INTRODUCTION

The US trade deficit with China has increased tremendously since China entered the World Trade Organization (WTO); in 2018, it surged to $420 billion, about half of the total US trade deficit in goods. The persistent and huge trade deficit triggered an ongoing trade war between the two largest economies in the world. That trade war poses a great risk to the economies of the two countries and to the world economy as well. President Trump has repeatedly complained that US trade with China was unfair, blaming the unfair practices of the Chinese government for the trade deficit and urging China to reduce tariff and non-tariff barriers to allow American companies easy access to the Chinese market (White House, 2018; Lee and Osgood, this volume, Chapter 9). There is no doubt that China’s tariff and non-tariff barriers hinder the access of American goods to the Chinese market and undermine US exports to China – and subsequently increase the bilateral trade imbalance. Before the trade war began, Chinese tariffs averaged 10 percent, much higher than 2.74 percent for US tariffs (World Bank, 2019).

Mainstream economists tend to downplay the role of trade barriers and ascribe the burgeoning US trade deficit to the low US household savings rate (Frankel, 2009). Former Federal Reserve chairman Bernanke (2005) suggested that the US trade deficit was a natural consequence of a “savings glut,” i.e., excess savings accumulated by major trading partners of the US, including China. It is true that the high consumption propensity associated with the low savings rate has been driving the robust American consumer demand for “Made in China” products, and hence contributing significantly to the trade deficit. However, if we examine the channels by which Chinese firms exported their products to the US, and the tasks those firms performed in the process, it becomes clear that the complexity of the bilateral trade imbalance goes far beyond the simple supply-and-demand relations emphasized by conventional wisdoms.
It is a matter of fact, Chinese exporters have been integrated into global value chains (GVCs), which are managed and operated by multinational enterprises (MNEs) in developed nations including the US. To a large extent, the rapid expansion of Chinese exports in the US market is a result of the development of GVCs in the last three decades. Trade along GVCs, commonly referred as value chain trade (Baldwin, 2016), is more sophisticated than the conventional cloth-for-wine trade observed by the British economist David Ricardo two centuries ago. It has transformed trade in goods into trade in tasks (Grossman and Rossi-Hansberg, 2008). In value chain trade, many firms located in a number of nations are involved in the production and delivery of ready-to-use products to consumers in international markets. Each firm specializes in one or more tasks according to its comparative advantage. Value chain trade represents a new division of labor for production of the same good, not the traditional division of labor over different goods. In the age of GVCs, bilateral trade between two countries, e.g., China and the US, is actually multilateral trade, as one country needs to import substantial amounts of intermediate goods from third countries in order to produce exports. The triangle trade pattern in Asia, where China assembles parts and components imported from Japan, Korean and other Asian countries, and the US is a destination market for the assembled products, illustrates clearly how the bilateral trade between the US and China has evolved into multilateral trade between the US and Asian economies (Xing, 2012).

In general, exports via GVCs contain a substantial portion of foreign inputs, and their gross value consists of both domestic and foreign value-added. Conventional trade statistics, nevertheless, implicitly assume that the whole of the gross value of exports belongs to the exporting nation, and thus tend to exaggerate an exporting country’s export capacity, and as a result distort bilateral trade balances. This is particularly true for China, because it has become the global center for assembly of manufactured products since it opened its doors four decades ago. According to UIBE-GVC Indicators, a database constructed by the University of International Business and Economics (UIBE), on average the foreign value-added embedded in Chinese exports to the US is $339 for every $1,000 in 2015. Moreover, with the development of GVCs, many MNEs, such as Apple and Nike, have evolved into factory-less manufacturers. They do not own production facilities; rather they outsource the production of their products to contract manufacturers, most of which are located in China and other developing nations. These factory-less manufacturers derive revenues from their intellectual property and services, such as design, brand and patented technology, which are embedded in the products made by contract manufacturers. Factory-less manufacturers generally capture the largest share of the value-added of the products sold in international markets, because of their monopoly over the intellectual property. Conventional trade statistics, however, are not able to track the value-added captured by factory-less manufacturers in foreign markets, despite the fact that
foreign consumers pay for the value-added whenever they purchase the products of these factory-less manufacturers. As a result, current trade statistics underestimate the exports of the countries that are the homes of factory-less manufacturers (Xing, 2020a).

The complexity of value chain trade and deficiencies in conventional trade statistics call for a new approach to analyzing the roots of, and finding solutions to, the bilateral trade imbalance between the US and China. This chapter examines from the GVC perspective the successful penetration of Chinese products into the US and identifies the origins of the sustained bilateral trade imbalance. It shows that on the one hand, conventional trade statistics exaggerate China’s trade surplus with the US, while on the other hand, they underestimate US exports to China. The trade deficit of the US with China, calculated with conventional trade statistics, is seriously distorted and inconsistent with the reality of value chain trade. Analysis suggests that adopting a new system of trade statistics compatible with value chain trade is critical for proper evaluation of the bilateral trade balance and mitigation of trade frictions.

GVCs provide a special channel for firms in developing countries to enter global markets. Participation in GVCs has greatly promoted the growth of Chinese exports to the US. However, the GVC strategy is not risk-free. As Solingen (in this volume, Chapter 1) points out, the favorable environment for the blossoming of GVCs has deteriorated and GVCs may be at the threshold of a new era, where various shocks such as the trade war and the Covid-19 pandemic will affect the future trajectory. The US–China trade war exposes the vulnerability resulting from China’s dependence on value chain trade. Currently, $250 billion in Chinese goods are subject to the punitive 25 percent tariff levied by the Trump administration. To evade the tariff, many MNEs have begun reorganizing their GVCs, moving their factories out of China or searching for alternative outsourcing partners in third countries. That reorganization of existing value chains unambiguously undercut China’s export capacity, which is even more damaging than the direct cost effect of the tariffs. Currency depreciation can function as an effective tool to counterbalance tariff hikes in the classic Ricardian trade. On the other hand, in value chain trade, the foreign value-added embedded in exports reduces the effectiveness of currency depreciation. Section E of this chapter employs simulation results to demonstrate the difficulty of using yuan devaluation to hedge the risk of the punitive tariffs, and analyze the impact of the trade war on China-centered GVCs.

A. GVCs: A Special Channel for Chinese Exports to Enter the US Market

In 2001, when China was officially accepted by the WTO, it exported $102.3 billion in goods to the US, and its trade surplus with the US amounted to $83.1 billion, about one-fifth of the total US trade deficit. By 2018, in less than
twenty years, China’s exports to the US increased more than fivefold, surging to $539.7 billion. The corresponding trade surplus rose to $420 billion, equivalent to almost half of the US trade deficit (US Census Bureau, 2019a). Not only did trade volume rise dramatically, but also the range and sophistication of Chinese exports to the US expanded substantially. Those exports included not only labor-intensive products such as shoes, T-shirts, toys and furniture, but also high-tech products including smartphones, laptops, tablets and digital cameras. It is noteworthy that in 2018 the US, the undisputed world leader in science and technology, had a $134.6 billion trade deficit with China in advanced technology products (ATPs), including biotechnology, information and communication technology (ICT), electronics, aerospace and advanced materials – all products representing the cutting-edge technology of the twenty-first century (US Census Bureau, 2019b).

Why are products manufactured in China so competitive in the US market? What are the major forces driving the rapid expansion and diversification of Chinese exports to the US? Most studies of China’s export miracle emphasize the importance of China’s comparative advantage in cheap labor, inflows of foreign direct investment (FDI), China’s WTO membership, the domestic institution reforms, and the exchange rate regime of pegging to the US dollar (e.g., Adams et al., 2006; Branstetter and Lardy, 2006; Prasad, 2009; Whalley and Xin, 2010; Lee and Osgood, this volume, Chapter 9). These studies focus mainly on costs of exports as well as barriers to international trade, and ignore organizational changes in modern international trade, specifically the role of GVCs. For instance, without the “Nike” brand on its sports shoes, could China export the same volume of those shoes to the US? Why do Apple’s innovation activities always enhance China’s exports to the US? The spillover effects of foreign brands and MNEs’ technology innovation on the growth of China’s exports to the US appear unrelated to China’s comparative advantage in cheap labor, the undervalued Chinese yuan, or trade liberalization.

To a large extent, the successful penetration of Chinese exports into the US market has been facilitated by GVCs, where Chinese firms perform production tasks such as assembly while GVC lead firms are responsible for product design, research and development (R&D), distribution and marketing. A typical GVC orchestrates a series of tasks necessary for the delivery of a product. Ranging from conception to delivery to end consumers, these tasks include R&D, product design, manufacture of parts and components, assembly and distribution (Gereffi and Fernandez-Stark, 2011). Firms in different countries work in coordination to complete those tasks. Each firm specializes in one or more tasks in which it has comparative advantage, and contributes to the value-added of the final product. Depending on their governance structure, GVCs can be classified as producer-driven and buyer-driven value chains. GVCs led by technology leaders in capital-intensive industries such as the automobile, aircraft, computer and semiconductor are producer-driven value chains. On the other hand, buyer-driven chains are typically organized by large retailers,
branded marketers, and branded manufacturers (Gereffi, 1999). The automobile value chains organized by Japanese auto-maker Toyota and the iPhone value chain of Apple are producer-driven value chains. Similarly, Walmart, taking advantage of its extensive retail networks in the US and other countries, has built its buyer-driven GVC by sourcing all goods from contract manufacturers.

GVCs function as a special channel for Chinese goods to surmount various barriers and enter the US market. Schmitz (2007) pointed out that firms in developing countries face both a marketing gap and a technology gap, and that overcoming those deficiencies is very challenging in global markets. Kaplinsky (2000) observed that intangible assets such as brands and global distribution networks have turned into major hurdles for firms in developing countries, which are striving to take part in the world market. Firms selling products in foreign markets face a variety of fixed costs, such as establishment of distribution channels, acquisition of an understanding of foreign regulations and consumer preferences, and production of commercials for product promotion. Those fixed costs generally hinder firms from exporting their products to international markets. Melitz (2003) argued that, because of those fixed costs, only more productive firms can enter international markets, while less productive firms are restricted to domestic markets. Melitz’s model implicitly assumes that when a firm exports its product abroad, it is responsible for all tasks from production until final retailing. This assumption is no longer true in the age of GVCs. Participating in GVCs governed by MNEs with internationally recognized brands, advanced technology, or global distribution networks can help firms in developing countries circumvent a variety of obstacles.

GVCs are generally organized and directed by MNEs, which control internationally recognized brands, advanced technology and worldwide distribution networks. Lead firms of GVCs usually specialize in high value-added tasks such as R&D, marketing and retailing, and outsource low value-added tasks such as assembly, testing and the production of parts and components to contract manufacturers. MNEs decide technical parameters, prices, and markets of products. This division of labor along the same product chain eliminates the need for contract manufacturers to invest in brands, establish global distribution networks and employ expensive commercials to promote products worldwide. In short, participating in GVCs enables firms to elude obstacles to selling products in international markets.

Xing (2016) identifies three spillover effects of GVCs that facilitated Chinese exports to high-income countries. One of the spillover effects is related to brands owned by GVC lead firms: by plugging into buyer-driven value chains as original equipment manufacturers or designated suppliers, Chinese firms can sell their products under internationally recognized brands, the labels of which definitely strengthen the competitiveness of “Made in China” products in the US market and enhance their appeal to American consumers. The preferences of brand-oriented American consumers translate automatically into demand for
“Made in China” products, thus stimulating Chinese exports to the US. For instance, the passion of American youngsters for trendy Nike shoes always boosts the exports of Nike’s contract manufacturers in China. The spillover effect of brands has significantly narrowed the marketing gap faced by Chinese exports.

The second spillover effect comes from technology innovations by GVC lead firms. According to UNCTAD (2014), ICT has surpassed motor vehicles and agriculture commodities and is now the largest group of traded goods in the world economy. MNEs in developed countries, such as Intel, Microsoft, Google and Qualcomm, have monopolized the intellectual property in ICT. Chinese firms, constrained by their limited technology capacity, find it difficult to market products with indigenous technology and to compete with incumbent foreign technology leaders, in either domestic or foreign markets. On the other hand, the production of any high-technology products requires both high value-added components and low value-added parts and services. By participating in producer-driven value chains, for example the value chain of the iPhone, and specializing in low value-added tasks (e.g., assembly), Chinese firms are able to join the value creation processes of high-technology products and benefit from the fast-growing demand for these products worldwide – an increase in the demand for high-technology products always implies a rising demand for the low value-added services provided by Chinese firms involved in value chains. China’s success in exporting high-technology products such as smartphones and laptop computers is a result of the spillover effect associated with technology innovations of GVC lead firms. In 2012, when few foreign consumers had heard of Xiaomi, OPPO or vivo, China exported one billion mobile phones, about 87 percent of the total Chinese mobile phone output, making China the largest exporter in the world. That achievement has little to do with China’s indigenous technology advancement; rather, it is mainly due to the fact that China was the assembly center for major global smartphone vendors, including Apple and Samsung. The technology spillover effect helped Chinese firms to bridge the technology gap and enjoy the explosive growth of global demand for mobile phones.

The third spillover effect of GVCs is related to distribution and retail networks. Building a global distribution network is very costly. Firms in developing countries also face difficulty in asking foreign distributors to carry their products, due to concerns about quality, technology, and fashion. In both buyer- and producer-driven value chains, lead firms own global distribution and retail networks which are used to market products supplied by contract manufacturers. For instance, global fashion retailers H&M, ZARA and UNIQLO have established extensive retail networks worldwide; Apple owns Apple Stores in every corner of the globe; and the Walmart has more than 4,000 outlets in the US. These firms outsource products from thousands of Chinese suppliers, who do not invest in distribution networks in the US and need not be concerned about where and how their products will be sold. The
distribution and retail networks of GVC lead firms eliminate the marketing gap and create a bridge to American consumers for “Made in China” products. In a nutshell, the three spillover effects discussed above originated from brand, technology and distribution networks; they have paved the way for Chinese goods to enter the US market and have contributed significantly to the rapid growth of Chinese exports. In addition to low costs, the three spillover effects of GVCs are key drivers of the expansion of Chinese goods in the US market. The operational coordination between lead firms and their support network implies that the successful penetration of “Made in China” is a result of the cooperation between Chinese firms and GVC lead firms, most of which are American MNEs. This is a fundamental difference between value chain trade and the classic Ricardian trade.

B. SOME STYLIZED FACTS OF THE VALUE CHAIN TRADE BETWEEN CHINA AND THE US

In this section, we discuss a few stylized facts to demonstrate the dependence of Chinese exports on GVCs. These facts refer to particular products and industries and intuitively illustrate the importance of GVCs in the bilateral trade between China and the US. Figure 2.1 shows China’s iPhone exports to the US in 2009 and 2015. The iPhone, a revolutionary invention of American company Apple, definitely belongs to the high-technology product category. The fact that a developing country, China, exports iPhones to the US contradicts the Ricardian comparative advantage theory. The pattern of iPhone trade can only be explained by value chain trade, where China performs assembly tasks. China’s export of iPhones to the US and other countries is not the result of its technology superiority but of its participation in the Apple value chain. iPhone exports are 100 percent value chain trade. In 2009, China exported 11.3 million iPhones valued at $2.02 billion to the US; in 2015 the number rose to 31.85 million units worth about $7.52 billion (Figure 2.1). In the six years, China’s iPhone exports to the US increased more than three times in

**FIGURE 2.1** China’s iPhone exports to the US (USD billions).

*Source:* Xing and Detert (2010) and the author’s estimates based on the teardown data of the iPhone 6 by HIS and “iPhone Sales statistics” by Finder.com.
terms of both volume and monetary value. On the other hand, during the same period, the average wage of Chinese workers rose from 32,736 yuan to 63,242, almost a 100 percent increase, while the Chinese yuan appreciated against the US dollar, from 6.83 yuan/dollar to 6.23 yuan/dollar, implying an 8.8 percent nominal appreciation. Measured in US dollars, the production cost in China increased substantially and China’s comparative advantage in labor-intensive tasks deteriorated. Therefore, the dramatic increase in iPhone exports cannot be attributed to any China-specific factors; it is the result of Apple’s innovation and marketing activities, which increased demand among American consumers. The spillover effects of Apple’s brand and technology innovations raised China’s iPhone exports to the US and eventually contributed to the widening of the China–US bilateral trade imbalance.

The iPhone is just one Chinese product among thousands imported by the US. The following is an extension of the discussion to the category of high-technology products. To date, China remains a developing country despite its rapid economic growth over more than four decades. China’s GDP per capita in 2018 was $9,600, less than one-fifth of that of the US. US companies still lead in most technology frontiers. For instance, in the smartphone sector, American companies Google and Apple own the two most popular operating systems, Android and iOS. All Chinese smartphone makers, including Huawei, OPPO and Xiaomi, depend on Qualcomm chipsets (World Bank, 2019). Microsoft and Intel continue to monopolize the technology platforms of personal computers. US investment in R&D far exceeds that of China. However, trade statistics show that the US has a huge trade deficit with China in ATPs. In 2018, the US deficit with China in ATPs amounted to $134.6 billion, about one-third of the total US trade deficit with China. The huge US trade deficit in ATPs, in which the US is supposed to have both absolute and comparative advantage, can only be explained by the involvement of Chinese firms in GVCs of ATPs. A breakdown of US imports in high-tech goods from China reveals that most the high-technology imports are in the category of ICT, including laptops, mobile phones, digital cameras and hand-held tablets. In 2018, the US imported $157.1 billion Chinese ICT goods, accounting for 90 percent of its high-technology imports from China (Figure 2.2).

It is well known that the production of ready-to-use ICT products is organized along value chains, where China is the center for assembly of parts and components supplied by other countries, such as Japan, the US, Germany and Korea. That is why as early as 2007, China surpassed the US, Japan, and the 27 EU countries and emerged as the largest high-tech exporter in the world (Meri, 2009). Xing (2014) shows that 80 percent of Chinese high-technology exports are processing exports, made of imported parts and components, and suggests that Chinese high-technology exports should be called “assembled high-technology.” A teardown of the smartphones made and/or assembled in China shows that most of the parts, in particular core technology components, are produced by foreign firms (Xing and He, 2018).
A recent exercise by a Japanese consulting firm reveals that the Huawei P30 Pro, the latest smartphone model by Huawei, the most innovative Chinese telecommunication equipment maker, contains 869 parts made by Japanese companies, 562 by Korean companies, 15 by American companies and only 80 supplied by Chinese domestic companies. The domestic value-added of the Huawei P30 Pro is less than 40 percent, indicating the high dependence of the Huawei P30 Pro on foreign technology. Chinese firms’ ICT production organization and the tasks performed by those firms indicate that the success of China’s high-technology exports to the US is primarily attributable to Chinese integration with GVCs. Chinese firms have been riding on the back of GVCs to penetrate the US market and they have benefited tremendously from the previously mentioned three GVC spillover effects.

High-technology goods account for about one-third of US imports from China. Here we expand the coverage of our analysis to include processing exports, a broader category than high-technology goods. Chinese exports to the US can be classified into two large categories: ordinary exports and processing exports. The former are mainly produced with domestically produced intermediate inputs while the latter are primarily made with imported materials. The Chinese customs office has compiled a special category of statistics: processing trade, which consists of processing imports and processing exports. By definition, processing trade is a subset of GVC activities: it can serve as a direct measure of value chain trade.

Processing trade plays a critical role in China’s exports to the US. Figure 2.3 shows the intensity of process exports as a share of China’s total exports to the US from 1993 to 2013. During that period, processing exports consistently accounted for more than half of Chinese exports to the US. Before the global financial crisis, process exports constituted more than
60 percent of China’s total exports to the US; at the peak in 1996, 72 percent. The share of processing exports has declined substantially in recent years. This does not necessarily mean that the dependence of Chinese exports on value chains has weakened. After the high growth of more than four decades, Chinese firms have narrowed technology gaps and developed massive production capacity. They have used more and more domestically produced intermediates to substitute for imported materials. In labor-intensive products such as shoes, apparel and toys, almost all intermediate inputs are made in China – one of the reasons that the share of processing exports fell gradually. However, as long as Chinese firms continue to function as contract manufacturers and rely on brands and distribution networks of GVC lead firms, their exports remain part of value chain trade.

C. GVCs AND THE STATISTICAL DISTORTION OF
THE US–CHINA TRADE IMBALANCE

1 Exaggerated Chinese Trade Surplus with the US

Since most of China’s exports to the US are produced and marketed via value chains and contain a large portion of imported intermediates, conventional
trade statistics are no longer viable for assessment of bilateral trade balances. Conventional trade statistics implicitly assume that the whole value-added of Chinese exports is created in China, regardless of whether imported intermediates are used in the exports or not; this greatly exaggerates China’s export capacity and its trade surplus with the US. Xing and Detert (2010) examined the case of the iPhone 3G and showed that the estimate of the US trade deficit with China in the iPhone trade was 90 percent higher than the real case. China contributed a mere $6.5 value-added to the production of an iPhone 3G, but the trade statistics valued China’s input at $179 – most of which was the value-added from Japan, Korea, and Germany. Xing and Detert argued that value-added, not gross value of exports, should be used as the measure of bilateral trade balance.

Since the launch of the first-generation iPhone in 2007, Apple has rolled out more than twelve generations of the iPhone. More and more Chinese firms have become involved in the iPhone value chain, performing relatively sophisticated tasks (Grimes and Sun, 2016). For a clear understanding of the US–China trade balance, it is important to determine whether the iPhone remains an important source of distortion in assessments of the US–China bilateral trade balance. Following the approach of Xing and Detert (2010), Xing (2020b) examines the case of the iPhone X in a comparison between the trade balance calculated as value-added and that as gross value.

According to Xing (2020b), the teardown data of the iPhone X show that the total bill for the phone materials is $409.25, of which the US contributed 18.7 percent, Korea 25.8 percent, and Japan 19.3 percent, while ten indigenous Chinese firms and Foxconn together contributed a total of 25.4 percent, about $104 (Figure 2.4). Chinese value-added for the iPhone X is higher than that for the iPhone 3G, since more Chinese firms are participating in the value chain of the iPhone X and performing more skilled tasks beyond simple assembly. For instance, Sunwoda, a leading Chinese battery maker, supplied the battery pack, and Kersen Technology provided the stainless frame.

When China ships one iPhone X to the US, the current system of trade statistics calculates that as a $409.25 export to the US. Traditionally we subtract the value of the parts imported from the US, and derive that the import of an iPhone X constitutes a $332.75 trade deficit for the US. However, as the teardown data reveal, Korea, Japan and other countries are also involved in the production of the iPhone, supplying more than 45 percent of the parts and components, so using $332.75 as a proxy for the US iPhone trade deficit with China is clearly an exaggeration of the bilateral trade balance; that figure is actually the trade deficit between the US and all other countries involved in the value chain. The case of the iPhone X illustrates how bilateral trade evolves into multinational trade in the age of GVCs. In terms of value-added, the US deficit with China for importing one iPhone X is only $104, less than one-third of the figure based on gross value. That distortion of conventional trade statistics regarding the bilateral trade imbalance is too large to be ignored.
The iPhone case convincingly demonstrates that conventional trade statistics significantly inflate China’s trade imbalance with the US. It is shown above that value-added is a better tool than gross value trade for evaluation of the bilateral trade balance. However, the iPhone X is an extreme case and cannot be taken as a general proxy for Chinese exports to the US. Many economists employ international input–output tables, which trace country origins of intermediates, to estimate the US–China trade deficit in value-added. Koopman, Wang, and Wei (2014) demonstrated theoretically how the value-added of gross exports of individual countries could be traced with input–output tables. Johnson and Noguera (2012) adopted the same approach and concluded that the 2004 US–China trade imbalance would be 30–40 percent smaller if it were measured in value-added. The Organisation for Economic Co-operation and Development (OECD) and WTO constructed a database of trade in value-added (TiVA) for estimating value-added in the gross exports of more than sixty countries (OECD and WTO, 2013). Here I use UIBE-GVC Indicators to calculate China’s overall trade surplus with the US in value-added as well as in computers, electronics and opticals (the largest group of Chinese exports to the US). China’s overall 2015 trade surplus with the US, calculated as value-added, was 56 percent of that calculated as gross value, and the trade surplus measured in value-added for computer, electronics and opticals was 41 percent of that calculated as gross value.

2 Underestimated US Exports to China

The exaggeration of China’s trade surplus with the US reflects one dimension of statistical distortion on the US–China trade balance. Current trade statistics
also underestimate US exports substantially. Many American MNEs have
developed GVCs for their products and optimally allocate tasks (ranging from
product design to R&D to manufacturing and marketing) along value chains.
Those MNEs concentrate primarily on brand marketing, product design and
technological innovation, and generally outsource manufacturing and assembly
tasks to foreign companies. This emergent international division of labor along
GVCs has transformed many American MNEs into factory-less manufacturers.
Bayard, Byrne, and Smith (2015) reported that in 2012, twenty-one of the
companies listed in the Standard and Poor’s 500 Index, including Advanced
Micro Device, Qualcomm Inc., Cisco System, Apple, and Nike, were exclu-
sively engaged in factory-less manufacturing. These factory-less MNEs no
longer manufacture any physical goods, but sell consumers the value-added
of their intellectual property and services, which is embedded in products
assembled or manufactured by contract manufacturers.

When factory-less American MNCs employ contract manufacturers located
outside of the US to produce or assemble their products, such as Nike shoes,
Gap clothes and iPhones, and then sell their products in international markets,
those “American goods” are not counted as part of “US exports,” because they
are not exported from the US but from foreign countries, typically China,
Indonesia, Vietnam and other developing countries. From each of those trans-
actions, factory-less American MNCs obtain the value-added attributed to their
brands, patented technologies and services, which generally constitutes a very
large share of the whole value-added of those products. For instance, the gross
profit margin of Nike products is 46 percent (Nike, 2015), though foreign
consumers purchasing the products pay not only for production costs but also
for the value-added of the intellectual property and services embedded in the
products. In terms of income generation, the export of the value-added of
intangible assets and services has the same function as the export of physical
goods, such as grain and cars. Current trade statistics, however, cannot record
the earnings of factory-less American manufacturers from abroad, because
(1) their products sold to foreign consumers do not cross US borders, and
(2) the value-added of intellectual property and services is embedded in physical
goods rather than sold separately, like royalty or license fees. Current statistics
underestimate US exports.

The iPhone X case can also be used to make the point. A Chinese consumer
buying an iPhone X pays $1,000 to Apple, of which $590.75 is the payment for
Apple’s brand, operating system, unique design, and the retail service of the
Apple Store. The $590.75 actually represents the sale of Apple’s service related
to its intellectual property to the Chinese consumer. The transaction, however is
not recorded as a US export to China. Chinese consumers’ passion for trendy
Apple products has turned China into Apple’s largest foreign market. Apple’s
sales in China grew dramatically, from USD 25.9 billion in 2013 to USD
56.5 billion in 2015 – more than 100 percent growth over two years (Apple,
2015). No matter how much Chinese consumers spend on Apple’s products, it
does not add one cent to US exports to China. This strange phenomenon reflects the failure of trade statistics to accurately measure the activities of value chain trade. Xing (2020a) estimated that in 2015, Apple garnered USD 19.2 billion in value-added from sales of iPhones, iPads, and iMacs in China. If that value-added were included in US exports to China, US exports to China would be 16.6 percent greater, and the corresponding deficit would decrease by 5.2 percent (Table 2.1). Recognizing the value-added of Apple as part of US exports would narrow the trade gap between the US and China and mitigate the remarkable bilateral trade imbalance. It is noteworthy that that potential revaluation is related to just one factory-less American company, namely, Apple. Many American factory-less MNEs, such as Nike, AMD and CISCO, operate in the same fashion as Apple. If all the value-added of their intellectual property and services were recorded as part of US exports to China, China–US trade would be more balanced than it appears in current trade statistics. Therefore, current trade statistics, which only measure the value of goods crossing national borders, are inconsistent with the present situation of GVC-dominated trade: a substantial portion of US exports is not included in current trade statistics. Actual exports of American companies are underestimated, and at the same time, the US trade deficit is exaggerated. To correctly assess the export capacity of the US economy and the sustainability of the US trade deficit, it is imperative to make the appropriate adjustments to current trade statistics. The value-added approach should be adopted for measurement of bilateral trade balances, and value-added obtained by American factory-less manufactures from abroad should be counted as part of US exports.

### Table 2.1 Apple’s sales in and US trade with China (USD billions)

<table>
<thead>
<tr>
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<th>2015</th>
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<tbody>
<tr>
<td>US exports</td>
<td>115.9</td>
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<tr>
<td>US trade deficit</td>
<td>367.3</td>
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<tr>
<td>Apple sales</td>
<td>56.5</td>
</tr>
<tr>
<td>Apple value-added</td>
<td>19.2</td>
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<tr>
<td>Apple value-added/US exports (%)</td>
<td>16.6</td>
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<tr>
<td>Apple value-added/US trade deficit (%)</td>
<td>5.2</td>
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</table>

*Source: Xing (2020a)*

D. THE US–CHINA TRADE WAR AND THE VULNERABILITY OF CHINA-CENTRED GVCs

Taking advantage of GVC spillover effects, Chinese firms have bypassed technology and marketing gaps and gained easy access to the US market. That strategy has been very successful and contributed tremendously to the explosive
expansion of “Made in China” products in the market, but it is not risk-free. In value chains, Chinese firms are obliged to follow the lead firms. They mainly perform tasks related to production stages, and passively receive orders about what and how much to produce. They have no power to decide where their products are sold. Their relations with lead firms are asymmetric. That arrangement frees Chinese firms of the risks associated with R&D, brand development and marketing; this is an advantage of participating in GVCs. On the other hand, when lead firms decide to search for alternative suppliers or redeploy their value chains because of product cost concerns, political instability or other considerations, Chinese firms face the danger of losing their GVC membership. The ongoing US–China trade confrontation clearly demonstrates the fragility of value chain trade.

President Trump used tariffs to wage a trade war with China. He believed that tariffs are the most powerful and effective weapon and could force the Chinese government to sign a trade deal on US terms. Now, a 25 percent punitive tariff has been levied on $250 billion of Chinese goods. Lee and Osgood (this volume, Chapter 9) detail the timeline of the trade war. It is almost impossible for American importers to absorb the 25 percent tariff without suffering a huge loss of profits. In the classic Ricardian trade, Chinese exporters could opt to improve productivity, lower production costs or hope for a devaluation of the Chinese yuan to offset the negative impact of the punitive tariffs. In value chain trade, these approaches are not as effective as was suggested in economics textbooks, the problem being foreign value embedded in Chinese exports.

Take the devaluation of the yuan as an example. The exchange rate between the yuan and the US dollar was 6.2 yuan/dollar when the trade war started in March of 2018. It rose to 7.03 yuan/dollar at the beginning of August 2019 – a 13.4 percent depreciation of the yuan against the dollar. That significant depreciation is not in line with China’s policy of maintaining the stability of yuan exchange rates. It was speculated that the Chinese government used the depreciation as a defense against US tariff attacks. Whether the depreciation of the yuan would be an effective tool for hedging the risk of punitive tariffs largely depends on the level of foreign value-added embedded in Chinese exports. Xing (2020b) simulated different scenarios of yuan depreciation levels required to completely offset the negative impact of tariffs. The simulation results suggest that (1) the required yuan depreciation is higher than the corresponding tariff; (2) it rises rapidly as foreign value-added increases; and (3) after the foreign value-added exceeds a certain threshold, the required yuan depreciation surges to an impossible level. In the case of a 25 percent depreciation, the yuan would have to depreciate by 28.6 percent to offset the tariff if the foreign value-added accounts for 10 percent of gross Chinese exports; a 50 percent depreciation would be needed if the foreign value-added increased to 40 percent. As mentioned before, Chinese exports to the US carry an average of 33.9 percent foreign value-added. The simulation suggests that on average a 43.4 percent
depreciation of the yuan would be required to completely offset the negative impact of the 25 percent punitive tariff. Clearly China could not counterbalance a 25 percent punitive tariff by means of yuan depreciation without causing economic turmoil. In other words, it would be impossible for China to use depreciation of the yuan to hedge the risk of the tariffs.

Conventional approaches to evading punitive tariffs are not realistic; one feasible option is to shift part of each value chain out of China. It is highly likely that lead firms will relocate production facilities out of China or search for alternative sourcing partners and/or contract manufacturers in third countries, thus reshaping the China-centered GVCs geographically. Aanstoos (this volume, Chapter 6) suggests that the uncertainty of the trade war and pessimism about US–China relations would also induce the redeployment of manufacturing value chains out of China. Hence, Chinese contract manufacturers face the risk of being replaced by suppliers from other countries. Many buyer-driven GVCs rely on China as a source of supplies: Walmart imports about $50 billion in goods from China annually, about one-tenth of total US imports from China (Scott, 2015). H&M has about 800 suppliers in China and more than 90 percent of UNIQLO contract factories are located there. These lead firms purchase mainly labor-intensive products from China. It is relatively easy for them to find alternative suppliers in other developing countries, such as Vietnam, Bangladesh and Indonesia. The asymmetric power between lead firms and Chinese suppliers implies that the latter have little leverage to resist the reorganization of value chains. The ongoing trade war has been undermining China’s exports to the US, and, more important, will permanently undercut China’s export capacity.

In a survey by the American Chamber of Commerce in China (2019), approximately 40.7 percent of respondents reported that they were considering relocating or had relocated their manufacturing facilities outside China. For those that are moving manufacturing out of China, Southeast Asia (24.7 percent) and Mexico (10.5 percent) are the top destinations. The slogan, “Designed by Apple in California – Assembled in China” is printed on the back of all Apple products. The trade war also prompted Apple to consider restructuring its China-centered value chains: Apple asked its major suppliers to evaluate the cost implications of shifting 15–30 percent of its production capacity from China to Southeast Asia (Li and Cheng, 2019).

Such relocation is not limited to American companies. Many Japanese companies have sped up their China exit in preparation for further escalation of the trade war. Nintendo, which had most of its Switch games assembled in China, started moving production to Vietnam; Sharp considered relocating production of the Dynabook laptop to Vietnam or Taiwan; and Ricoh had shifted production of US-bound multifunction printers to Thailand from China (Sese, 2019). Zhang (this volume, Chapter 3) provides a comprehensive analysis of the impacts of the trade war on Japanese companies. Clearly the trade war is reshaping China-centered value chains. China would lose its status as the
global assembly center for manufacturing, and its export capacity would be permanently damaged. China would no longer play a central role in the GVCs targeting the US market.

On January 15, 2020, the US and China signed the phase one deal, which brought a temporary truce in the trade war. It was expected that the truce might mitigate the uncertainty of the bilateral economic relations between the two nations. Unfortunately, the Covid-19 pandemic, originating in Wuhan, China, unfolds a new risk to the Chinese-centered GVCs, where China has been a major production base for various medical supplies, such as masks, hand sanitizers, ventilators and protective gears for medical staff. In particular, China is the largest exporter to the US of medical devices. Chinese pharmaceutical firms have been a major supplier of active pharmaceutical ingredients and have captured 97 percent of the US market for antibiotics and 90 percent of the market for vitamins (Huang, 2020). The pandemic disrupted the operations of Chinese factories producing these medical supplies, which further exacerbated the shortage of these products, desperately needed for fighting the spread of the coronavirus. The Covid-19 pandemic reveals the danger of relying on GVCs for supplying medical goods, essential for human health. In the future, medical goods may be considered to be as important as food and energy in terms of national security. Reshoring production facilities of masks, sanitizers, ventilators and essential drugs back to home may be a new trend, which would accelerate the pace of the redeployment of value chains out of China, and thus weaken the centrality of China in GVCs.

E. CONCLUDING REMARKS

Most Chinese exports to the US are produced by value chains. The spillover effects of GVCs have helped Chinese goods to overcome technology and marketing gaps and facilitated their penetration into the US market. There is an urgent need for an examination of the US–China bilateral trade balance in the GVC context. I argue that from the GVC point of view, the trade imbalance between the US and China is significantly exaggerated, because (1) China’s exports to the US are inflated by no longer viable trade statistics calculations; and (2) US exports to China are underestimated. Reforming current trade statistics calculations is crucial for an understanding of the roots of the expanding bilateral trade imbalance, and for finding policy solutions to that problem.

In the past, Chinese exports benefitted tremendously from participation in GVCs and took advantage of the brands, technology and global distribution networks of MNEs, including American companies. The ongoing trade war exposes the vulnerability of that strategy. Faced with punitive tariffs, Chinese exporters cannot adopt conventional approaches such as the depreciation of the yuan to mitigate the risk of trade war. Given the asymmetric power structure of GVCs, Chinese firms have little leverage to resist the shifting of
China-centered GVCs. The trade war has been cutting off the linkage of many Chinese contract manufacturers with existing GVCs and will permanently damage China’s export capacity. The unfolding Covid-19 pandemic further exposes the risk of the US’s reliance on China for medical supplies. It is inevitable that the US will raise domestic production of medical supplies and diversify foreign sources of these goods, which will further undermine the importance of China in GVCs.

ACKNOWLEDGEMENTS

This research was funded by a University of California Office of the President grant to Professor Etel Solingen for the project on “The Role of Design and Production Networks in East Asia.” The author is grateful for the comments of Professor Etel Solingen and other participants in the workshop “The Role of Design and Production Networks in East Asia’s International Relations” on September 26–27, 2019, at the University of California San Diego.