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China's evolving role in global production networks: Implications for Trump's trade war

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***Abstract*:** This paper examines China's evolving role in global production networks and its implications for assessing the potential impact of the 'trade war' declared by President Trump. The analysis, which is based on a systematic disaggregation of trade based on global production sharing into components and final assembly, suggests that the Sino-US trade gap is a structural phenomenon driven by the pivotal role played by China within East Asia cantered production networks. The global competitiveness of US MNEs depends on their ability to use China as the production base for supplying the rest of the world, and China is now an important supplier of components used in US manufacturing. Given this intricate interdependence between the two economies within global production networks, attempt to impose punitive tariffs on China is bound to face formidable opposition from business interests in the United States. Even if the protectionist threat becomes a reality, the impact may not be as damaging as commonly thought because global production sharing has considerably weakened the link between relative prices and trade flows.

***Key word*:** China, global production networks, Sino-US trade dispute, punitive tariffs, MNEs

JEL Codes: F13, F14, F59

China's evolving role in global production networks: Implications for Trump's trade war[1]

1. Introduction

The early literature on China's rise as an export powerhouse widely interpreted the shift in its export composition away from standard labour-intensive products towards 'high-tech' product lines within global production networks as an indication of China becoming an advanced-technology superpower. It was predicted that the sophistication of China's export basket was rapidly approaching the level of those of most advanced industrial nations (Lall and Albaladejo 2004; Rodrik 2006; Yusuf et al. 2007). China's perceived export prowess, coupled with the rapid increase in intra-regional trade within China-centred production networks, led to the view that East Asia was becoming a self-contained economic entity with potential for maintaining dynamic growth independent of the economic outlook for the developed market economies (Yoshitomi 2007; Park and Shin 2009; Kohli et al. 2011).

Subsequent studies, which analysed the trade data with a specific focus on cross-border linkages within global production networks, challenged this view (Bergsten et al. 2006; Schott 2008; Athukorala 2009; Roach 2014; Yao 2009; Athukorala and Kohpaiboon 2012). These studies demonstrated that the interpretation of China's global economic integration in earlier studies had missed the fact that China was engaged predominantly in the final assembly stages of East Asia-centred global production networks of vertically integrated global high-tech industries. Even though East Asian economies had become the major suppliers of parts and components for assembly operations in China, most destinations for finished products remained markets outside the region. It was, therefore, too early to proclaim that China and East Asia were decoupling from the global economy.

The purpose of this paper is to revisit this debate by extending the period covered to more recent years. The analysis is motivated by a sizeable recent literature on the deepening of China's engagement in global production sharing. There is evidence coming from firm-level studies that firms engaged in final assembly in China have begun to procure inputs from domestic sources (Upward et al. 2013; Yang and Hayakawa 2015; Yang and Tsou 2015; Kang and Shen 2016; Kee and Tang 2016; Kong and Kneller 2016). According to these

[1] The author is grateful to Arianto Patunru for valuable comments on an earlier version of this paper.

studies, the process of industrial deepening has been underpinned by the relocation of manufacturing facilities to China by foreign component-producing firms to supply the rapidly expanding final assembly activities in China. There is also evidence of a notable decline in the share of foreign-invested enterprises (FIEs) in domestic manufacturing as a result of the rapid expansion of the operations of local firms, a number of which have become significant global players (Lardy 2014). Closely linked with the shift in ownership structure are some signs of Chinese firms moving gradually from a strategy of pure imitation to one of innovation (Wei et al. 2017, Yip and McKern 2016). So far no attempt has been made to examine whether these structural changes in domestic manufacturing have begun to change the patterns of China's engagement in global network trade. Filling this knowledge gap is important for broadening our understanding of China's engagement in the global economy.

A clear understanding of the emerging patterns of China's trade is particularly relevant for the current debate on the possible implications of the 'trade war' declared by US President, Donald Trump, on Sino–US trade relations and the global economy at large. A recent trade modelling exercise predicts that the implementation of the proposed 45 per cent US tariff would cut Chinese exports to the United States by 73 per cent (Guo et al. 2017). Based on an interview with several China experts, Wu (2017) reports anecdotal evidence of possible export contraction of similar magnitude. These predictions are based on the conventional notion that trade takes place in goods that are produced from start to finish in a given country (horizontal specialisation).

The validity of these predictions is, however, questionable given that 'global production sharing'—splitting the production process into discrete activities that are then allocated across countries—has become a prime mover of global trade and China's global economic integration. Modern international trade driven by global production sharing creates interdependence among countries in a way that old-fashioned horizontal approach to trade fails to capture. The goods a country exports are often produced with imported parts and components and the goods it imports often contribute to the expansion of domestic production and indirectly induce its own exports. These intricate complementarities between trade and production have direct implications for both President Trump's ability to implement punitive tariffs and the economic impact if the protectionist threat becomes a reality.

The rest of this paper is structured as follows. The next section provides an overview of China's emergence as a global export powerhouse. This is followed by an analysis of the emerging patterns of China's engagement in global production sharing, focusing on both its changing commodity composition and the geographic profile of trade. The forth section examines the implications of the emerging patterns of China's engagement in global production networks for Sino–US trade relations in the context of the current debate about the implications of punitive tariffs proposed by the Trump administration. The final section summarises the key findings and offers some policy suggestions.

2. China in global production networks

The rise of China as a major trading nation is one of the most momentous developments in the post–World War II era, surpassing even the stunning rise of Germany and Japan. Total merchandise exports from China increased from US$8 billion (around 1 per cent of global exports) in 1978, when the country's liberalisation process began, to US$408 billion (7.7 per cent of global exports) in 2000 and to more than US$2 trillion (14.1 per cent) in 2015.[2] In 2004, China overtook Japan to become the third-largest exporter in the world after the United States and Germany, and, in another three years, it became the second-largest exporter, surpassing the United States. Since 2009, China has been the world's largest exporting nation. China's ratio of exports to gross domestic product (GDP) currently stands at 33 per cent compared with an average level of 10 per cent for other major economies such as the United States, India and Brazil (World Bank, various years).

China's phenomenal export expansion has been underpinned by a dramatic shift in the commodity composition of its exports, away from primary products and towards manufactured goods. The share of manufactures in China's total merchandise exports increased from less than 40 per cent in the late 1970s to more than 90 per cent from the late 1990s, compared with a global average of 70 per cent. China accounted for more than half of the increase in total global manufacturing exports between 1990 and 2015. Integration of domestic manufacturing within global production networks has been the prime mover of China's rise as an export powerhouse during this period.

[2] The data reported in this paper are in current US dollars and are taken from the UN Comtrade database (comtrade.un.org/), unless otherwise stated.

In terms of organisational structure, production networks take two major forms: buyer-driven production networks and producer-driven production networks.[3] Until the early 1990s, the expansion of manufacturing exports from China took place predominantly within buyer-driven production networks. China's export composition during this period remained heavily concentrated in traditional labour-intensive manufactures such as apparel, footwear, toys and sporting goods. Hong Kong manufacturing firms, which relocated their plants to the newly established special economic zones (SEZs) in the Chinese mainland, played a pivotal role in linking China to these production networks (Song and Sung 1995; Roach 2014).

Since then, there has been a palpable shift in China's export composition, away from conventional labour-intensive products and towards assembly operations within producer-driven production networks—in particular, those within the broader category of machinery and transport equipment. Within a few years, the increase in the rate of China's market penetration into global machinery trade turned out to be faster than that for traditional labour-intensive manufacturing. Export expansion was underpinned by a notable increase in the entry of multinational enterprises (MNEs) to set up assembly plants in China. The share of MNE subsidiaries in manufacturing exports from China increased from about 10 per cent in the early 1990s to over 60 per cent in 2010 (Lardy 2014).

Successfully linking a developing country to global production networks requires policy reforms to create a business environment conducive to export-oriented production. However, combining economy-wide reforms with public policies specifically designed to attract MNEs to set up production bases is vital, particularly in the case of production sharing within producer-driven networks.

The main drivers of China's emergence as the premier global assembly centre were its ample supply of relatively cheap and trainable labour, trade liberalisation and trade-related

[3] Buyer-driven networks are common in diffused-technology consumer goods industries (such as clothing, footwear, travel goods and toys). The 'lead firm' in such a network is the international buyer (large retailers such as Walmart, Marks & Spencer, H&M) and production sharing takes place mostly through arm's-length relationships, with global sourcing companies (value chain intermediaries) playing a key role in linking producers and lead firms. Producer-driven networks are common in vertically integrated global industries such as electronics, electrical goods, and automobiles. In these networks, the 'lead firm' is a multinational manufacturing enterprise (such as Intel, Motorola, Apple and Samsung) and production sharing takes place through the lead firm's global branch network and/or its close operational links with established contract manufacturers. There is, therefore, a close link between trade and foreign direct investment (FDI) within these networks. On the analytical distinction between these two variants of production networks, see Gereffi (1999).

infra-structure provision through the establishment of SEZs. In terms of labour supply, China had the specific advantage of the availability of supervisory manpower to complement the vast pool of unskilled workers. Assembly processes within production networks require much greater numbers of middle-level supervisory workers (in addition to the availability of trainable low-cost unskilled labour) than is required in traditional labour-intensive manufacturing.[4] Under global production sharing, developed countries normally shift to developing countries the low-skill–intensive parts of the value chain; however, these low-skill activities can be more skill intensive than even the most skill-intensive activities in the developing country (Feenstra 2010).

If the 'service link cost' associated with production sharing—the costs of connecting and/or coordinating activities into a smooth sequence to produce the final good—had outweighed the gain from the favourable labour market conditions (Jones and Kierzkowski 2004), participation in global production sharing would not have occurred. These extra costs include transportation, communication and related tasks involved in coordinating production activity in a given country with what is being done in other countries within the production network. The SEZ-centred trade and foreign investment policy reforms in China were successful in meeting this requirement.

In addition to these factors, a significant reduction in 'country risk' as a result of the end of the Cold War[5] and China's accession to the World Trade Organisation (WTO) in 2001 provided a setting conducive to the smooth functioning of China-centred production networks. Country risk is a key determinant of whether a firm outsources its production processes to another country, either by setting up an affiliated company or by establishing an arm's-length relationship with a local firm. This is because supply disruptions in a given overseas location could disrupt the entire production chain, and it is impossible to fully offset these risks by writing *complete contracts* (Spencer 2005; Helpman 2006).

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[4] See Steve Jobs's discussion with former US President Barack Obama on Apple's assembly operations in China in Isaacson (2011: 546): 'At that time, Apple had 700,000 factory workers employed in China, and that was because it needed 30,000 engineers on-site to supervise those workers. If you could educate these engineers, he said, we could move more manufacturing plants here.'

[5] Country risk considerations during the Cold War are considered a possible reason US electronics MNEs favoured Singapore (and subsequently Malaysia, Thailand and the Philippines) in which to establish assembly plants in the initial stage of their overseas operations (in the 1960s and 1970s), while bypassing South Korea, Taiwan and Hong Kong (in particular, Hong Kong, a country that followed almost laissez-faire economic policy throughout)—countries that were more familiar to them (Athukorala and Kohpaiboon 2014).

3. Trade patterns

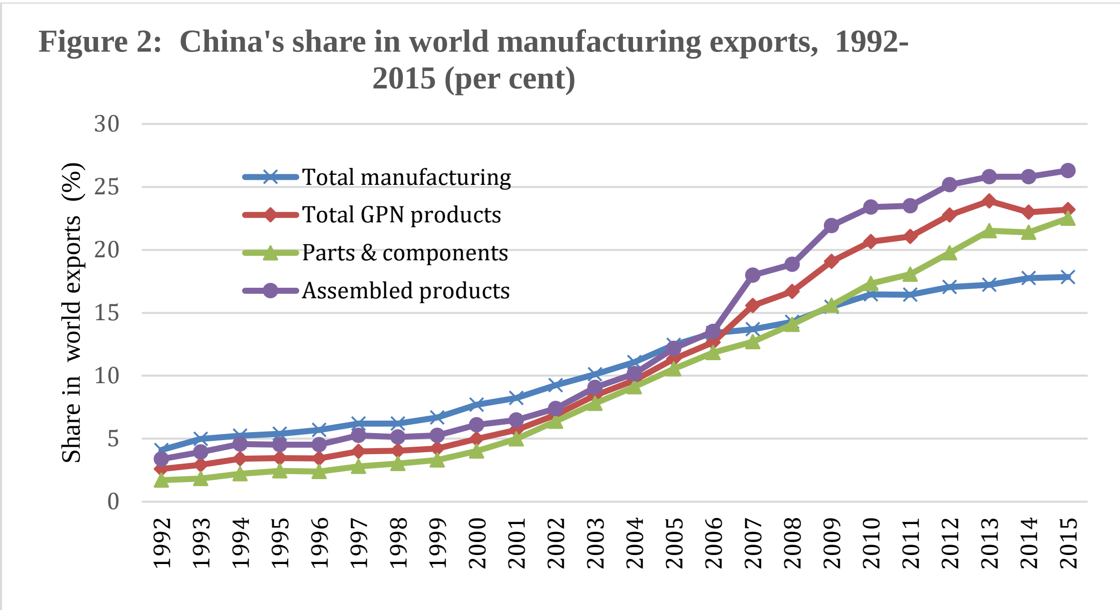
To explore the magnitude and patterns of trade arising from cross-border production networks, it is necessary to separate parts and components (henceforth referred to as 'components') from final (assembled) products traded within global production networks in reported standard (customs records–based) trade data. The methodology for data compilation is descried in Appendix 1. In the following discussion, 'global production network (GPN) products' refers to the sum of components and assembled products.

Exports of GPN products from China increased from US$47 billion in 1992–93 to US$1.5 trillion in 2014–15,[6] when these products accounted for more than 70 per cent of China's total manufacturing exports (Figure 1). Within GPN products, assembled products account for a larger share than components throughout the period. This pattern reflects China's dominant role as an assembly centre within global production networks. However, components also account for a sizeable share and that share has increased in recent years, reflecting deepening of the domestic production base.

From the early 1990s, China's share of global network products remained above its share of total global manufacturing exports (Figure 2) and the difference became prominent after about 2005. In 2014–15, China accounted for 27 per cent of total global network product exports in the world compared with an 18 per cent share in total world manufacturing exports. Shares of both final assembly and components were notably higher than the aggregate global export share.

[6] To minimise possible random shocks and measurement errors, two-year averages are used in intertemporal comparisons throughout this section.

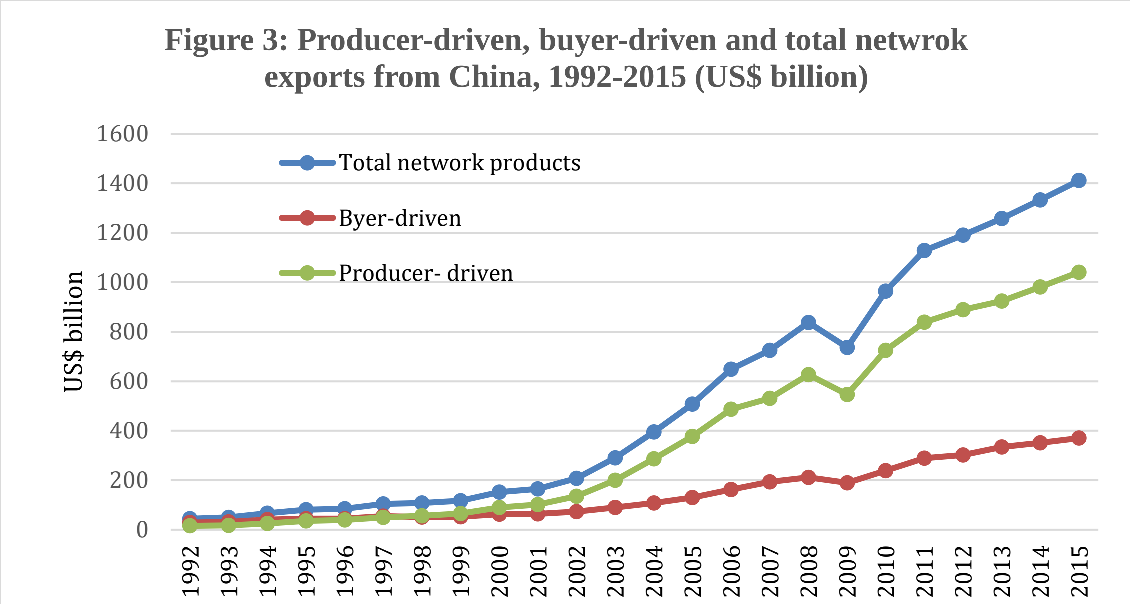
Source: Data compiled from UN Comtrade database (comtrade.un.org/).



Source: Data compiled from UN Comtrade database (comtrade.un.org/).

Product composition

China’s share of products exported within producer-driven networks in total GPN product exports increased from 52.1 per cent in 2000–01 to 74.2 per cent in 2014–15 (Figure 3; Table 1). Information technology products (automated data-processing machines, telecommunications and sound recording instruments and electrical machinery) are the prominent export products within this category. These products accounted for over 45 per cent of total global network exports in 2014–15.



Source: Data compiled from UN Comtrade database (comtrade.un.org/).

The shift in product composition towards products within producer-driven networks from those within buyer-driven networks seems to reflect a widening of the domestic production base rather than China losing international competitiveness in products traded within buyer-driven networks. As can be seen in Table 2, China's shares of global exports of most products at the two-digit Standard International Trade Classification (SITC) level have increased during this period, notwithstanding the widely perceived decline in China's international competitiveness owing to rising domestic wages. Interestingly, world market shares of buyer-driven exports have recorded notable increases, even though their production is considered relatively more labour intensive. China accounted for a staggering 49.2 per cent of world market share in apparel in 2014–15, up from 30.9 per cent in 2000–01. The world market share of footwear and travel goods increased from 21.9 per cent to 40.5 per cent between the two periods. Within producer-driven exports, automated data-processing machines (SITC 75) and telecommunications and sound recording instruments (SITC 76) showed the fastest rates of global market penetration: in 2014–15, China accounted for 49.2 per cent and 36.1 per cent, respectively, of total global exports of these products.

Table 1 Commodity composition of China's exports within global production networks, 2000–01 and 2014–15 (per cent)[1]

Products[2]	**Parts and components**		**Assembled products**		**Total GPN products**	
	2000–01	**2014–15**	**2000–01**	**2014–15**	**2000–01**	**2014–15**
(a) Exports within producer-driven networks	72.0	85.3	34.8	64.5	52.1	74.2
Chemicals (5)	0.3	0.7	-	-	0.1	0.3
Power-generating machines (71)	4.05	5.6	0.25	0.5	1.65	2.7
Specialised industrial machines (72)	1.15	2.0	0.8	3.7	1.6	3.0
Metal-working machines (73)	0.3	0.4	0.6	0.7	0.5	0.6
General industrial machinery (74)	4.35	8.1	1.8	7.2	3.95	7.6
Automated data-processing machines (75)	18.0	14.9	5.7	15.9	12.1	15.7
Telecommunications and sound-recording instruments (76)	18.7	22.3	6.1	8.7	13.9	14.6
Electrical machinery (77)	18.8	22	6.75	10.1	11.5	16.2
Road vehicles (78)	2.8	6.1	3.8	4.6	3.45	5.3
Other transport equipment (79)	0.5	0.4	2.0	4.1	1.4	2.5
Professional and scientific instruments (87)	0.5	1.2	3.4	7.2	2.1	4.6
Photographic apparatus (8)	1.65	0.8	3.3	1.9	2.7	1.4

(b) Exports within buyer-driven networks	27.9	14.7	65.2	35.5	47.9	25.2
Textiles (656–7)	28.2	14.2	0	-	10.1	5.9
Apparel and clothing accessories (84)	0.3	0.5	40.7	24.4	28.1	13.1
Footwear (85)	-	-	10.75	7.3	6.9	4.1
Travel goods (83)	-	-	3.8	3.8	2.4	2.1
Total (a + b)	**100**	**100**	**100**	**100**	**100**	**100**

*

Notes: [1] Two-year averages' [2] Commodity codes of the Standard International Trade Classification (SITC) are in parentheses.

- Zero or negligible

Source: Compiled from UN Comtrade database (comtrade.un.org/).

Table 2 China's share of global network trade, 2000–01 and 2014–15 (per cent)[1]

Products[2]	Parts and components		Final assembly		Total global network products	
	2000–01	**2014–15**	**2000–01**	**2014–15**	**2000–01**	**2014–15**
(a) Exports within producer-driven networks	5.85	17.8	13.65	16.2	3.7	11.5
Chemicals (5)	1.8	12.1	-	-	1.8	11.9
Power-generating machines (71)	2.25	9.1	6.0	8.5	1.15	4.8
Specialised industrial machines (72)	2.0	8.4	6.0	9.7	1.6	7.2
Metal-working machines (73)	2.4	9.1	6.15	8.1	1.75	6.5
General industrial machinery (74)	3.8	13.4	10.8	16.3	2.8	9.8
Automated data-processing machines (75)	11.1	29.9	39.8	71.3	7.7	49.28
Telecommunications and sound recording instruments (76)	12.5	46.3	37.3	35.4	8.3	36.1
Electrical machinery (77)	5.0	19.2	18.8	30.6	3.35	12.9
Road vehicles (78)	2.1	8.6	5.35	3.7	1.2	4
Other transport equipment (79)	1.2	2.9	3.3	11.1	1.6	7.5
Professional and scientific instruments (87)	2.3	10.5	10.1	16.1	3.9	13.3

Photographic apparatus (88)	9.5	18.5	12.8	13.3	5.5	12
(b) Exports within buyer-driven networks	12.9	32.1	33.8	46.2	19.7	39.6
Textiles (656–7)	13.6	34.5	17.3	-	13.6	34.8
Apparel and clothing accessories (84)	-	-	-	48.1	30.9	49.2
Footwear (85)	8.7	20.6	25.6	42.6	21.9	40.5
Travel goods (83)	0	0	16.5	41.8	23.7	41.6
Total (a + b)	**6.5**	**22.4**	**16.7**	**27.6**	**5.1**	**17.6**

Notes: [1] Two-year averages' [2] SITC commodity codes are in parentheses. - Zero or negligible

Source: Compiled from UN Comtrade database (comtrade.un.org/).

Interestingly, China's world market share has increased in both components and final assembly within producer-driven production networks, reflecting consolidation of China's role within global production sharing.

There are at least four possible explanations for this across-the-board increase in global market penetration of manufacturing exports from China. First, even though the average domestic manufacturing wage has significantly increased, China's manufacturing wages are still much lower than those in the United States and other mature industrialised economies (Table 3). For instance, in 2014, the annual average wage for manufacturing workers in China was only one-fifth of that in the United States and most other developed countries. Allowing for other factors (discussed below), these 'international' wage differences are presumably a significant determinant of China's attractiveness as a location within production networks.

Second, there is still some slack in the labour markets in China's interior provinces and producers therefore have the option of relocating production within the country in response to labour scarcity and rising wages in the coastal provinces. Large firms located in industrial centres also have the option of using subcontracting arrangements with township and village-owned enterprises (TVEs) as a cushion against increasing wages (Athukorala and Wei 2017). Third, increases in labour costs may have been more than balanced by reductions in service linkage costs resulting from trade and investment policy reforms and, more importantly, improvements in provision of trade-related infrastructure. Finally, as already noted, compared with many countries, China has the advantage of being able to meet labour requirements (unskilled labour and supervisory manpower) for large-scale assembly operations within global production networks.

Deepening of production sharing

As noted at the outset of this paper, there is some scattered evidence that China's manufacturing base has deepened over the years, with an increase in domestic production of components within global production networks. Has this structural change gained enough significance over time to be reflected in China's trade data?

Table 3 Annual average wages for manufacturing workers in selected countries (US$)

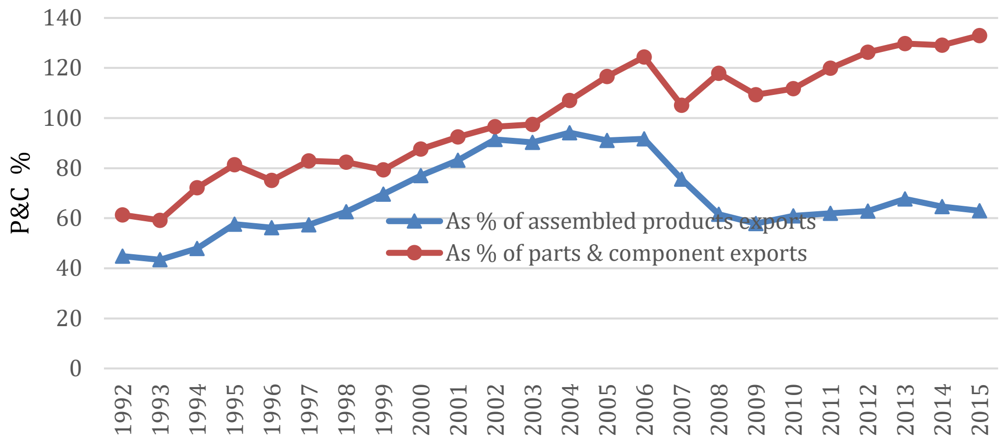
Country	2010	2014
Australia	71,420	84,743
Canada	53,454	58,452
France	72,771	74,403
Germany	75,519	78,895
Ireland	-	75,288
Italy	63,757	70,483
Netherlands	73,816	75,216
Sweden	-	78,050
United Kingdom	61,958	70,400
United States	77,055	87,021
Czech Republic	-	24,863
Poland	23,605	24,088
Brazil	32,590	36,735
Mexico	16,021	16,675
China	15,508	16,287
India	14,039	14,708
Indonesia	19,048	18,771
Japan	65,643	66,339
South Korea	46,293	60,039
Malaysia	17,726	21,899
Philippines	10,998	9,526
Singapore	54,997	66,852
Taiwan	29,307	31,845
Vietnam	-	10,652

- Data suppressed to avoid disclosure of data of individual companies.

Notes: Data for the United States relate to US affiliates of foreign MNEs in US manufacturing. For other countries, the data are for foreign affiliates of US MNEs.
Source: US BEA (2014).

Two data series compiled to shed light on this issue are plotted in Figure 4: the ratio of components exports to imports and the ratio of components imports to exports of assembled products. The former series indicates China's integration into global production networks as a supplier of components; the latter indicates the degree of dependence of final goods assembly in China on imported components.

Figures 4: China: Parts and components imports relative to exports of parts and components and assembled products (%)



Source: Data compiled from UN Comtrade database (comtrade.un.org/).

Geographic profile

Data on the destination-country and source-country composition of China's GPN exports and imports are summarised in Tables 3 and 4, respectively. A number of interesting developments relating to China's geographic patterns of engagement in global production networks can be observed.

On the export side, there has been a notable decline in China's share of GPN products destined for developed countries, from 69.7 per cent in 2000–01 to 50.2 per cent in 2014–15. Exports to Japan recorded the sharpest decline, from 17.8 per cent to 8.1 per cent between the two periods. Developed countries other than Japan accounted for 42.8 per cent of China's total GPN product exports, compared with 51.9 per cent in 2000–01. The United States remains the largest market for both components and assembled products, accounting for more than one-fifth of Chinese exports.

While China's market shares in all developing countries/regions, other than Taiwan, have increased across the board, its degree of export penetration in Africa, Latin America and the Caribbean and West Asia (the Middle East) was much sharper, though starting from a low base. The share of Chinese exports destined to the East Asian developing countries (South Korea, Taiwan and the countries of South-East Asia) has increased at a slower rate, from 21.8 per cent in 1992–2003 to 20.5 per cent in 2013–14, compared with the share of exports to other developing countries, which increased from 21.5 per cent to 28.6 per cent.

Table 3 Destination-country composition of China's global network exports, 2000–01 and 2014–15 (per cent)*

Country/country groups	Parts and components		Assembled products		Total GNP products	
	2000–01	2014–15	2000–01	2014–15	2000–01	2014–15
Japan	19.4	9.4	15.3	7.1	17.8	8.1
South Korea	4.5	7.1	2.8	4.8	3.8	5.7
Taiwan	5.9	2.7	3.9	2.6	5.0	2.6
South-East Asia	11.5	11.5	8.6	12.5	10.1	11.9
South Asia	2.4	5.0	2.6	4.2	2.5	4.6
India	0.4	3.1	0.5	2.4	0.5	2.7
West Asia	1.8	4.3	2.5	5.0	2.1	5.7
Central Asia	0.1	0.6	0.1	0.8	0.1	0.7
Oceania	1.1	1.6	1.7	2.5	1.4	2.1
Australia	1.0	1.5	1.5	2.0	1.2	1.8
NAFTA^	28.8	27	31.7	25.3	29.6	24.1
United States	27.1	23.4	29.7	22.2	27.7	22.7
Canada	1.1	1.4	1.3	1.3	1.2	1.4
European Union (EU)	21.1	18.9	21.4	19.9	21.2	19.5
Non-EU Western Europe	0.4	0.3	1.6	0.6	1.0	0.5
Russian Federation	0.1	2.1	0.4	2.3	0.3	2.2
Africa	1.6	3.5	3.2	4.6	2.3	4.1
Latin America and the Caribbean	2.3	6.9	4.4	7.9	3.3	8.5
Total	**100**	**100**	**100**	**100**	**100**	**100**
Memorandum items						
Developed countries#	70.1	52	70.3	50.0	69.7	50.2
Developed countries excluding Japan	49.3	42.6	54.9	43.0	51.9	42.8
Developing countries#	29.9	48.0	29.7	50.0	30.3	49.8

* Two-year averages

^ North American Free Trade Agreement

Based on the UN Standard Country Classification.

Source: Compiled from UN Comtrade database (comtrade.un.org/).

Table 4 Source-country composition of China's global network imports, 2000–01 and 2014–15 (per cent)*

Country/country groups	Parts and components		Assembled products		Total GNP products	
	2000–01	**2014–15**	**2000–01**	**2014–-5**	**2000–01**	**2014–15**
Japan	28.5	22.2	28.8	12.8	28.8	15.5
South Korea	8.2	14.1	5.3	19.4	6.7	17.7
Taiwan	16.2	11.4	12.4	19.6	14.3	17.2
South-East Asia	8.7	14.9	3.5	12.9	6.8	13.5
South Asia	0.0	0.4	0.0	0.1	0.0	0.2
India	0.0	0.4	0.0	0.1	0.0	0.2
West Asia	0.1	0.3	0.2	0.3	0.2	0.3
Central Asia	0.0	0.0	0.0	0.0	0.0	0.0
Oceania	0.3	0.2	0.5	0.1	0.3	0.1
Australia	0.2	0.1	0.3	0.1	0.3	0.1
NAFTA^	15.3	10.0	16.4	12.8	15.1	11.4
United States	14.0	9.3	17.4	11.9	15.0	10.6
Canada	1.0	0.4	1.0	0.5	1.0	0.5
European Union (EU)	20.5	24.2	28.5	19.2	24.3	21.1
Non-EU Western Europe	0.8	1.1	1.3	1.3	1.0	1.2
Russian Federation	1.1	0.1	1.2	0.1	1.1	0.1
Africa	0.0	0.1	0.0	0.1	0.0	0.1
Latin America and the Caribbean	0.3	1.2	0.1	1.8	0.2	1.6
Total	**100**	**100**	**100**	**100**	**100**	**100**
Developed countries#	64.5	55.4	77.2	44.4	70.4	47.6
Developed countries excluding Japan	35.6	34.1	48.4	31.6	41.6	32.4
Developing countries#	35.5	44.6	22.8	55.6	29.6	52.2

* Two-year averages

^ North American Free Trade Agreement

Based on the UN Standard Country Classification.

Source: Compiled from UN Comtrade database (comtrade.un.org/).

On the import side, the share accounted for by developed countries in GPN exports has declined at a much faster rate—from 70 per cent in 2000–01 to 47.6 per cent in 2014–15—compared with what we observed for the export side. However, there are notable inter-country differences. The major winners of market share in China are South Korea and Taiwan and the countries in South-East Asia, with South Korea recording the biggest gain. By contrast, Japan's share has declined sharply, from 28.8 per cent in 2000–01 to 15.5 per cent in 2013–15. The data clearly show the heavy concentration of China's components imports from neighbouring East and South-East Asian countries (including Japan). The share accounted for by these countries in total components imports increased from 53 per cent to 62 per cent between 2000–01 and 2014–15.

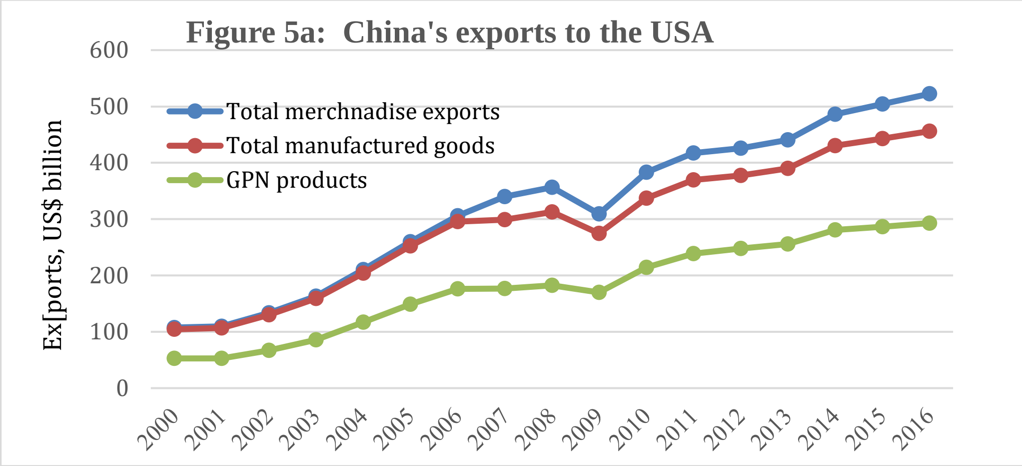
4. Production sharing and Sino–US trade relations

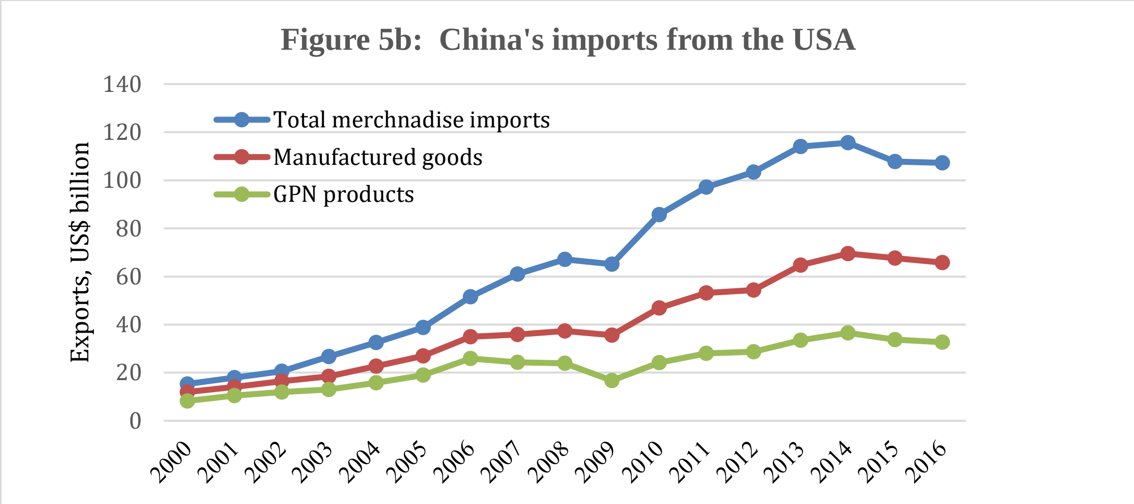
China's exports to the United States are dominated by manufactured goods, with other (primary) products accounting for less than 5 per cent of total merchandise exports (Figure 5a). GPN products account for the bulk of manufactured goods, with their share increasing from 45 per cent in 2000–01 to over 65 per cent in 2015–16.

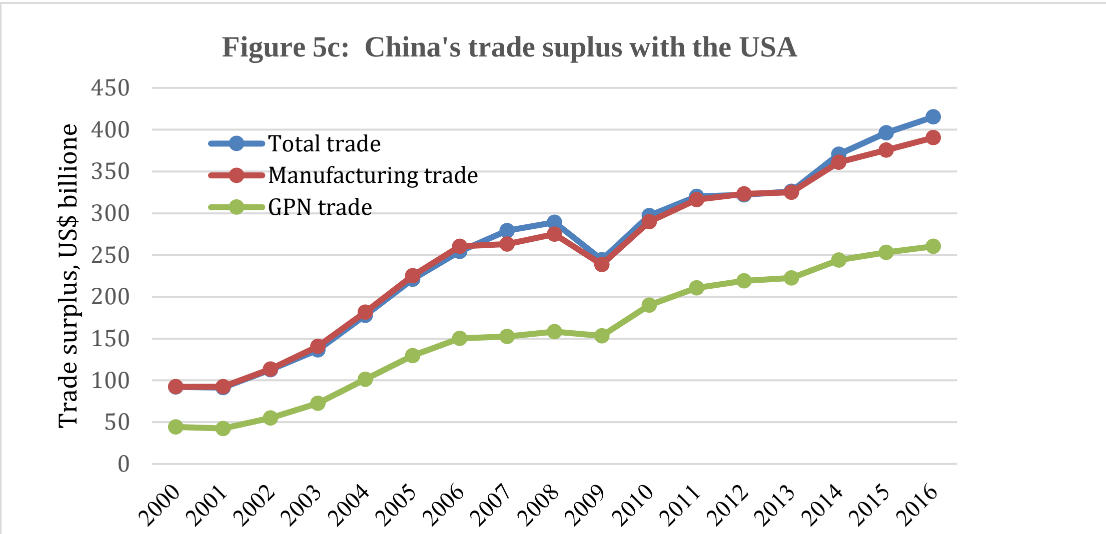
The share of manufactured goods in China's imports from the United States (US exports to China) declined from 78 per cent in 2000–01 to 61 per cent in 2015–16. The share of GPN products in total manufacturing exports declined from 73 per cent to 49 per cent between these two periods. In recent years, the annual rate of increase in China's imports has been much slower than the rapid increase in China's exports to the United States.

These patterns are consistent with our observation in the previous section of deepening GPN production bases in China. With the rapid expansion of manufacturing production in China—a process in which US MNEs play a significant role—the share of manufacturing in Chinese imports from the United States has declined over time. In particular, given the expansion of components production in China, firms engaged in assembly operations appear to procure inputs from domestic Chinese sources.

Figure 5: China – USA Merchandise trade and trade surplus, 2000-2016 (US$ billion)







Source: Data compiled from UN Comtrade database (comtrade.un.org/).

The changing export and import patterns of Sino–US trade relations are vividly captured in China's trade surplus with the United States, which is the focal point of that country's China-bashing. Manufacturing trade accounts for almost all of China's trade surplus with the United States. GPN product trade accounted for more than two-thirds of the surplus over the past decade, compared with about 50 per cent during the preceding decade. The actual impact of GPN product trade on the widening trade surplus could be much larger than is depicted in these data: the trade data decomposition procedure used in this study does not cover the entire GPN product trade (see Appendix 1).[7]

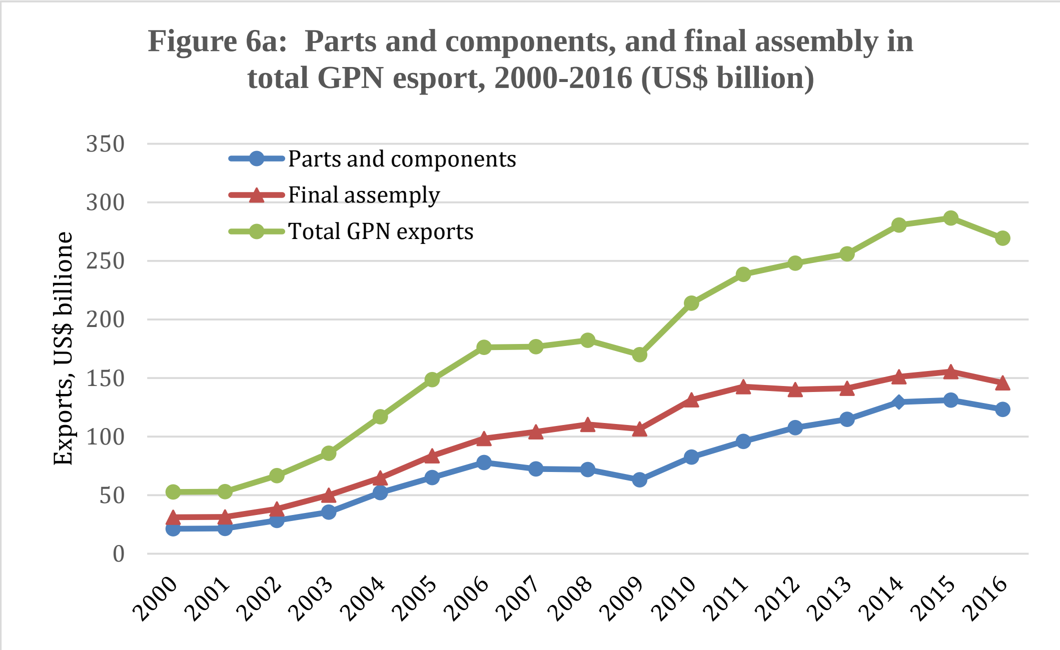
These patterns are consistent with our observation in the previous section of deepening GPN production bases in China. With the rapid expansion of manufacturing production in China—a process in which US MNEs play a significant role—the share of manufacturing in Chinese imports from the United States has declined over time. In particular, given the expansion of components production in China, firms engaged in assembly operations appear to procure inputs from domestic Chinese sources.

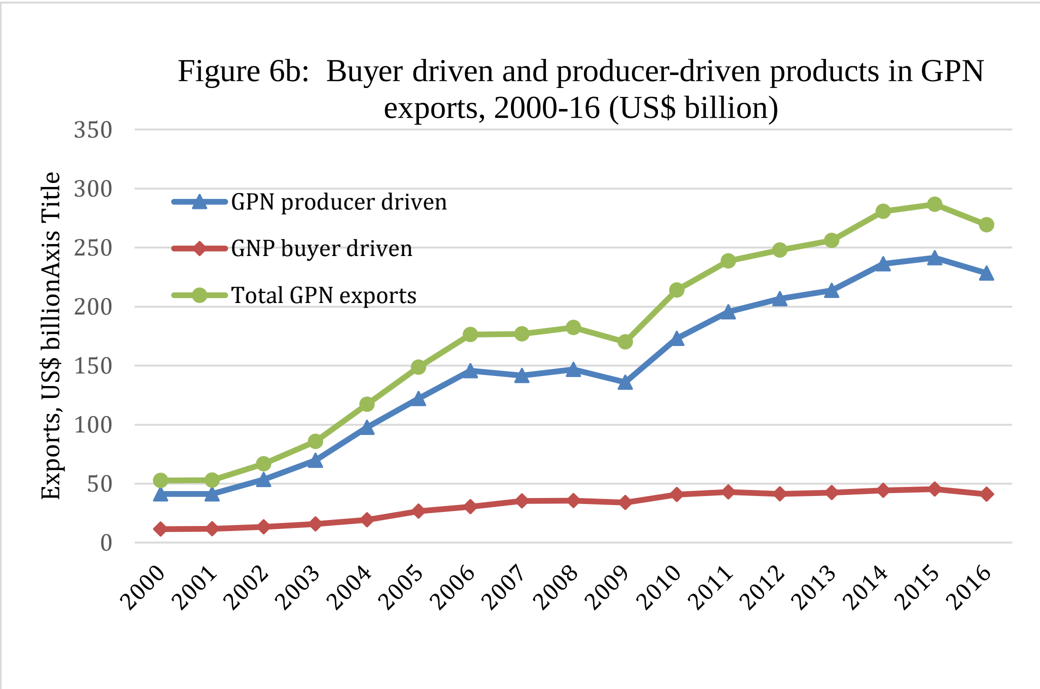
GPN product imports to the United States increased fivefold (from about US$50 billion to more than US$300 billion between 2000 and 2015). Throughout this period, components, which are mostly inputs to US manufacturing, have accounted for an average of 45 per cent of these imports (Figure 6a).

Contrary to popular perceptions based on sensational media stories about massive procurements by Walmart and other US retail stores, standard consumer goods (apparel, footwear, toys and so on) account for a small share of China's total GPN product exports to the United States. Over the past decade, products traded within producer-driven production networks have accounted for more than 85 per cent of GPN product trade between the two countries. This is because most US MNEs in vertically integrated global industries have shifted final assembly processes to China while retaining mostly product design, global marketing and other headquarters functions in the United States.

[7] The focus of this paper is solely on the *record* trade surplus, which is the focus of the current debate on Sino–US trade. The issue of the extent to which this is a reflection of shifting production bases from other countries to China as part of the ongoing process of global production sharing is beyond its scope. On this issue, see Athukorala and Yamashita (2009) and Koopman et al. (2012).

Figure 6: Composition of China's GNP exports to the USA, 2000-2016, US$ billion





Source: Data compiled from UN Comtrade database (comtrade.un.org/)

The debate about the widening Sino–US trade imbalance has mostly, if not entirely, focused on China's exports to the United States. Ignored in the debate is the importance of China for US MNEs as a base for expanding their exports to the rest of the world. In 2013, the latest year for which the relevant data are available, the value of goods exported to the rest of the world by US MNE affiliates in China was US$37.5 billion, which was almost three times the value of their exports to the United States (US$13.6 billion) (Table 5).

Table 5 Sales values for US multinational enterprises operating in China, 2013 (US$ billion)

	Goods and services	Goods
Total sales	261.8	217.7
Local sales	206.7	166.6
Exports		
To the United States	15.4	13.6
To other countries	39.7	37.5

Source: US BEA (2016).

The discussion in this section supports the view that the widening trade imbalance is essentially a structural phenomenon driven by the process of global production sharing, from which both economies benefit. Protectionist policies would hurt manufacturing production, resulting in job losses in the United States, and hinder the global operations of US MNEs on the back of China's emergence as a manufacturing giant.

Given this intricate interdependence between the two countries, President Trump's attempt to impose punitive tariffs on China is bound to face formidable opposition from major business interests in the United States. So far, his attempt to 'bring factories home' has not materialised beyond the highly publicised cases of Ford Motors and Carrier Corp. abandoning their plans to set up production plants in Mexico. There is anecdotal evidence that US MNEs are already back to their usual practice of 'going global' after a pause in the immediate aftermath of Trump's election victory (Krugman 2017; Black 2017).

Even if punitive tariffs were eventually imposed, the impact on trade flows within global production networks may not be as damaging as commonly thought. There is evidence that global production sharing considerably weakens the link between relative prices and trade performance, particularly when it comes to trade in components (Swenson 2000; Arndt and Huemer 2007; Burstein et al. 2008; Feenstra 2010; Athukorala and Khan 2016).

Production units of the value chain located in different countries normally specialise in specific tasks, which are not directly substitutable for tasks undertaken elsewhere. Substitutability of components obtained from various sources is, therefore, rather limited. Also, the establishment of overseas production bases and related service links entails high fixed costs, making relative price/cost changes less important in business decision-making.

5. Concluding remarks

This paper has examined the implications of the evolving role of China in East Asia–centred global production networks for regional and global integration of the Chinese economy. Consolidation of its role within Asia-centred global production networks has been the prime mover of China's rapid export growth. The deepening of production bases within global production networks is evident from the notable decline in components imports relative to total processed products exported from China and from its emerging role as a net exporter of components.

China's reliance on its East Asian neighbours for components supply has significantly declined in recent years, reflecting deepening of China's engagement in production networks. China is also emerging as a significant supplier of components within production networks in East Asia and beyond. The shares of components exports to China in total manufacturing exports (to the world) of neighbouring East Asian countries are much smaller than commonly thought. Moreover, in recent years, there has been a notable decline in these shares as the input requirements of final assembly in China are increasingly being met through domestic sourcing.

There has been a notable geographic diversification of final assembly exports from China, but Western countries still account for a sizeable share. The shares of developing countries have generally increased across the board. The degree of China's market penetration in Africa, Latin America and the Caribbean and West Asia (the Middle East) was much sharper, although starting from a low base, than that in East Asia. Therefore, there is no evidence of an East Asia bias in China's evolving export patterns. There is also no evidence that China's rise is reshaping East Asia as a self-contained economic entity with potential for maintaining growth dynamism independent of the developed economies.

The evidence in this paper supports the view that, in a context in which global production sharing is becoming a symbol of economic globalisation, the real story behind the

Sino–US trade gap is much more complicated than what is revealed by standard trade-flow analysis. The widening trade imbalance is basically a structural phenomenon driven by the process of global production sharing and the pivotal role played by China within East Asia–centred global production networks. Initially, China predominantly engaged as the main point of final assembly in Asian production networks, based on its ample supply of labour and moves taken by US firms to supply high-end components from their Asian bases to China. As the production base became more deeply rooted, China's dependence on imported components diminished and China has now become an important supplier of components to the United States and other countries.

The global competitiveness of US MNEs depends on their ability to use China as the production base for supplying the rest of the world. Given this intricate interdependence between the two countries, President Trump's attempt to impose punitive tariffs on China is bound to face formidable opposition from major business interests in the United States. Even if the punitive tariffs were eventually imposed, the impact on trade flows within global production networks may not be as damaging as commonly thought because global production sharing considerably weakens the link between relative prices and trade performance.

Appendix 1: Trade data compilation

Following the seminal paper by Yeats (2001), it has become common practice to use data on parts and components to measure GPN product trade. However, there has been a remarkable expansion of production sharing, from parts and components to also encompass final assembly. Moreover, the relative importance of these two tasks within production networks varies among countries and over time in a given country, making it problematic to use data on the parts and components trade as general indicators of the trends and patterns of GPN product trade over time and across countries. In this study, we define GPN product trade as incorporating both components and final (assembled) goods exchanged within production networks.

The data used in this study, for all countries except Taiwan, are compiled from the UN Comtrade database. The data for Taiwan (a country not covered in the UN trade data reporting system) come from the database of the Council of Economic Planning and

Development, Taipei. The data are compiled at the five-digit level of the SITC, based on SITC Revision 3.

Parts and components are delineated from the reported trade data using a list compiled by mapping parts and components in the intermediate products subcategory of the UN Broad Economic Classification (BEC) with the SITC.[8] It is important to note that parts and components, as defined here, are only a subset of intermediate goods, even though the two terms have been widely used interchangeably in the recent literature on global production sharing. Parts and components—unlike standard intermediate inputs such as iron, steel, industrial chemicals and coal—are 'relationship-specific' intermediate inputs; in most cases, they do not have reference prices are more demanding of the contractual environment (Hummels 2002; Nunn 2007). Most (if not all) parts and components also do not have a 'commercial life' of their own unless they are embodied in a final product.

There is no hard and fast rule for delineating final goods assembled within global production networks from the standard trade data. The only practical way of doing this is to focus on the specific product categories in which GPN product trade is heavily concentrated. Once these product categories are identified, approximate trade in final assembly can be estimated as the difference between parts and components, which are directly identified based on our list, and the total trade of these product categories.

Guided by the available literature on production sharing, we identified 14 product categories: power-generating machinery (SITC 71), specialised industrial machines (SITC 72), metal-working machines (SITC 73), general industrial machinery (SITC 74), office machines and automatic data-processing machines (SITC 75), telecommunications and sound recording equipment (SITC 76), electrical machinery (SITC 77), road vehicles (SITC 78), other transport equipment (SITC 79), travel goods (SITC 83), apparel and clothing accessories (SITC 84), footwear and sport goods (SITC 85), professional and scientific equipment (SITC 87) and photographic apparatus (SITC 88). It is reasonable to assume that these categories contain virtually no products produced from start to finish in a given country. Of these, SITC 83, SITC 84 and SITC 85 can be classified as products predominantly traded within buyer-driven production networks, with the rest belonging to producer-driven production networks. The difference between the value of total exports of these categories and the value of total parts and components falling under these categories was treated as the

[8] The lists are available from the author on request.

value of final assembly. Admittedly, however, the estimates based on this list do not provide full coverage of final assembly in global trade. For instance, outsourcing of final assembly does take place in various miscellaneous product categories, such as clothing, furniture, sporting goods and leather products. It is not possible to meaningfully delineate parts and components and assembled goods in reported trade in these product categories because they contain a significant (yet unknown) share of horizontal trade.

A number of recent studies have analysed trade patterns using 'value-added' trade data derived by combining the standard trade data with national input–output tables (Johnson 2014 provides a survey). The underlying rationale is that, in a context of rapidly expanding cross-border trade in components driven by global production sharing, the standard (gross) trade data (trade data based on customs records) tend to give a distorted picture of the bilateral trade imbalances of a given country and the geographic profile of its global trade linkages (Lamy 2013). This approach is, however, not relevant for the present study, which aims to examine patterns and determinants of global production sharing. The pertinent approach is to analyse data on the reported (gross) exports, separated into parts and components and final assembly. Trade and industry policies have the potential to influence only a country's engagement in a given slice of the value chain; domestic value adding evolves over time as the country becomes integrated into the value chain.

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