese exports to enter the markets of developed countries. A 1% increase in GDP per capita will be expected to raise the share of processing exports 2 percentage point. The coefficient of the exchange rate ex_{ust} is 0.392 and statistically significant at 1%. ex_{ust} is the price of the dollar in terms of Chinese Yuan. The positive coefficient implies that the depreciation of the Yuan against the US dollar would increase the share of processing exports and vice versa. According to the estimate, a 1% appreciation of the Yuan would give rise to 1.48 percentage point decrease in the share of processing exports. Chinese Yuan has appreciated about 35% cumulatively against the US dollar since 2005. Meanwhile, the share of processing exports in China's total exports fell to 39% in 2013 from its peak 57%. The empirical result provides evidence that the appreciation of the Yuan undermined China's comparative advantage in the assembly task of GVCs, thus undercutting the overall growth of China's exports. The estimated coefficient of the dummy variable T is -0.0157 and statistically significant at 1%, suggesting that the share of processing exports trended lower. The WTO dummy is positive but insignificant.

Moreover, the empricial result reveals that, China's processing exports are not uniformly distributed across trading partners, and there exists siginficant cross-country heterogeneity, which is correlated with incomes. As demonstrated earlier, processing exports incorporate more than 50% of foreign value added. To a large extent, the share of processing exports determines the proportion of domestic value added embedded in China's exports. The Low intensity of processing exports implies high domestic value added in exports. In other words, China caputres relatively more value added in its exports to low income countries compared with to high income ones.

5. Concluding Remarks

As the center of global assembly, Chinese exporting firms have been closedly integrated with GVCs. Besides the intrinsic comparative advanatge, the rapid growth and worldwide expansion of China's exports should be examined in the context of GVCs. For investigating the contribution of GVCs to China's exports, in particular the exports to the markets of high income countires, we focuse on processing exports, a subset of GVC activies. Our analsyis shows that, China's processing exports benefit substantially from the spilliver effects of GVCs in brands, global distribution networks and technology innovations of lead firms. By taking part in GVCs, Chinese firms can bundle low skilled labor services with globally recoganized brands and advanced technology, then sell to global consumers. More than 50% foreign value added imbeded in processing exports suggest that, to a large extent the competitiveness of processing exports is determined by foreign contents rather than China's comparative advantage and indigenous technology innovations.

Procesing exports actually fucntion as a vehicle for "Made in China" to enter the markets of high income countries. While the share of processing exports to high income countries, such as the US and Japan exceed more than 50%, the share to low income countries is as low as 20%. The regression analysis shows that there exists a significant postive correlation between the share of processing exports and the income of import countries, providing empirical evidence on the facilitating role of GVCs for "Made in China" products to penentrate the markets of high income countries. The cross-country heterogeneity of processing exports suggests that, China actually captures relatively more value added from its exports to low income countries than to high income ones.

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Table 1. Processing Exports and Income of Trading Partners

VARIABLES	(1) OLS Estimation	(2) Fixed Effect
Ln(y)	0.299***	0.705***
	(0.00777)	(0.0984)
Ln(ex)	0.372**	0.392***
	(0.153)	(0.121)
EAD	0.539***	
	(0.0275)	
WTO	-0.0381	-0.0391
	(0.0492)	(0.0330)
Eport	0.123**	
	(0.0500)	
t	-0.00655	-0.0157***
	(0.00507)	(0.00435)
Constant	8.276	23.29***
	(10.32)	(8.500)
Observations	2,401	2,401
R-squared	0.434	0.722

Source: Authors' calculation, standard errors are in parentheses, with *** (**,*) denotes statistical significance at 1 (5, 10) percent level