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Factoryless Manufacturers and International Trade in the Age of Global Value Chains

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Abstract

The emergence of factoryless manufacturers in the world economy has given rise to a new mode of exporting services of intangible assets by multinational corporations, which has challenged the reliability of conventional trade statistics for the measurement of value chain trade. This study finds that even though Apple, the largest factoryless manufacturer in the world, sells billions of dollars products in the Chinese and Japanese markets, the official trade statistics do not count any of the sales as US exports to those two countries. The same is true for Nike, the largest seller of athletic footwear and apparel in the world. Using a hypothetical case of iPhone trade, the study provides an intuitive illustration of the failure of official trade statistics to record trade in intangible assets by factoryless manufacturers. For an appropriate evaluation of the contribution of factoryless manufacturers to international trade, this study estimates the exports in services of intangible assets by the American factoryless manufacturers, Apple, Nike, AMD, Cisco and Qualcomm. The estimation shows that in 2018 the five companies exported $70.3 billion in intangible asset services, equivalent to 8.2% of US exports in services as reported by official trade statistics. From the perspective of US-China economic relations, in 2018 Apple, Nike, AMD and Qualcomm sold to Chinese customers $27.9 billion services of intangible assets, equal to 48.9% of US service exports to China as reported by official trade statistics. Counting those exports as part of US exports to China would reduce the US trade deficit with the country by 7.3%.

Key words: China, US, GVCs, Exports, Apple

JEL: F1

1. Introduction

Trade along global value chains (GVCs) constitutes a new international division of labor, where lead firms specialize in high-value added tasks such as research and development (R&D), product design, branding, marketing, and retailing, while non-lead firms transform raw materials; manufacture parts and components; and assemble and test final products. As a result of their adoption of GVC strategy, more and more multinational corporations (MNCs), especially those from industrialized nations, have evolved into factoryless centers of product design, technology innovation, brand development, marketing, and retailing. Factoryless manufacturers, also referred as factoryless goods producers, generally have no production facilities, but they own the rights to the intellectual property (IP) or design of the products assembled/made by contract manufacturers. By holding monopolies on intangible assets, factoryless manufacturers control the manufacturing process and retain ownership of their products (Bayard, Byrne and Smith, 2015). Typical factoryless manufacturers include the world's largest consumer electronics maker, Apple; world No.1 athletic shoe maker Nike; fabless semiconductor manufacturer Advanced Micro Device (AMD); Japan's largest fashion producer, Fast Retailing Co.; and Swedish clothing retailer Hennes & Maurita AB. Factoryless manufacturing is also very common in the pharmaceutical industry. A survey of North American and European pharmaceutical companies reveals that a quarter of these companies outsourced all of their production (Coyle and Nguyen, 2020).

The global operations of factoryless manufacturers have not only amplified trade flows of intermediate goods; they have also created a new business model—selling services of intangible assets to international customers via tangible products assembled/made by foreign contract manufacturers. The emergence of factoryless manufacturing has extended the range of traditional exchanges of final goods and primary products between nations, to include trade in services of intangibles; this has significantly strengthened the role of intangible assets in international trade. This new export mode challenges the validity and appropriateness of current trade statistics system for the measurement of value chain trade.

Trade statistics are generally calculated on the basis of the value of goods crossing national borders. If goods are shipped from a country across its borders and declared to its customs, the shipment is recorded as an export from that country, i.e. the physical crossing of a national border is a necessary criterion for including the value of such goods in trade statistics. For instance, the compilation of *International Trade in Goods Statistics in the European Union*

draws primarily on customs records, which basically mirror the physical movement of goods across borders (UNECE, 2015). Crossing home country's borders, however, is no longer necessary for factoryless manufacturers to export their products to international markets, since all of their products are assembled/made by foreign contract manufacturers and shipped to international markets from where those products are produced. In other words, GVC strategy enables factoryless manufacturers to export goods without those goods crossing their home countries' borders. Moreover, since factoryless manufacturers retain ownership of their products assembled by contract manufacturers until the products are sold to end users, when contract manufacturers ship those products to foreign upstream firms, or the end consumers in international markets, they only declare to customs the cost of manufacturing. The value added of intangible assets embedded in those goods is not recorded in the trade statistics of any country even if the goods cross national borders. For example, Foxconn, a major assembler for Apple, declares only the production cost of iPhones to the Chinese customs when it ships them to the US. Therefore, in the era of GCVs, exports of services of intangibles embedded in tangible products manufactured via outsourcing activities of factoryless manufacturers have for the most part been missing from conventional trade statistics.

As more and more MNCs in industrialized countries specialize in the creation of intangible assets and derive most of their income from the sale of the services of those assets, the gains of developed countries from globalization depend more on intangibles than on physical goods. To date, developed countries own most patents and international trademarks. Japan, US and the European countries combined accounted for 82.5% of patents registered in those three countries in 2013 (Durand and Miberg, 2018). It is estimated that in 2019 intangible assets accounted for about 27% of the income of manufacturing GVCs in OECD countries (Alsamawi, et al, 2020). In terms of the trade between developed and developing countries, trade in tasks means the former exchange their services of intangible assets for services of fabrication and assembling by the later. Failing to count trade in services of intangible assets by factoryless manufacturers unambiguously understates the extent to which developed nations benefit from the unprecedented globalization, and more importantly, it distorts the trade balance between the North and the South. The evolution of international trade from the classic cloth-for-wine to trade in tasks requires a fundamental reform of the compilation of trade statistics. It is imperative that trade in services of intangible assets (embedded in physical products assembled/made by foreign contract manufacturers) be included in evaluations of value chain trade and of the contribution of intangibles to the 21st century world economy. Expanding the

content of trade from tangible products to include services of intangible assets via GVCs would provide economists and policy makers with a better understanding of the role of MNCs in the global economy, and would enable them to more accurately assess (a) the benefits of globalization to developed countries and (b) the trade balances between developed and developing countries.

So far, the majority of GVC studies have focused on tasks within the manufacture of tangible intermediates and the assembly of parts into final products. Little attention has been paid to the tasks in which lead firms specialize and the tasks which add value to final tangible products with intangible assets. The OECD TiVA database provides a comprehensive breakdown of country origins of intermediate inputs employed in the manufacture of products, but it does not include the value added associated with intangible assets. A few studies of servicification within GVCs (e.g., Heuser and Mattoo, 2017) narrowly focus on the services embedded in the fabrication and assembly stages of the production process (services such as finance, logistics and transportation, which are essential elements for the production of physical components and final products).

It is important to emphasize here that the mode of exports of intangible assets by factoryless manufacturers differs fundamentally from conventional trade in intangible assets. Traditionally, owners of intangible assets charge licensing fees or royalties through licensing agreements on a variety of intellectual property (IP), including software, patented technologies, trademarks, and designs, but factoryless manufacturers such as Apple and Nike do not license their IP to third parties. Rather, they use their IP to organize and manage their value chains and outsource all fabrication activities to contract manufacturers. They gain returns on their IP by selling tangible products assembled/made by contract manufacturers, who are mostly located in the developing world. It is true that factoryless manufacturers tend to transfer the ownership of their IP to their foreign affiliates for tax purposes—in which case the earnings derived by the affiliates from that IP are booked as part of foreign investment income in current accounts, not as export of IP-related services (Jenniges, et al., 2018). This kind of IP arrangement often leads to the income of intangible assets unobservable in any country's gross domestic product (Haan and Haynes, 2018).

In this paper, I examine the failure of current trade statistics to record trade in intangibles by factoryless manufacturers. I begin with an examination of the official data on Chinese and

Japanese imports of laptop computers and mobile phones from the US, and demonstrate that Apple sales in the two countries are completely missing from the trade data. In the same fashion, I uncover that Nike sales in China are also missing from the country's imports from the US. Then, I analyze a hypothetical case of iPhone X trade to illustrate why conventional trade statistics cannot capture exports of services of intangible assets by factoryless manufacturers. Finally, I estimate the exports of services of intangibles by the American factoryless manufacturers: Apple, Nike, AMD, Cisco and Qualcomm. The estimates show that in 2018 those five companies exported $70.32 billion in services of intangibles via their tangible products assembled/made by foreign contract manufacturers, equivalent to 8.2% of US exports in services reported in official trade statistics. In the Chinese market in 2018, Apple, Nike, AMD and Qualcomm together exported $27.9 billion in services of their intangible assets, equal to 48.9% of US exports in services to China as reported in the official trade statistics for that year. If that $27.9 billion were counted as a US export to China (and I believe it should be), the US trade deficit with China would shrink by 7.3%.

2. Missing exports of American factoryless manufacturers

The most salient example of a factoryless manufacturer is Apple, which manages sophisticated supply chains globally for the production of trendy technology gadgets: iPods, iPhones, iPads, iMacs and Apple Watches. Initially, Apple produced its own computers, but in the 1990s, it sold almost all of its in-house manufacturing facilities to contract manufacturers. To date, "substantially all of the Company's manufacturing is performed in whole or in part by outsourcing partners located primarily in Asia" (Apple, 2018). In 2018, the overseas sales of Apple amounted to US$153.5 billion (Apple, 2018), equivalent to 10.1% of US exports. However, in terms of conventional trade statistics, Apple is not recognized the largest US exporter. Boeing, with $71 billion overseas sales in 2018, less than half of Apple's foreign sales, has for years been regarded as the largest single US exporter. Even in the list of the top 100 US exporters in terms of containerized ocean shipping, compiled by the Journal of Commerce, Apple does not appear.

The passion of Chinese consumers for Apple products has turned China into the largest overseas market for Apple, accounting in 2018 for $51.94 billion in products in the Chinese market. However, if we were to refer to the official data on China's imports and exports, we would conclude that Apple did not even export $1 in products to China. According to the United Nations (UN) Comtrade Database, a repository of official international trade statistics

provided by UN member states, in 2018 China imported $2.58 million from the US in laptop computers, tablets and other portable data processors, as defined in Harmonized System (HS) 847130; it also imported $1.47 million from the US in mobile phones, as defined in HS 851712. Altogether, China imported $4.05 million from the US in laptop computers, mobiles phones and other similar products included in the two HS categories. The definitions of the two categories would place all Apple products in those two groups, i.e. if Apple exports its products to China, those products should be included in the official trade statistics.

Table 1. Does Apple export its products to China?

Year	**A** China's laptop and mobile phone imports from the US (million US dollars)	**B** Apple sales in China （billion US dollars）	**C** Manufacturing cost of Apple products sold in China (billion US dollars)	**B/A** (1,000)	**C/A** (1,000)
2015	1.67	58.72	35.17	35.2	21.1
2016	3.60	48.49	29.53	13.5	8.2
2017	2.98	44.76	27.53	15.0	9.2
2018	4.05	51.94	32.05	12.8	7.9

Source: UNCOMTRADE, Apple form 10-K, and the author's estimates.

Comparing Apple sales in China with the official trade statistics gives rise to a puzzle: does Apple export its products to China? The $51.94 billion in sales of Apple products is more than 12,000 times China's total reported 2018 imports in laptop computers and mobiles from the US. The disparity between the official trade data and the Apple sales figure is too large to be explained by statistical errors or by Apple's extraordinarily high gross margins. The sales figure includes the income Apple derived from its intangible assets and services imbedded in those products—which might contribute to the disparity. Even if we use the manufacturing cost of Apple products sold in China as a basis for comparison, the gap remains huge. It is estimated that the cost of production of Apple products sold in China in 2018 is approximately $32.05 billion, almost 8,000 times the official figure for China's imports from the US in laptop computers and mobile phones that year. Table 1 lists China's imports of laptop computers and

mobile phones from the US for the period 2015–2018, and compares them with Apple's annual sales in the country, along with the corresponding manufacturing cost. The disparity is significant and present in all of the years. In that light, the only possible explanation of the disparity is that the official trade statistics do not at all recognize Apple sales in China as US exports. It is clearly evident that current trade statistics are not capable of recording value chain trade. As a result, a substantial amount of exports by American factoryless manufacturers are "missing" from official trade statistics.

Table 2: Does Apple export its products to Japan?

Year	A Japanese laptop and mobile phone imports from the US (million US dollars)	B Apple sales in Japan (billion US dollars)	C Manufacturing Cost of Apple Products sold in Japan (billion US dollars)	B/A (1,000)	C/A (1,000)
2015	7.30	15.71	9.41	2.2	1.3
2016	8.61	16.93	10.31	2.0	1.2
2017	8.24	17.73	10.91	2.2	1.3
2018	8.69	21.73	13.41	2.5	1.5

Source: UNCOMTRADE, Apple form 10-K, and the author's estimates.

As a matter of fact, Apple's foreign sales are not just missing from the trade statistics tracking the bilateral trade between China and the US. They are also missing from the statistics on US trade with all US trading partners. In the case of Japan, for example, the same phenomenon is clearly visible for the bilateral trade between Japan and the US. UN Comtrade reports that in 2018 Japan imported $8.69 million in laptop computers and mobile phones from the US, defined by HS 847130 and HS 851712. On the other hand, according to the annual report of Apple (2018), its sales in Japan totaled $21.73 billion, 2,500 times the value of Japanese imports from the US in those two HS groups. It is estimated that the total manufacturing cost of Apple products sold in Japan in the year amounted to $13.41 billion, which is more than 1,500 times the value of the Japanese imports reported by UN Comtrade. Table 2 displays Japanese imports in laptop computers and mobile phones from the US from 2015 to 2018, and

compares them with Apple annual sales in Japan, along with the corresponding manufacturing cost. There is an immediately visible, dramatic disparity between the Japanese imports and Apple's sales and cost figures for that period. The Japanese case is another demonstration of the failure of conventional trade statistics to record trade in intangibles via GVCs.

Table 3. Does Nike export its products to China?

Year	A Chinese apparel and footwear imports from the US (million US dollar)	B Nike sales in China (billion US dollar)	C Manufacturing cost of Nike products sold in China (billion US dollar)	B/A	C/A
2015	107.25	3.07	1.66	28.6	15.4
2016	146.35	3.79	2.04	25.7	13.9
2017	119.77	4.24	2.35	35.4	19.6
2018	209.33	5.13	2.89	24.5	13.8

Source: UNCOMTRADE, Nike form 10-K, and the author's estimates.

The missing export phenomenon also exists in the trade of labor intensive goods such as apparel and footwear. According to UN Comtrade Database, in 2018 China imported $209.33 million in apparel and footwear from the US, as defined in HS 62 and HS 64. Comparing this figure with Nike sales in China raises the same question: does Nike export its products to China? China is the largest overseas market for Nike. In 2018, Nike sold $5.19 billion in athletic apparel and footwear to the Chinese consumers, which is almost 25 times larger than China's imports in apparel and footwear from the US in the year. It is estimated that the total manufacturing cost of those Nike products is about $2.89 billion, roughly 14 times larger than the value of the Chinese imports reported by the official trade statistics. The definitions of HS 62 and 64 imply that, Nike products should be classified into the two categories by trade statistics if they were shipped to China from the US. Table 3 displays China's imports in apparel and footwear from the US during the period 2015-2018 along with Nike sales in the Chinese market and the corresponding manufacturing cost. The huge gap between the Chinese imports and the Nike sales existed in all of the years. Nike is the largest seller of athletic footwear and apparel in the world, however, "virtually all Nike products are manufactured by independent contractors. Nearly all footwear and apparel products are produced outside the

United States" (Nike, 2018), which explains why Nike sales in China add nothing to US exports to China from the perspective of conventional trade statistics.

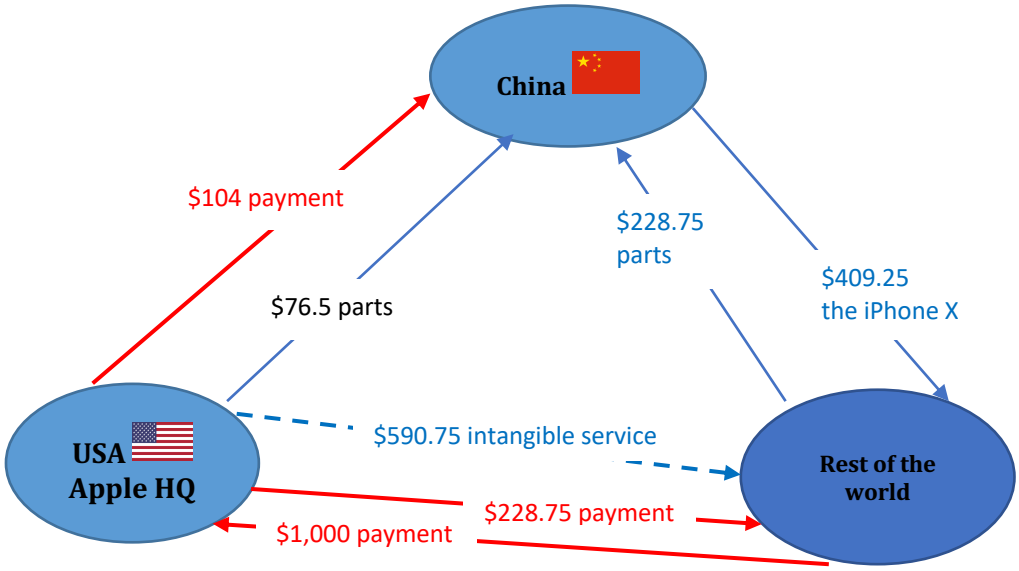
3. In the age of GVCs, trade flows no longer match income flows

There are two reasons for the discrepancy between the picture presented in conventional trade statistics and the reality that American factoryless manufacturers such as Apple and Nike actually export billions of dollars goods to the global market every year. First, American factoryless manufacturers generally outsource the manufacturing of their products to factories located outside of the US. Their products, says iPhones and Nike shoes, are exported to overseas markets from where they are manufactured, not from the US. They do not have to cross American borders to enter foreign markets. Hence, American customs cannot record the shipments of those products to foreign countries as US exports. For instance, all Apple products sold in the Chinese market are directly shipped from the Chinese factories of Foxconn, Wistron, Pegatron, Luxshare Precision and etc.; they are not shipped from the American continent. Second, what American factoryless manufacturers sell to foreign consumers is the services of their intangible assets, such as product design, brand, patented technologies and supply chain management know-how. When foreign contractors export products manufactured for those American companies to international markets, they only declare the cost of manufacturing, which does not include the value added attributed to the intangible assets. Therefore, the value added by American factoryless manufacturers via intangible assets is not recorded by customs in other countries—and hence it actually constitutes a missing US export (Xing, 2020b).

Now, I take up the case of trade in the iPhone X assembled in China, to offer an intuitive explanation of the failure of conventional trade statistics to track exports of intangible assets by factoryless manufacturers. Assuming that an iPhone X is sold neither in China nor in the US, but somewhere in the rest of the world. Figure 1 depicts trade and income flows between China, the US and the rest of the world related to the manufacture and sales of that iPhone X. In the figure, blue lines indicate flows of goods associated with the production and export of the iPhone X, while red lines denote corresponding flows of income. The retail price of the iPhone X is assumed to be $1,000. A teardown analysis (Xing, 2020a) reveals that the production cost, which comprises the costs of all parts and assembly service, amounts to $409.25, and that Apple contributes $590.75 of value added to the phone through its intangible assets (iOS operating system, brand, product design, marketing and retail networks). To make

the iPhone, Foxconn in China imports US$76.5 and $228.75 worth of parts and components, respectively, from the US and the rest of the world. As a result, the sale of a US$1,000 iPhone X gives rise to a total of $714.5 in export volume in the world economy, i.e. the sum of $305.25 in parts exported to China and the $409.25 value of the iPhone X when exported by China. It is worthy of note that the official trade statistics report only the US$76.5 in parts shipped directly from the US to China as a US export, which is about one tenth of the total export value generated by the sale of the $1,000 iPhone X abroad. Unambiguously, the trade statistics greatly underestimate the contribution of the iPhone X to US exports.

Figure 1 Mismatch between trade and income flows: the case of trade in the iPhone X



Source: Xing (2020a)

Examination of income flows, illustrated by the red lines in Figure 1, reveals that the income flows do not match the trade flows. Specifically, (1) China only received $104 for parts made in China and for assembly, despite the officially reported $409.25 export; (2) the trade statistics show that China imported $305.25 in parts from the US and the rest of the world for assembly of the iPhone X, but there is no corresponding income flowing from China to those regions, because Apple paid the suppliers in the US and the rest of the world directly; and (3) from its sales of the iPhone X in the rest of the world, the US received $1,000 income from abroad, although there is no corresponding trade flow matching the $1,000 received. This hypothetical iPhone trade unambiguously demonstrates that conventional trade statistics only capture the

value of physical goods crossing borders, and cannot trace exports of services of intangible assets embedded in physical goods.

GVCs have evolved into the dominant mode of production and international trade. The international division of labor along value chains, as illustrated by the case of the iPhone (Xing, 2020a) and the smile curve (Meng, et al, 2020), suggests that MNCs from developed nations generally specialize in the creation of intangible assets, while firms from developing nations perform tasks related to material fabrication and product manufacturing. Trade in tasks means international exchanges involving services of intangible assets and activities related to the manufacture of tangible products. Hence, from the perspective of value chain trade, exports of services by factoryless manufacturers via tangible goods assembled/made by foreign contract manufacturers should be considered a new type of trade in services.

4. In the age of GVCs, trade flows no longer match income flows

To measure the exports of services of intangible assets by a factoryless manufacturer, I follow the approach used in Xing (2020b). Generally, the total value added TV of products sold by a factoryless manufacturer in the global market can be written as

$$TV = V_1 + V_2 + V_3 + V_4 + V_5 \qquad (1)$$

where V_1 is the value added of parts manufactured in foreign countries; V_2 is the value added of parts produced in the home country of the factoryless manufacturer; V_3 is assembly cost; V_4 is the value added of the sale services provided by local employees in foreign destination markets; and V_5 is the value added attributed to the factoryless manufacturer's intangible assets (e.g., brand name, design, software). Regardless of whether in the real world foreign made parts contain the materials or components supplied by the home country or vice versa, theoretically, the total value added of any product can always be decomposed as in equation (1). As explained earlier, when parts and assembled final products are shipped between countries, V_1, V_2 and V_3 are automatically recorded as trade flows. The value added V_4 and V_5, however, can only be realized after the factoryless manufacturer sells its products to foreign customers. V_5 denotes the service value of the intangibles embedded in the products and owned by the factoryless manufacturer, i.e., what the factoryless manufacturer sells to the foreign

consumers—which is an export from the perspective of the factoryless manufacturer's home country. V_5 is an undocumented export that is missing from official trade statistics.

The export of services of intangible assets by the factoryless manufacturer, V_5, can be estimated using the formula

$$V_5 = \beta S - V_4 \qquad (2)$$

where β is the average gross margin of the factoryless manufacturer's products and S is total overseas sales. Gross margin is a company's total sales revenue minus the costs of goods, divided by total sales revenue. In other words, βS is equal to the difference between the sales revenue and the total cost of manufacturing tangible products—the sum of V_1, V_2 and V_3. To estimate the exports of intangible assets by factoryless manufacturers, I select five American companies for examination: Apple, Nike, AMD, Cisco, and Qualcomm. Apple and Nike are two famous factoryless manufacturers of consumer goods. AMD, Cisco and Qualcomm are fabless semiconductor manufacturers. Qualcomm is "a global leader in the development and commercialization of foundational technologies and products used in mobile devices and other wireless products, including network equipment, broadband gateway equipment and consumer electronic devices," and Qualcomm's semiconductor business primarily utilizes a fabless production model; Qualcomm does not own or operate foundries for the production of silicon wafers from which integrated circuits are made (Qualcomm, 2018). Cisco "designs and sells a broad range of technologies that have been powering the Internet since 1984." It presently uses a variety of independent third-party companies to provide services related to printed-circuit board assembly, in-circuit testing, product repair, and product assembly. Cisco's arrangements with contract manufacturers generally provide for quality, cost, and delivery requirements, as well as manufacturing process terms, such as continuity of supply; inventory management" (Cisco, 2018). AMD produces x86 microprocessors; chipsets; discrete and integrated graphics processing units (GPU), and professional GPUs; and servers, embedded processors and semi-custom System-on-Chip (SoC) products and technology for game consoles. It outsources board-level graphics product manufacturing to third party manufacturers, such as GlobalFoundries and Taiwan Semiconductor Manufacturing Company (TSMC) (AMD, 2018).

The data needed for the estimations (foreign sales, gross margins and expenses of administrative and sales) are taken from the annual reports (Form 10-K) of the companies examined. I assume that trade statistics include the service revenues and license incomes

derived by those companies from foreign markets. The revenues from services and license income are excluded in the estimation. The foreign sales data presented in Table 4 consist only of the revenues from tangible products. In 2018, Apple sold $132.0 billion in products abroad, the highest among the five companies, with a gross profit margin of 38.2%, while Nike's foreign sales amounted to $21.5 billion with an average gross margin of 43.8%. Excluding licensing revenues, Qualcomm obtained $16.9 billion in revenue from overseas markets with an average gross margin of 55%. Together the five companies derived $190.7 billion in revenue from overseas markets in 2018 (Table 4).

Table 4. Estimated exports of services of intangibles by the five American factoryless manufacturers in 2018 (billion US dollars)

Company	Apple	Nike	AMD	Cisco	Qualcomm	Total
Foreign sales	132.0	21.5	5.2	15.1	16.9	190.7
Exports	46.6	6.0	1.8	7.7	8.2	70.3

Source: Forms 10-K of Apple, Nike, AMD, Cisco and Qualcomm; and the author's estimates.

V_4 represents the retail services provided by local employees in foreign destination markets, for example, the retail services provided by the Chinese employees of Apple stores in China. The annual reports of those companies disclose only aggregate numbers for sales and administrative expenses. Since tangible assets such as brands, software and design have the character of economies of scale, and since most of the administrative and marketing activities are done at the headquarters, I assume for these estimations that marginal sales and administrative expenditure in foreign markets are 50% of average sales and administrative expenses. Table 4 reports estimated exports of services of intangibles by the five American companies in 2018. Specifically, of Apple's $132 billion in foreign sales, $46.6 billion was attributed to its intangible assets, such as the famous Apple brand, iOS software, elegant and trendy design, and other services. This figure represents the value of what Apple itself actually sold to foreign consumers via its tangible products assembled by foreign contractors. It is an exported service of Apple's intangibles but it is not recorded in the current form of trade statistics. Similarly, through its sales of athletic footwear, apparel and other tangible products, Nike exported $6.0 billion in services of its intangible assets to foreign consumers in 2018. Cisco and Qualcomm had lower foreign sales than Nike, but their gross profit margins were

60.7% and 55.0% respectively, much higher than that of Nike, and their exports were higher too. Cisco exported $7.7 billion in services of intangible assets through its $15.1 billion in sales of hardware in overseas markets; Qualcomm exported $8.2 billion in services of intangibles through its sales of $16.9 billion in chips to foreign customers. AMD, the smallest among the five companies, is estimated to have exported $1.8 billion in services attributed to its intangible assets. Together, by selling foreign customers tangible products assembled/made by foreign contract manufacturers, the five American factoryless manufacturers exported $70.3 billion in services of intangible assets in 2018.

Table 5. The five American factoryless manufacturers and US trade in 2018 (billion US dollars)

Exports in services			Trade balance*		
Official	Adjusted with the factoryless manufacturers	Change	Official	Adjusted with the factoryless manufacturers	Change
862.4	932.7	8.2%	-579.9	-509.6	12.1%

Source: US Census of Bureau and the author's estimates; *: including both goods and services.

According to the practice of conventional trade statistics, trade in services include cross-border sales of research and development services, royalties and license fees for IP. The accumulation of intangibles is a result of research and development activities. Brand development, product design and marketing are service oriented tasks. To assess the significance of the exports of services of intangibles by the five American factoryless manufacturers, I compare the estimated exports of those companies with US exports in services and overall trade balance reported by the official trade statistics. In 2018, the US exported $862.4 billion in services. The $70.3 billion in exports in services of intangibles by the five companies is equivalent to 8.2% of US exports in services. If that were counted as a US export in services, US service exports would rise to $932.7 billion, and in turn the overall US trade deficit would fall 12.1% to $509.6 billion (Table 5).

5. American factoryless manufacturers and the US-China trade

According to US Census Bureau statistics, in 2018 the US had a $420 billion trade deficit in commodity trade, amounting to almost half of the US trade deficit in goods. That persistent and rising trade deficit triggered the on-going trade war between the two countries. Besides

macroeconomic factors such as differences in savings rates, the incompatibility between current trade statistics and value chain trade is one of major causes of the apparently huge trade imbalance between the two nations. Several studies (e.g., Xing and Detert, 2010; Johnson and Noguera, 2012; Koopman, Wang and Wei, 2014; Xing, 2020a) have documented the statistical distortion of the US-China trade balance. While foreign value added inflates China's trade surplus with the US, the emergence of factoryless manufacturers has led to underestimation of US exports to China. By outsourcing all fabrication tasks to foreign contract manufacturers, many American firms have adopted a new business model for the marketing of products in the Chinese market. Instead of selling US made goods, they sell products built around American brands, designs and technologies, but made/assembled in China or third countries. Every year, American factoryless manufacturers sell Chinese customers billions of dollars in tangible products such as iPhones, Nike shoes, AMD CPUs and Qualcomm chipsets, and earn billions of dollars from the Chinese market as a return on their intangible assets and services. In 2018, Apple's net sales in China totaled $51.9 billion; Nike, Qualcomm and AMD sold $5.1 billion, $15.1 billion and $2.5 billion respectively in products in China. The total Chinese revenue of the four American companies was $74.6 billion (Table 6). Their extraordinarily high gross profit margins, e.g., 43.8% on Nike products and 55% on Qualcomm semiconductor products, imply that those American companies captured a significantly large share of the value added of the products sold in the Chinese market. What those American companies are actually selling to Chinese customers are the services of their intangible assets. Such business activities, however, are not treated as a US export to China because conventional trade statistics are designed for the classic cloth-for-wine trade, not for value chain trade. Compared to exports of agricultural products such as corn and soybeans, or of airplanes, exports of services of intangible assets via GVCs create both jobs and income for the American economy. Those exports should be considered a new type of export in the age of GVCs.

To evaluate the importance of American factoryless manufacturers in the bilateral trade between the US and China, I apply equation (2) to estimate the exports of services of intangible assets by Apple, Nike, AMD and Qualcomm to China in 2018. The estimates indicate that Apple earned $18.3 billion from its $51.9 billion sales in China, in the form of a return on its intangible assets (iOS, great brand, trendy design, marketing and supply chain management know-how). In terms of bilateral payments, that $18.3 billion is the value of the purchase by Chinese consumers of the services of Apple, a US export to China via the value chains of Apple. The export of Nike's service to China is estimated at $1.4 billion. Of Qualcomm's $15.1 billion

sales in China, $7.5 billion is attributed to the value added of Qualcomm's intangible assets, and can be regarded as the fabless semiconductor manufacturer's service export to China. In the same fashion, I calculate that AMD exported $0.8 billion in services of intangibles to China that year. In a nutshell, the four factoryless manufacturers jointly exported $27.9 billion in services of intangible assets to Chinese customers via tangible products in 2018 (Table 6).

Table 6. Estimated exports of services of intangibles by selected American factoryless manufacturers to China (billion dollar)

Company	Apple	Nike	AMD	Qualcomm	Total
Sales in China	51.9	5.1	2.5	15.1	74.6
Exports	18.3	1.4	0.8	7.4	27.9

Source: Forms 10-K of Apple, Nike, AMD and QCOM; and the author's estimates.

Compared with US exports in services to China as reported by the official trade statistics, the exports of the four American factoryless manufacturers to China are too large to be ignored. According to the US Census Bureau, the US exported $57.1 billion in services to China in 2018. If the exports of the four American companies were counted as part of US exports to China, US service exports to China would increase by 48.9% to $85.0 billion, and the US overall trade deficit with China (including both goods and services) would shrink by 7.3% to $352.1 billion (Table 7). Clearly, adding the exports of services of intangibles by American factoryless manufacturers would substantially increase the volume of US exports to China and reduce the US trade deficit. This is not a statistical trick or an academic exercise for artificially narrowing the trade imbalance between the two nations. It is an adjustment necessary to make trade statistics compatible with value chain trade. The logic for doing so is straightforward. When Chinese consumers and firms purchase tangible products of American factoryless manufacturers, such as iPhones, Nike shoes, Qualcomm chipsets and AMD CPUs, they pay not only the cost of manufacturing those products, but also the value added associated with the services of intangible assets embedded in those products. In other words, Chinese consumers and firms actually purchase the services of intangible assets of American factoryless manufacturers, similar to purchasing made in the US goods, but accomplished through sophisticated value chains rather than conventional trade in goods and services.

Table 7. Selected American factoryless manufacturers and US trade with China in 2018 (billion US dollar)

US exports in services to China			US trade deficit with China*		
Official	Adjusted with the factoryless manufacturers	Change	Official	Adjusted with the factoryless manufacturers	Change
57.1	85.0	48.9%	-380.0	-352.1	7.3%

Source: US Census Bureau and the author's calculation; *: including trade in goods and services.

6. Concluding Remarks

To export means to sell domestically made products to foreign markets. Factoryless manufacturers sell services of their intangible assets embedded in tangible goods to foreign customers. That kind of activity meets the definition of export. Exports are important for national economies because they create jobs and income for domestic economies. The earnings gained by factoryless manufacturers from the global market support highly paid jobs in their home countries in areas including research and development, product design, marketing, and supply chain management. It is the global market that offers a space where factoryless manufacturers can maximize the scalability of their IP. Failing to count exports of factoryless manufacturers leads to underestimation of the contribution of those firms to national economies and often leads to serious distortion of bilateral trade balances. As shown here, Apple's international sales are not counted as US exports at all. That strange phenomenon reflects a failure of trade statistics to realistically measure value chain trade, a dominant form of international trade in the 21st century.

The estimates of this study suggest that American factoryless manufacturers have contributed significantly to US exports. The 2018 exports of services of intangible assets by Apple, Nike, AMD, Cisco and Qualcomm amounted $70.3 billion, equivalent to 8.5% of the official record of US exports in services that year. If those exports were regarded as US exports, the US trade deficit would fall by 12.1%. In terms of the bilateral trade between US and China, Apple, Nike, AMD and Qualcomm sold $27.9 billion services of their intangible assets to Chinese customers in 2018, equal to almost half of US exports in services to China as reported in official statistics. If those exports were counted as US exports to China, the bilateral trade imbalance would be reduced by 7.3%.

This discussion applies to both American MNCs and MNCs from other developed nations. For example, Dyson of the UK, UNIQLO of Japan, and ZARA of Spain have adopted the new business model of selling the services of intangible assets via tangible products assembled/ made by foreign contractors. This new trend in recent decades is a result of GVC development. Expanding the scope of trade from tangibles to include intangibles is essential for a more accurate understanding of the benefits of globalization, in particular the benefits to nations specializing in cultivating intangible assets.

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