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**Trade in Intangibles and A Global Value Chain-based View
of International Trade and Global Imbalance**

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Trade in Intangibles and A Global Value Chain-based View of International Trade and Global Imbalance¹

Abstract

This paper aims to develop a framework for the measurement of global trade that integrates trade-in-intangibles and trade-in-goods in the context of globalisation, fragmentation of production activities and increasing trade in intangibles, and applies it for the analysis of global trade imbalance. Through in-depth discussions of the five modes through which trade-in-tangibles are carried out, it develops a framework of international trade measurement from the perspective of global value chains. The overall trade deficit of the U.S. reduced nearly half of its size from USD750 billion to USD396 billion in 2016 with a cautious adjustment without taking into account the intangibles income to most of the U.S. firms accrued through outsourcing activities. It argues that the global trade imbalance and policy responses to solve it should be discussed on the basis of a framework that fully incorporates different types of trade activities in the 21st century. Re-distribution of income from the entities who gained greatly from the trade in intangibles to the rest of the society is crucial to reduce the inequalities. Tax avoidance by depositing these benefits at different locations globally should be curbed.

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1. Introduction

Trade imbalances have been a major issue that ignited the recent wave of anti-globalisation in some of the industrialised countries. The acknowledged huge trade deficit (of \$375 billion in 2017) between China and the United States is also a main argument that persuaded the U.S. to launch a significant tariff increase against a wide range of products imported from China in March 2018². It is generally argued that a country's position in global trade should be understood in a multilateral trade setting instead of a bilateral one. Yet, given the prevalence of globalisation, fragmentation and segmentation of global production (Helpman and Krugman, 1985; Krugman et al., 1995; Venables, 1999; Baldwin and Evenett, 2015), and the deep embeddedness of trade in knowledge and services in global value chains (GVCs), an important question arises with regard to the channels of the trade in intangibles, which include a range of intellectual properties such as patents, know-how, trademarks, copyrights, brands, and trade secrets, etc., and the flows of value across national borders as a result, and how we should modify the framework of international trade to comprehensively and truthfully reflect the complex trade relationships between countries in the 21st century.

While the trade literature has evolved from classical theory of trade in goods to theories of intra-industry trade, and recently to trade in tasks, trade in intangibles has not been fully integrated into the theory of international trade except being partly considered in the literature of trade-in-tasks. In its current status, almost all of the literature focuses on trade in goods and services or in tasks in the manufacturing process of goods. Moreover, while trade theory has reflected many of the important evolutions in trade mode and some types of trade in intangibles, progress in trade statistics has only not been able to reflect many of this change. The framework of international trade statistics lagged behind in providing a full picture of international trade, partly due to the challenges in data collection and partly due to the lack of a comprehensive framework that integrates international trade in goods and in intangibles. As far as I am aware, Reindorf and Slaughter (2009) is the only pioneering work on trade in

² Official documentation of the beginning of this is “Presidential Memorandum on the Actions by the United States Related to the Section 301 Investigation”, which can be found on the official website of the White House of the US: <https://www.whitehouse.gov/presidential-actions/presidential-memorandum-actions-united-states-related-section-301-investigation/> .

intangibles. This edited volume supported by NBER includes insightful and pioneering work by Carol Robbins on measuring payments for the supply and use of intellectual property, by Francisco Moris on new data and methodological issues R&D exports and imports, and by Gordon Hanson and Chong Xiang on international trade in motion picture services. Moris (2017) finds a complementarity relationship between supply-chain trade in R&D services and FDI flows. Another indirectly linked research is a recent study by Gusvenen et al (2018) on profit shifting in the U.S. MNEs, which finds that productivity growth of U.S. firms after making adjustments taking into account profit shifting are especially large in R&D-intensive industries, which most likely produce intangible assets that facilitate profit shifting. However, overall, trade in intangibles has not been fully and systematically analysed and integrated into the measurement of trade in theory and in practice.

On the other hand, although the literature on global value chains (GVCs) has placed intangibles at the centre of the research, it focuses on its role in the governance of the GVCs, although intangibles are somewhere behind the scene as an important factor that affects the power relationship in the GVCs. It is argued that governance is usually exerted by companies that are not in the manufacturing stage, but rather they control the knowledge exchange and trade it within different forms of governance (hierarchy, where FDI is the most hierarchical, then outsourcing, and arms-length) (Gereffi et al., 2005; Mudambi, 2008).

This paper aims to integrate the literature on technology, international trade, international business, and global value chains, and develop an analytical framework of global trade that integrates trade-in-intangibles and trade-in-goods in the context of globalisation of production and increasing trade in intangibles. Through in-depth discussions of the five modes through which trade-in-tangibles are carried out, it develops a framework of international trade statistics from the perspective of GVCs. The full global value chain ranges from ideas/knowledge creation, resources' extraction, spare parts' production, integration and assembly, and branding, marketing, as well as after sales services' provision. Intangibles are a type of factor endowment of a country, although they are not a natural endowment, but a created endowment. Intangibles enter into international trade not only as a factor endowment embedded in manufactured

goods but also directly through various trade modes which are specific for intangibles. Therefore, the true picture of international trade should be presented under an integrated framework that encompasses international trade in goods, services and intangibles.

In what follows, this paper first reviews the classical theories of international trade and the context in which they were formulated; secondly, it analyses the models of global production and the types of trade involved in and derived from these processes; and thirdly, it proposes a comprehensive framework for the analysis of international trade that integrates international trade in goods, services and knowledge in different trade modes from a GVCs perspective.

2. International trade theory: A brief overview

The classical theory of international trade starts from Adam Smith. His seminal work, the *Wealth of Nations* (Smith, 1776), argues that trade serves as a ‘vent for surplus’ which can be used to vent off the surplus production capacity that a country has and to bring the production possibilities’ frontier back to full capacity. Later David Ricardo’s ‘Theory of comparative advantage’ (Ricardo, 1817) argued that all countries have a comparative advantage in some products. Countries can benefit from international trade by specialising in products in which they enjoy a comparative advantage, independent of whether such advantage is ‘absolute’ as posited by Adam Smith, due to resource allocation and welfare effects. Heckscher-Ohlin’s ‘Theory of factor proportion’ builds on Ricardo's theory of comparative advantage and predicts patterns of commerce and production based on the factor endowments of a trading region. This model suggests that countries export products that use their abundant and cheap factors of production, and import products that use the countries’ scarce factors (Leamer, 1995).

In order to overcome the limitation of the Heckscher-Ohlin model in explaining some of the observed trade patterns, Raymond Vernon developed the Product Life Cycle Theory (PCT) in the 1960s (Vernon, 1966). This theory suggests that countries who innovate first tend to enjoy a comparative advantage in technology-terms. Early in a product's life-cycle, all the parts and labour come from the area where the product was invented. Yet, as a technology moves to a mature and saturation stage, it becomes more

and more standardised and its diffusion to less advanced countries increases. According to the PCT theory, the import or export of a product is determined by the relative overall cost of production. At later stages of a product's life cycle, production gradually moves away from the point of origin and the product may even become an item that is imported by its original country of invention.

Since the 1970s, marked by a drop in transportation costs, the production process has become more segmented and specialised, and the production network / value chain changed from local / national to global. This gave rise to intra-industry trade. Following this, the 'new trade theory' (e.g. Krugman, 1979; 1981; 1991; Lancaster, 1980; Balassa, 1986; Melitz, 2003) was developed to explain intra-industry trade based on economies of scale, monopolist competition and network effects.

Into the new millennium, outsourcing and trade in tasks has become a new trend due to technical progress and computerisation and innovations in business model in MNEs. It is even regarded as a new industrial revolution (Blinder, 2006). Research into trade in tasks has looked into the motivations and benefits of offshoring and outsourcing and the evolution in industry organisations (Grossman & Rossi-Hansberg, 2008 and 2012; Rodriguez-Clare, 2010; Baldwin and Venables, 2013; Baldwin and Robert-Nicoud, 2014). It is found that the presence of MNEs creates trade in headquarters' services, many of which are intangibles, such as R&D, technology, and design, as well as marketing services. While offshoring through FDI or outsourcing are important modes for the 'export' of intangibles, they are still partial as the trade of intangibles takes place also in other types (Markusen, and Venables, (2000).

All these development in trade theory has provided great insights into the evolution in trade mode and the motivations and impact of international trade. However, almost all of these theories have been developed and applied in the context of international trade of *goods*. In the classic and neo-classic theories of trade, countries produce all the factors' inputs, and production processes are carried out in a single country. Although the New International Trade theory has taken into account the fragmentation of production globally, it remains mostly concerned with international trade in tasks and components involved in the production of the goods. Overall, despite the great

advancement in the literature of international trade, intangibles have not been explicitly considered as a factor in international trade. The various channels for the trade in intangibles have not been considered fully and systematically.

3. Global Value Chains and the Smile Curve

The term GVCs identifies a production structure in which tasks and business functions are distributed among several companies, globally, or regionally (Grossman and Rossi-Hansberg, 2012). It is “the sequence of productive (i.e. value added) activities leading to and supporting end use” (Sturgeon, 2001). In the chain of tasks / activities that contribute to the value creation of a product (i.e. the value chain of a product), the normal activities start from basic and applied research and design (R&D) which results in the creation of the ideas as well as the technology and design of new products and new production process; this continues to commercialisation of the research outcome, be it either patents or other intellectual properties (ideas, papers, know-how, etc.) and is followed by resources’ extraction and materials’ (including agricultural commodities) production; manufacturing of spare parts and components and the integration and assembly of final products follows, and finally marketing, advertising, brand management, specialised logistics, business services and after-sales services. It may be worth adding that the definition of value chain in the literature goes beyond the concept of trade in intermediate goods, emphasising the power structure defining the relationship between lead-firms and suppliers at different links of the chain (Milberg, 2004).

Through the diffusion of information and communications technologies from the 90s onwards, international production has become highly fragmented and segmented. Instead of carrying out the entire production cycle, countries increasingly specialise in those *tasks* in which they enjoy a comparative advantage. The production and value creation take place across several countries in a process characterised by growing transnational trade in intermediates that is commonly conceptualised as global value chains (GVCs). GVCs are now regarded as the face of 21st century international commerce (WIPO, 2017).

Within GVCs, countries tend to specialise in specific segments of a good or service value creation. Some countries specialise in the production of ideas and new technology through R&D, others in resources' extraction and primary production, others again specialise in manufacturing of intermediates and/or assembly activities, while some focus on marketing, branding, and after-sales services or business-services provision. A country may specialise in one or a few activities in the GVC, in particular, those which engage with R&D may also engage with the marketing and branding of the same product, for example, Apple. As a result, international trade expands from the trade of goods (as analysed in the classical trade theory) to the *trade of a bundle of goods, services and knowledge* (Baldwin and Evenett, 2015).

Whenever the creation and production of an exported product is accomplished within one single country using intermediate goods and services produced by that very same country, then this simple one-country version of the value chain is the scenario of international trade analysed in the classical and neo-classical trade theory. Yet, as we will observe, this is increasingly less the case.

3.1 The Smile curve and the value creation in different stages of a value chain.

According to Stan Shih (Shih, 1992), the value-added created at different stages of the value chain depends on several factors (e.g. labour vs. capital intensiveness, tacit knowledge, competition). In many manufacturing industries, the two ends of the value chain – conception, research and development at the starting end, and branding and marketing at the finishing end – command higher value per worker when added to the product than does the middle part of the value chain – manufacturing (Shih, 1996; OECD, 2013; Alcacer and Oxley, 2014; Rungi and Del Prete, 2018). In other words, the value-added per head of the activities at the two ends of a GVC is higher than that in the middle, which can be depicted using a Smile Curve, for example as shown in Figure 1, as proposed by Stan Shih (Shih, 1992). Resources' extraction and materials' production also produce value-added. But a firm's (and at the aggregate level, a country's) capability to capture increasing value depends on the governance of the value chain (Gereffi et al., 2005; Mudambi, 2008; Kaplinsky, 2000) and the governance of the country where this activity takes place.

To note, however, when value-added is measured in absolute amount, the curve will be flatter than it is measured in per worker terms. For bespoke products aiming at niche markets, the curve will be deeper; while for products with large markets, the curve will be flatter when value-added is measured in absolute amount, but will remain deep when measured by per worker.

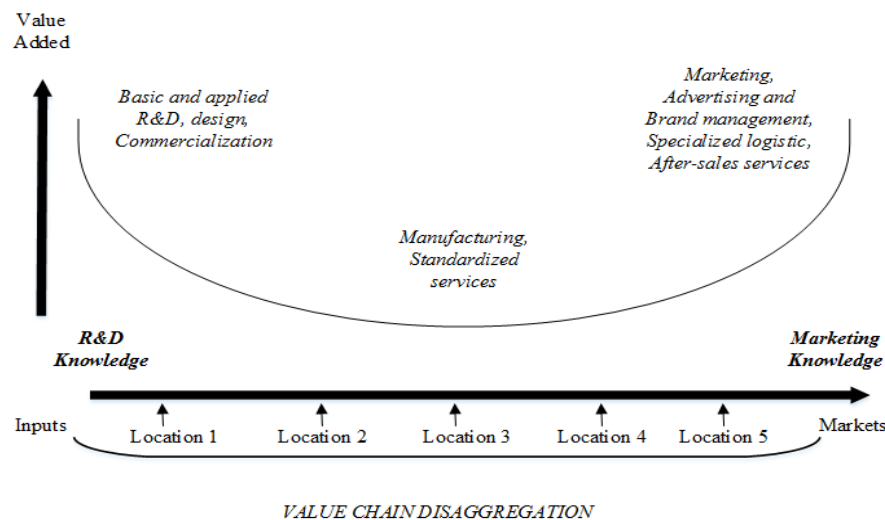


Figure 1. The Smile curve of GVCs. Source: Shih (1992)

4. Trade in intangibles and a GVC-based integrated framework of international trade

Most countries specialise in one or several activities in the value chains. Therefore, the value-added of one product is not owned in one country but is spread in different countries along global value chains. If it is a one-country mode of the value chain, then the whole value-added is captured in one country except for the profits from selling the imported products to the final customers in the importing country. According to Constantinescu et al. (2018) and World Bank (2017), in 2014 about two-thirds of total trade involved production that crossed national borders at least twice before reaching end users.

Because the global R&D resources are highly concentrated in a few industrialised countries (World Bank, 2017; OECD, 2017), new knowledge creation remains a prerogative of a few industrialised economies. According to WIPO, until 2017, the world's top 25 innovative countries were all developed economies except China, a new comer from the developing world which only gained a place in the top 25 in 2017. At

the same time, some countries have developed a strong and internationalised business services' sector such as the UK, and some have developed a series of brands that enjoy international fame, such as France, Germany, Japan and Italy. As a result, developed countries tend to export knowledge (ideas, technology, business models, and marketing, brand management, and business services, and some after-sales services) and knowledge-intensive components and spare parts or products, and import manufacturing products, while developing countries tend to export manufactured final products while importing knowledge-intensive products, services or acquiring knowledge directly using various knowledge specific trade modes. In terms of value-added capturing, most of the products' value-added distributions follow the Smile curve, in particular if measured by value-added per worker. Nevertheless, the proportion of value captured by intangible capital exceeds that of physical capital in the GVCs, and has been increasing in recent years. In 2014 the income share accruing to intangibles was 32% for the all products manufactured and sold worldwide, almost double the share for tangibles (WIPO, 2017).

In a paper on intangible capital and growth in advanced economies, Corrado et al. (2012) use a model that has two sectors, an upstream or knowledge-producing sector and a downstream or knowledge-using sector. The upstream sector takes freely available concepts or ideas—basic knowledge—and produces “finished” ideas or commercial knowledge (e.g., blueprints). Another way of thinking about the two sectors is that one is the “innovation” sector and the other is the “production” or “final output” sector. They argue that conventional economy-wide GDP growth is given by the growth rate when investments in innovation are not capitalized. But when such investments are capitalized, aggregate value-added and its real growth reflect the current production of *both* sectors. Therefore, intangibles represent an important source of growth and a driver of value creation.

Given such an important role of intangibles (knowledge and other forms of intangibles) as found in Corrado et al. (2012) and Haskel and Westlake (2017), this paper proposes a model of international trade from the perspective of global value chain and considers international trade in both goods and knowledge (including technological and managerial/marketing knowledge). We start from a simple 2-country and 2-sector

model. Country A exports knowledge and imports manufacturing products, and country B imports knowledge and exports products. Therefore, international trade (trade balance) of a country is a combination of trade in intangibles and goods in a value chain.

What complicates this new form of trade is that trade in intangibles takes place in different and sometimes more complex forms than traditional trade in goods. Normally, trade in intangibles (knowledge and brands) takes five different forms: licensing, foreign direct investment (FDI), outsourcing, collaboration/alliances, and consultancy services' provision. Each of them captures the value-added in the value chain in different forms as summarised in Table 1.

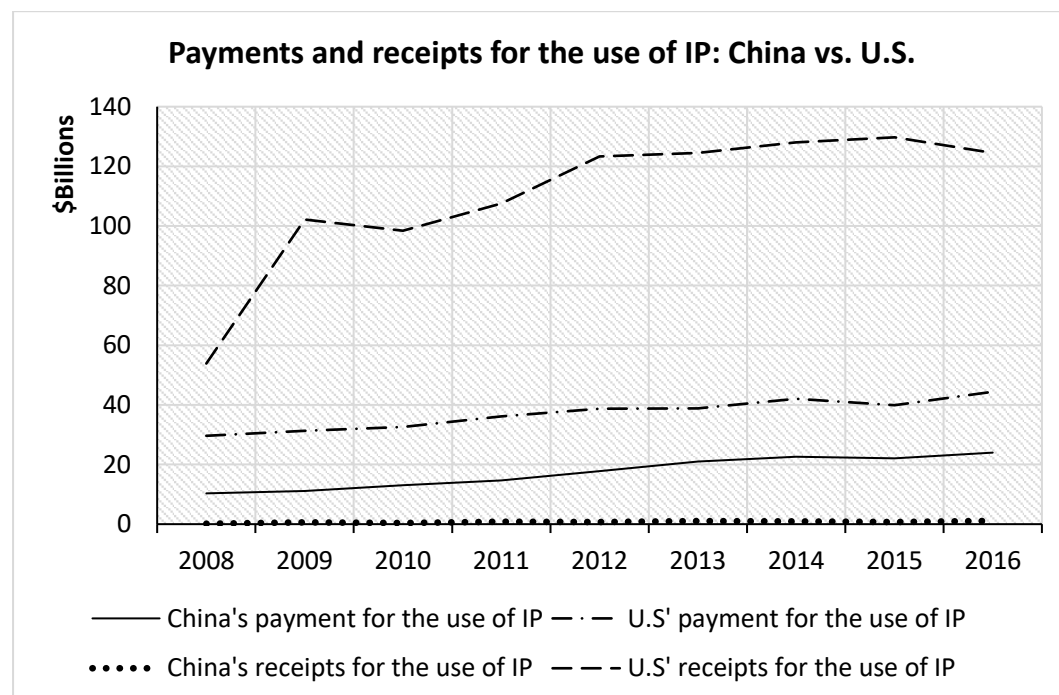
Table 1. Different modes of IP trade and forms of value capture

TYPES OF TRADE OF INTANGIBLES	DESCRIPTION	FORMS OF VALUE CAPTURE
LICENSING (patented technology & business model, or know-how or brand)	License the right to use the IP and transfer relevant knowledge	Royalty fee, guaranteed and flat rate, or a fixed lump sum payment upfront.
FOREIGN DIRECT INVESTMENT	Invest and hold equity shares (IP counts as part of investment or tools to control)	Dividends, hidden profits obtained through transfer pricing.
OUTSOURCING	Sign vendor contract	Profit of final products net of outsourcing costs. Captures value of branding, marketing channel, or ideas/concept, or key components that the vendor owns. Controller.
COLLABORATION/ALLIANCE	Form alliance between different firms and parties (Intangibles count as part or all of the contribution)	Share proportional part of the value-added of final product. Captures value of intangibles according to agreed contract.
CONSULTING SERVICES (include training, consultancy)	Provide knowledge to individuals and organisations	Consultancy fee for the training or consultancy or other forms of services provided, e.g. after-sales services for installation, maintenance and repair.

Licensing. An often-used method for the trade in intangibles is licensing. This method applies to a wide range of intangibles including patented technologies and business models, as well as un-patented know-how or branding, etc. The owner of an intellectual

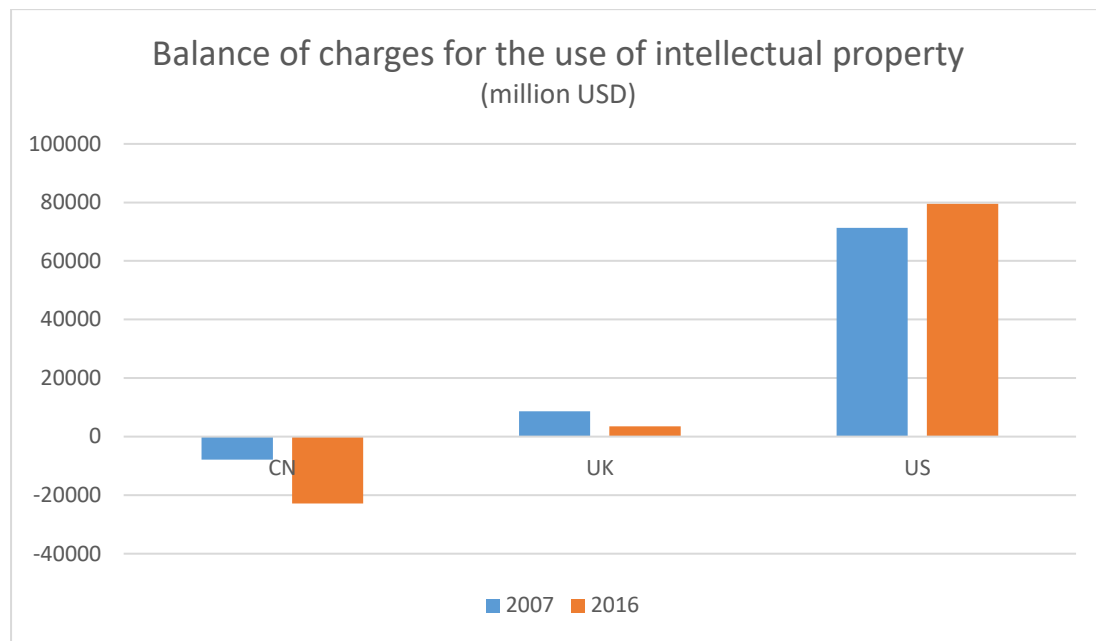
property may charge licensing fees or royalties for the use of intellectual property rights (such as patents, trademarks, copyrights, industrial processes and designs including trade secrets, and franchises) and for the use, through licensing agreements, of produced originals or prototypes (such as copyrights on books and manuscripts, computer software, cinematographic works, and sound recordings) and related rights (such as for live performances and television, cable, or satellite broadcast) (IMF, 2017). In addition to direct licensing, there are also cases of cross-licensing that companies in different countries allow to each other for the usage of specific patented technologies. In particular, this is often used in the electronic industry where the production of a final product requires many patented technologies owned by different companies or organisations. In 2016, the total international payment for IP was as high as \$2238.5 billion. China paid \$13.04 billion for the use of foreign intellectual property rights and received \$1.08 billion in the same year. In comparison, the United States paid \$44.39 billion for the use of foreign intellectual property rights and received \$124.42 billion in the same year. (Figure 2). The balances of IP payments and receipts in China, US and the UK are summarised in Figure 3 showing that the US has much higher net income from licensing for the use of IPs than another major IP creator, the UK.

Figure 2. Payments and receipts for the use of IPs



Source: IMF, Balance of Payments Statistical Yearbook: 2017.

Figure 3. Balance of charges for the use of IPs of China, U.S. and the U.K.



Source: WTO

Foreign direct investment. In many cases, especially when an IP is owned by a firm, the firm may choose to combine the IP with a certain amount of physical capital (including either financial capital or machines and equipment and /or marketing know-how), and directly invest in a foreign country by setting up a company or manufacturing / service units in that country. This can be either a greenfield investment wholly owned by the foreign IP owner/investor or a joint venture with a local partner. The greater the commercial/financial capability the IP owner has, the more likely the owner is to use an FDI to capture the value of its IP, instead of licensing. Normally, business IP owners are more likely to resort to FDIs for value creation than are universities and research institutes. Examples of such IP capturing are direct investments by Siemens, Volkswagen, Mercedes Benz, General Motors, General Electrics through joint ventures or wholly owned subsidiaries in China and some other developing countries.

IP owners will gain a return on their IP which was invested into the joint venture or subsidiary, as it is counted as a certain proportion of the assets through: dividends, increased value of the assets as the company grows, and in some cases, hidden profits obtained elsewhere through transfer pricing. For example, in the US, in 2016, the top technology internet firms of the US, for example Amazon, has \$12. 2 billion from web

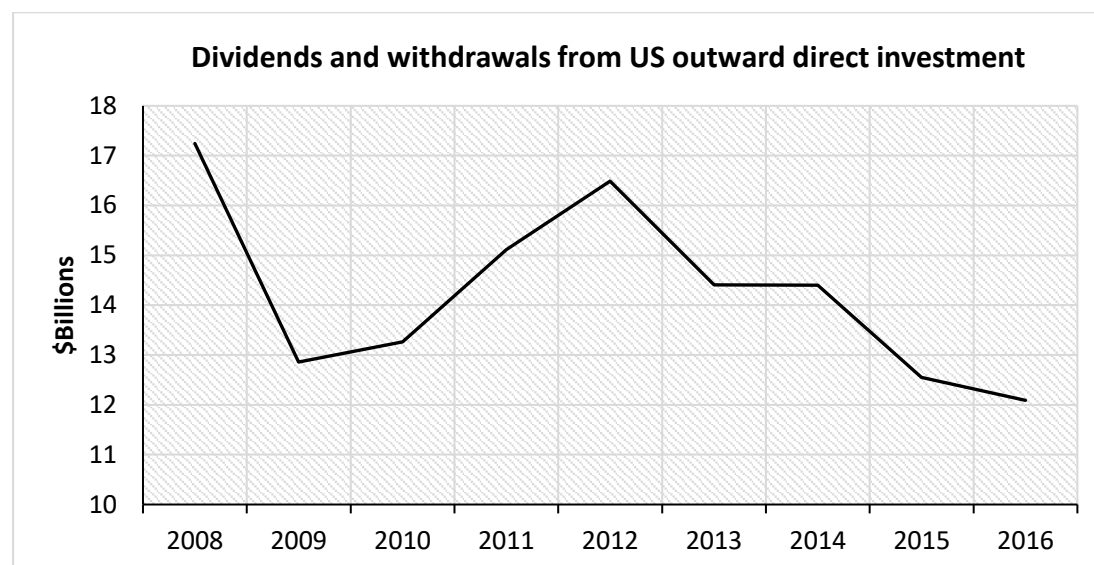
services, and \$44 billion from overseas operations; income from international operations of eBay was \$5.1 billion, and \$47.4 billion for Google³. In 2016, in their subsidiaries in the UK only for example, Microsoft Limited (UK) registered a turnover of \$1,290 million, Intel Corporation (UK) Limited \$5,544 million, and Cisco International Ltd (UK) had a turnover of \$11,777 million⁴. As far as the size of such gains, in a recent study of “offshore profit shifting” of US MNEs, Guvenen et al. (2018) define offshore profit shifting “occurs when an MNE structures itself so that profit that would have accrued in the United States accrues instead in its foreign affiliate. These shifted profits are recorded in the primary income account as a return on U.S. assets held abroad, which does not affect U.S. GDP”. They constructed an alternative measure of value added that adjusted for profit shifting and found that “The adjustments raise aggregate productivity growth rates by 0.09 percent annually for 1994-2004, 0.24 percent annually for 2004-2008, and lowers annual aggregate productivity growth rates by 0.09 percent after 2008. The adjustments are especially large in R&D-intensive industries, which most likely produce intangible assets that facilitate profit shifting. The adjustments boost value added in these industries by as much as 8 percent in the mid-2000s.”

Figure 4 reports the dividends and withdrawals of U.S. MNEs over the 2008 to 2016 period. The two major components of direct investment income on equity are dividends and withdrawals and reinvested earnings. Dividends and withdrawals are distributed earnings allocated to the owners of a business for placing funds at the disposal of the business. For corporations, they represent the payment of dividends to the owners of equity. They are the returns to the shareholders or owners. The amount of dividends and withdrawals paid back to U.S. shareholders or owners decreased from USD17.2 billion in 2008 to USD 12 billion in 2016. This amount of income from US outward FDI is very small in comparison to the large scale of US OFDI overseas and also small in comparison to U.S.’ income from IP licencing and commercial services income. The possible reasons behind this surprisingly small amount income from U.S. OFDI is the operations of the U.S. MNEs, some due to normal re-investment activities, and some may be due to the tax avoidance operations of these corporations.

³ Source: company reports extracted from their website.

⁴ Source: FAME database.

Figure 4. U.S. MNEs' direct investment income: Dividends and withdrawals



Source: Bureau of Economic Analysis

In the host countries, for example, in China in 2015 the profits of foreign invested enterprises (FIEs) by foreign investors other than HKMT was RMB995.7 billion; for HK, Macao and Taiwan the profit was RMB594.8 billion. Table 2 reports the profits of above scale industrial firms in China over the 2008 to 2015 period. Nearly half of the FIEs claimed to be losing money in that year. According to the China National Tax Bureau, around a third of these losses are due to operational problems, while two thirds of these firms were reporting losing money due to abnormal reasons, such as transfer pricing⁵.

Table 2. Profit of above scale industrial firms in China (100M RMB)

	2008	2009	2010	2011	2012	2013	2014	2015
Total	30562	34542	53050	61396	61910	68379	68155	66187
SOEs	2532	1973	3303	3567	3882	2944	2708	
Collective	617	638	806	864	895	580	541	509
Shareholding	3306	4033	6203	7648	7650	8043	7413	6448
HK&M&T	2976	3448	5113	5521	4947	5456	5930	5948
Foreign	5266	6659	9906	9973	9019	10347	10647	9957

Data source: China Macroeconomic Information Network

Note: HK&M&T refers to Hong Kong, Macao and Taiwan investors invested firms.

Above scale firms refers to firms with annual turnover over 20 million Renminbi.

⁵ Data source: China Macroeconomic Information Network and website of the Ministry of Commerce, China.

Outsourcing. In recent years, outsourcing has increasingly become a widely-used mode of international production. Some owners of technology or design choose to outsource the manufacturing of their product to one or a number of sub-contractor firms. At the same time, however, they maintain control of the value chain by investing and operating in R&D and design activities, as well as controlling product branding and marketing. For instance, in the Apple case, the outsourcing company owns intellectual properties in the form of patents, designs, as well as branding and marketing channels. According to the 2017 World Intellectual Property Report (WIPO, 2017), in the iPhone value chain, the value captured by the lead firm, Apple, accounted for 42% of the iPhone sale price; this is followed by 22% for cost of materials, 15% for distribution and retail, 5% for IP licences, 5% for unidentified material. Among the rest, there was only 1% for labour in China. Similarly, Huawei and Samsung capture 42% and 34% of the value-added in their mobile phone value chains, respectively (WIPO, 2017).

Outsourcing takes place not only in the technology-intensive electronics sector, but also in other industries. In the coffee value chain, for example, IPs include farming methods and trademarks owned by the farmers, know-how and trade secrets in processing and trade of coffee, as well as industry design and know-how in blending and roasting for market preferences. In this global value chain, branding is increasingly being used as a means of differentiation (WIPO, 2017).

In the services industry, outsourcing is also widely used, especially in the professional or business sectors where services can be disembodied, and remote-delivery becomes feasible with the facilitation of digital technologies. For example, in the business services sector, IPs such as brand and process design are owned by MNEs, while the accounting tasks are outsourced to contractors in India or South East Asia.

In this model, the values of the IPs are the net profits of final products after deduction of the total costs, including that of outsourcing. Owners of IPs can, without making a direct investment, capture the value of their concepts, patents, designs, brands, trade secrets and know-how, at various parts of the GVC, either as the controller (normally

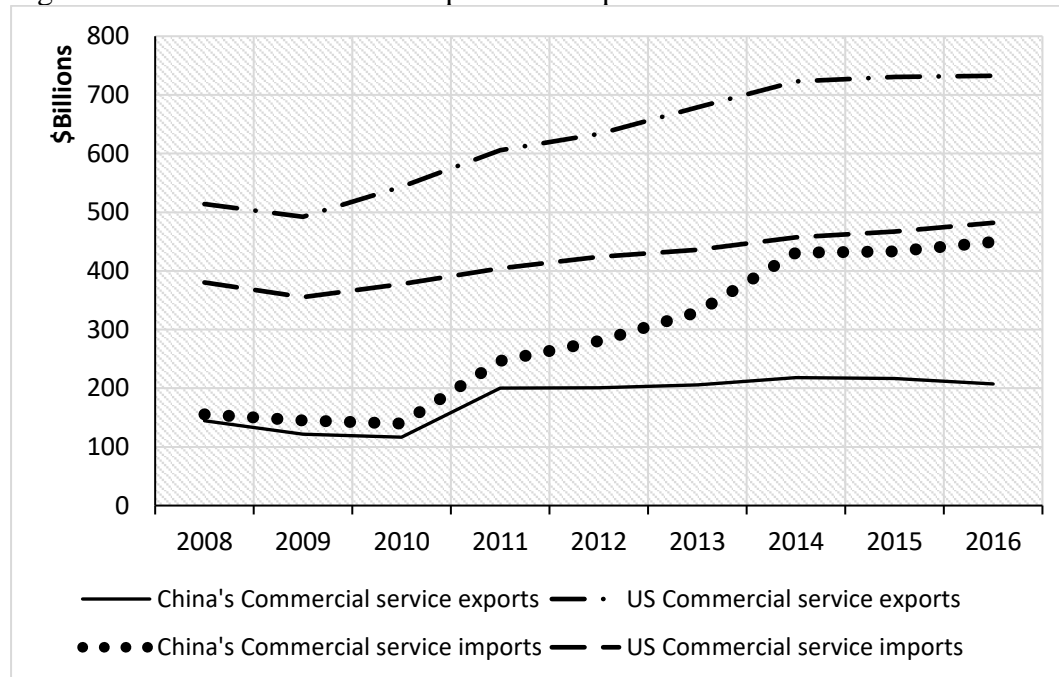
the developed country MNEs) or as a participant (including both western or developing country firms).

To note, the value of IP captured via outsourcing does not only involve the outsourcer and outsourcee countries. As final products are sold globally, the total value captured includes the value embedded in the goods imported to the vendor's country but also those sold globally, whether via the vendor country or not. If the final products are sold via subsidiaries global-wise, the income to the vendor country is represented by the dividends transferred back to the headquarters. For example, the value of income generated by intangibles owned by Apple for the U.S. includes not only the IP value embedded in the exports of iPhones to China but also to all the other countries in the world, which should be transferred back to the Apple headquarters in the U.S. as dividends. This is, nevertheless, a very difficult area for monitoring and supervision by the home country's government. MNEs also have reasons for not transferring their profits in the subsidiaries back to the home countries.

Collaboration. In this method, owners of IPs form alliances with different firms and parties. Here intangibles count as part of the assets. The form of value capture will be a certain percentage of the value-added of the final product which is proportional to the IP's value in the total assets of the alliances. This mode differs from the FDI mode in that it does not require equity investment. This can take different forms. For example, the vendor can issue a licence for use of an IP, but not convert it into equity share nor charge a guaranteed flat licence fee in the traditional way. Instead, the IP owner will gain financial income according to an agreed proportion of the actual sales of the product. Another widely-used form of collaboration occurs when all parties agree to form a consortium to carry out R&D jointly. If successful, their collaboration continues through the phase of production and commercialisation. This may involve bilateral or multilateral collaboration. An example is represented by Sematech, the semiconductor technology consortium in the United States, which includes U.S. firms and some foreign firms at the later stage (Walsh et al., 2016). Another example is China's 3G development consortium which included Datang, Huawei, ZTE and Siemens and some small American firms (Mu and Lee, 2005).

Consulting services. Consulting services are a mode to transfer knowledge to individuals and organisations through the provision of training, consultancy services, or after-sales services for installation, maintenance and repair, etc. Intellectual properties are shared with the recipients (though the owners do not lose them). The value of their IPs is realised through consultancy fees received by service providers. IMF defines services' receipts of a country as economic output of intangible commodities that may be produced, transferred, and consumed at the same time. In 2016, the total international payment for services was as high as \$3777 billion. China paid \$452.6 billion for imports of services and received \$208.4 billion in the same year. In comparison, the United States paid \$504.7 billion for the imports of services and received \$752.4 billion in the same year. Figure 5 reports the commercial services imports and exports in China and the US. Figure 6 shows the balance of trade of commercial services in the US, UK and China. The comparison of China and the US in insurance and financial services and ICT services are reported in Appendix 1, which gives a broadly similar picture. Compared to other methods of IP value capture, the value of IP captured through consulting services is lower partly because the significance of IP in terms of uniqueness and un-replicability is less than IP traded in other forms.

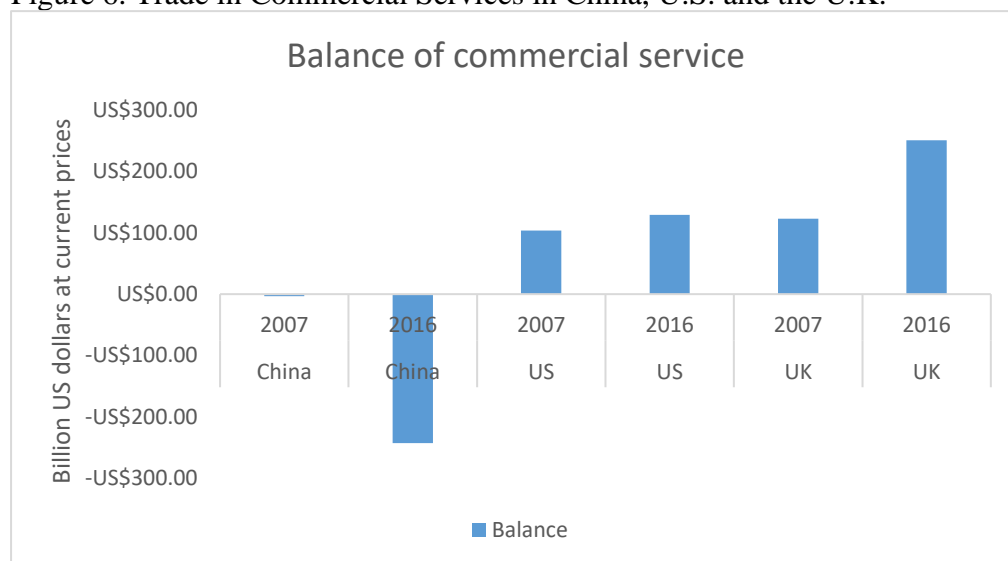
Figure 5. Commercial services imports and exports in China and the U.S.



Source: World Integrated Trade Solution

Notes: Commercial service imports are total service imports minus imports of government services not included elsewhere.

Figure 6. Trade in Commercial Services in China, U.S. and the U.K.



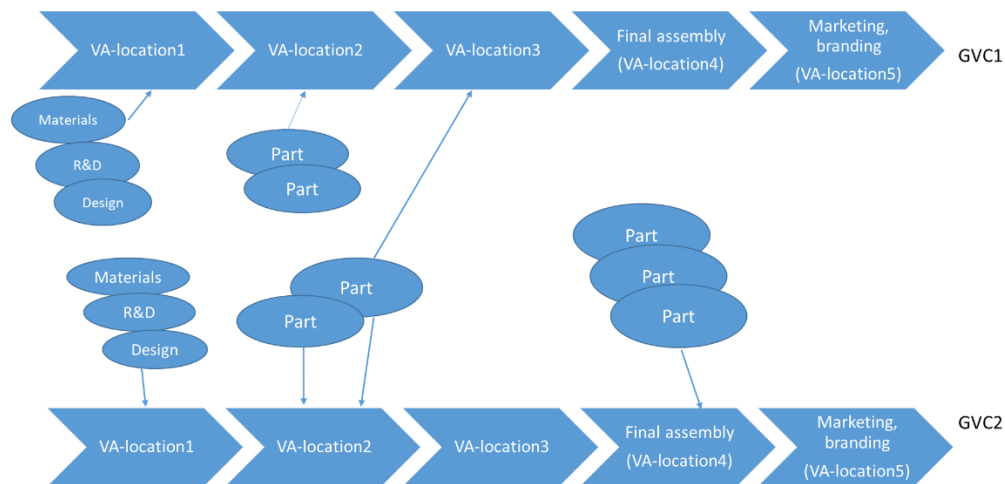
Source: WTO

To note, due to the nature of public goods of knowledge, trade of intangibles may also generate externalities / spillovers along the GVCs, in the same industries, clusters and regions where the activity takes place. While they are normally positive to the local economy, measuring these externalities constitutes a difficult task.

The Integrated Framework of Measurement

Therefore, if we allow for trade in both goods and intangibles and assume that the exports of intangibles take place via all the aforementioned channels, the trade relationship between countries is no longer a linear 2x2 model, but a network model including both the ‘spiders’ and ‘snakes’ (Baldwin and Venables, 2013) instead. We should understand it from a more complicated network perspective, which posts a challenge to trace the trade flows, especially when tangibles and intangibles are both included and nested in a multi-stage, multi-country network (as depicted in Figure 7).

Figure 7. GVC-based network model of international trade



Nevertheless, if we want to understand the trade relationship between country A and B, at least, exports country A to B should include the following:

- (1) Exports of goods recorded under the ‘balance of trade’ of the current account of the international Balance of Payments,
- (2) Royalty fees due to licensing of intangibles recorded as part of factor income under the current account,
- (3) Trade in IP- or knowledge-intensive services recorded as part of factor income under the current account,
- (4) Returns on intangibles capitalised and captured through foreign direct investment recorded also as part of factor income under current account,
- (5) Value-added created via outsourcing and collaboration/alliances activities attributed to intangibles (technology, management capital and brand) recorded in companies’ exports or overseas sales to all other countries.

Correspondingly, the imports into country A from country B should include (1) the imports of goods, (2) the payments for IPs and (3) intangibles-intensive services as well as (4) transferred funds of dividends of MNEs’ subsidiaries as summarised in Table 2.

Table 2. Trade value flows including the trade of intangibles

Trade income	Trade payments
Exports of goods	Imports of goods
IP receipts	IP payments
Commercial services receipts	Commercial services payments
Dividends of MNE subsidiaries, proportion due to intangibles (Factor income in BOP)	Transferred funds of dividends of MNEs from the country
Value-added created via outsourcing and collaboration/alliances which should be attributed to own intangibles recorded in companies' exports or overseas sales to all other countries	

The most challenging part is to trace and record income under channels 4 and 5. For various considerations, e.g. tax avoidance, MNEs may transfer the value to a country where the tax rate is low or almost exempt; for strategic considerations they may invest the income directly in a third country. It is very difficult for the home country to trace or supervise these decisions and behaviours of the MNEs. The income captured through channel 5 may be discovered in theory, but this is very difficult and costly in practice. This is because we have to trace each GVC product by product, calculating the value-added at each stage of the GVC given complex input and output combinations at each stage of the GVC. Moreover, in many cases, strong IP owners use a mixture of methods for IP value capturing, depending on the characteristics of the IP, industry, market, partner and destination market. This makes the tracing and reporting of the value created by IP challenging in practice.

Taking the overall trade balance of the United States as an example, Table 3 reports the detailed breakdown of the cross border trade flows in goods and intangibles. The data of the net flow for the use of intellectual property is collected from the IMF. The data of commercial services are collected from The World Integrated Trade Solution. The data of US inward and outward direct investment are collected from the Bureau of Economic Analysis of the United States Department of Commerce. As transportation services and travel services may involve less trade in intangibles, I only count the net

flow of trade in insurance and financial services and trade in Computer, communications and other services. With regard to the net income from trade in intangibles embedded in FDI, as there is no available data on the net income from intangibles bundled in FDI transaction, we use different estimates to proxy this income. In particular, we assume that the net income of U.S. from exporting intangibles through OFDI accounts for 2% or 3% of the total U.S. investment position abroad, on average. On the other hand, U.S. has also imported intangibles embedded in other countries' FDI position in the U.S. Given US's leadership in intangibles in many sectors, I only included FDI position in U.S. intangible intensive industries: 1) manufacturing, 2) information, 3) professional, scientific, and technical services to exclude FDI flows that does not involve intangible trade. The U.S.' expenditure in importing intangibles through FDI can be proxied by certain return ratio (eg., 2% or 3%) of the total FDI position in these selected industries in the U.S. Of course, these ratios are hypothetical and may vary significantly across industries as suggested by Guvenen et al (2018). Another proximate measure of trade in intangibles through FDI is income of U.S. OFDI and of FDI in U.S., without current-cost adjustment, which is also discussed in Table 3. Finally, the income from intangibles traded through outsourcing is difficult to trace and rarely are comprehensive data available. Therefore, I use only one MNE, Apple Co Ltd., which has published data in annual report and some rigorous research result such as published in WIPO (2017) as an example.

As we can see from Table 3, after adjusting for the income from trade-in-intangibles, in the year 2016, the net trade of the USU.S. taking into account of net trade in goods, in IP licensing, in insurance and financial services, computer, communications and other services, in net income from direct investment overseas (assuming IP income is 2% of USU.S. outward FDI position on a historical-cost basis), in net expenditure from FDI position in the U.S. (assuming IP expenditure is 2% of U.S. FDI position in intangible intensive industries on a historical-cost basis) and non-Americas net income of Apple was USD396.38 358.05 billion in 2016 instead of USD749.93 billion as reported only on the basis of trade in goods; and USD397.15363.42 billion in 2015 instead of USD762.57 billion. To note, this adjustment has not taken into account of the net income of intangibles involved in all other outsourcing activities by USU.S. firms except Apple. This is also estimated on the basis that we assume IP income is 2%

of USU.S. outward FDI position and IP expenditure is 2% of U.S. FDI position in intangible intensive industries. If this share of IP income and expenditure increases to 3%, the net trade deficit of the USU.S. reduces to USD362.21305 billion in 2016 and USD363.54313 billion in 2015, respectively.

Table 3. Balance of trade of the United States (billion US\$)

Indicators	2009	2010	2011	2012	2013	2014	2015	2016
1 Net trade in goods	-509.70	-648.68	-740.64	-741.17	-702.24	-752.17	-762.57	-749.93
2 Charges for the use of intellectual property, Net	67.11	74.97	87.25	85.78	89.18	87.73	84.58	80.06
3 U.S. Direct Investment Abroad: Position on a historical-cost basis	3565.02	3741.91	4050.03	4410.02	4579.71	4910.07	5048.77	5332.23
4 U.S. Direct Investment Abroad: Income Without Current-Cost Adjustment	340.04	417.61	448.24	438.09	448.89	445.82	406.69	409.97
5 2% of U.S. Direct Investment Abroad: Position on a historical-cost basis	71.30	74.84	81.00	88.20	91.59	98.20	100.98	106.64
6 3% of U.S. Direct Investment Abroad: Position on a historical-cost basis	106.95	112.26	121.50	132.30	137.39	147.30	151.46	159.97
7 Foreign Direct Investment Position in the United States on a Historical-Cost Basis (Selected intangible intensive industries: Manufacturing; Information; Professional, scientific, and technical services)	909.31	972.30	972.60	1080.82	1216.27	1392.17	1686.24	1916.12
8 Foreign Direct Investment: Income Without Current-Cost Adjustment	97.99	145.09	165.97	160.33	168.24	177.29	148.34	159.75
9 2% of Foreign Direct Investment Position in the United States on a Historical-Cost Basis (Selected industries: ibid)	18.19	19.45	19.45	21.62	24.33	27.84	33.72	38.32
10 3% of Foreign Direct Investment Position in the United States on a Historical-Cost Basis (Selected industries: ibid)	27.28	29.17	29.18	32.42	36.49	41.77	50.59	57.48
11 Trade in Commercial service, Net	136.84	166.20	201.12	209.43	242.89	265.90	263.46	250.60
12 Trade in Transport services, Net	-1.94	-2.97	-1.55	-1.04	-3.86	-3.46	-9.83	-12.54
13 Trade in Insurance and financial services, Net	0.81	9.77	20.36	21.26	36.86	48.29	46.67	40.86
14 Trade in Travel services, Net	38.48	50.39	61.17	61.30	79.36	85.80	91.65	85.31
15 Trade in Computer, communications and other services, Net	99.50	109.02	121.14	127.91	130.52	135.27	134.96	136.97
16 Apple Non Americas net profits							31.95	27.34
Total of intangibles net income except outsourcing 2+4-8+13+15	409.47	466.28	511.02	512.71	537.22	539.82	524.57	508.11
Total of intangibles net income except outsourcing 2+5-9+13+15	220.53	249.15	290.30	301.53	323.82	341.65	333.47	326.21
Total of intangibles net income except outsourcing 2+6-10+13+15	247.09	276.85	321.07	334.83	357.46	376.82	367.08	360.38
Total of intangibles net income except outsourcing 2+6-10+13+15+16							399.03	387.72
Net trade overall 1+2+4-8+13+15	-100.23	-182.40	-229.62	-228.46	-165.03	-212.35	-238.01	-241.82

Net trade overall 1+2+5-9+13+15	-289.17	-399.53	-450.34	-439.64	-378.42	-410.52	-429.10	-423.72
Net trade overall 1+2+6-10+13+15	-262.61	-371.83	-419.57	-406.34	-344.78	-375.35	-395.49	-389.55
Net trade overall 1+2+5-9+13+15+16							-397.15	-396.38
Net trade overall 1+2+6-10+13+15+16							-363.54	-362.21

Note: The current-cost adjustment is an adjustment to earnings that converts depreciation reported for financial accounting purposes to a measure more consistent with economic accounting principles.

Sources: 1: The World Integrated Trade Solution; 2: International Monetary Fund, Balance of Payments Statistics Yearbook and data files; 3, 4 & 8: The Bureau of Economic Analysis of the United States Department of Commerce; 5, 6, 7, 9 & 10: The Bureau of Economic Analysis of the United States Department of Commerce, author's calculation; 11, 12, 13, 14 & 15: The World Integrated Trade Solution, author's calculation; 16: Apple annual report, estimated as average profit ratio times non-Americas net sales.

5. Conclusions

This paper attempts to integrate the literature on technology, international trade and global value chains, and develop an analytical framework of global trade that integrates trade-in-intangibles and trade-in-goods in the context of globalisation and fragmentation of production activities and increasing trade in intangibles. Through in-depth discussions of the five modes through which trade-in-tangibles are carried out, it develops a framework of international trade statistics from the perspective of global value chains. Applying this framework to the trade balances of the United States, it finds that after adjusting for the income from trade-in-intangibles, in the year 2016, the net trade of the U.S. taking into account of net trade in goods, in IP licensing, in insurance and financial services, computer, communications and other services, in net income from direct investment (income from OFDI minus payment for inward FDI, assuming IP income is 2% of FDI position on a historical-cost basis), and non-Americas net income of Apple was USD396.38 billion in 2016 instead of USD749.93 billion as reported only on the basis of trade in goods; and USD397.15 billion in 2015 instead of USD762.57 billion. If we further adjust for the net income of intangibles involved in all other outsourcing activities by U.S. firms except Apple, the size of the trade deficit of the U.S. will be even smaller. The paper therefore argues that the global trade imbalance and policy responses to solve it should be discussed on the basis of a framework that fully incorporates different types of trade activities in the 21st century.

This framework of trade measurement provides a useful lens for us to understand the broad picture of international trade in the 21st century. The balance of trade in goods no longer presents a good indicator of the trade relationship between countries, not even when it is expanded to include the trade in services. The various avenues of the trade in intangibles should also be considered in the big picture. A possible solution is a combination of reliable self-reporting systems by each of the companies involved in the GVCs and digital technologies. For example, we can use Internet of Things to link and trace the various inputs and outputs and use Big Data technology to cross-check the accuracy of the reported data and to make inference and fill up missing data. International cooperation on establishing the standards and on implementation is a

critical pre-condition for this new framework and data collection to be feasible and reliable.

Findings from the research has significant policy implications. Firstly, findings of the research contributes to the discussion on how to measure globalisation. It suggests that globalisation shall be measured not only by increasing interaction and integration of the flows of goods, investment and services, but also the flow of intangibles which is more complicated to trace and measure.

Secondly, findings of the research shed light to the debate on the impact of globalisation and the policy measures to make a more inclusive globalisation. In recent years, globalisation has been blamed as an important cause to the increasing inequality in the developed countries. The tide of anti-globalisation has been seen in some major industrialised countries. International trade in goods has been the target of attack. Trade and investment protectionism is on the rise. Findings from the research suggests that global economic imbalance is not as severe as suggested by the statistics of trade in goods. In fact, the industrialised countries have a huge surplus in trade in intangibles. The problem is that the benefits of trade in intangibles are highly concentrated to the a few owners of the intangibles and a small community of skilled researchers or technicians who created them. Therefore, a re-distribution of income from the entities who gained greatly from the trade in intangibles to the rest of the society is crucial to reduce the inequalities. Tax avoidance by depositing these benefits at different locations globally should be curbed.

Finally, findings from this research also contribute to the discussion on trade imbalance. We shall take a holistic view to look at international trade from GVC perspective. The policy measures to address the trade imbalance between the industrialised (the U.S. for example) and some developing countries (China for example) shall be developed on a true picture that presents the comprehensive trade interactions between the two countries. Based on the analysis in this paper, the true trade deficit for the U.S. against China is significantly less than the acknowledged \$357 billion in 2017. Therefore, the target for deficit reduction negotiation should be conducted on this basis. Moreover, as a policy tool, increase the exports of intangibles, not only the increase of exports of

high-technology products, is another policy tool for consideration for the governments in the two countries.

Future research should further develop this GVC network based trade model, build up necessary data collection system, standard and a global data base, from major GVCs to all GVCs and to all types of GVC and non-GVC-based trade, analysis how position of the countries in the GVCs affect their capacity to capture and share value-added, how the recent technological revolutions may radically reshape the GVC organisation, and change the position of countries in the GVCs, and also how this technological revolution may affect the value distribution between participating countries, and how this would affect income distributions between countries, and on developing countries' efforts of upgrading, and what regulatory conditions are needed for such intangibles and goods integrated trade framework to work, what is the role of IPR protection and what are the regulations are needed to ensure the generate and share and use of reliable data for good?

Reference

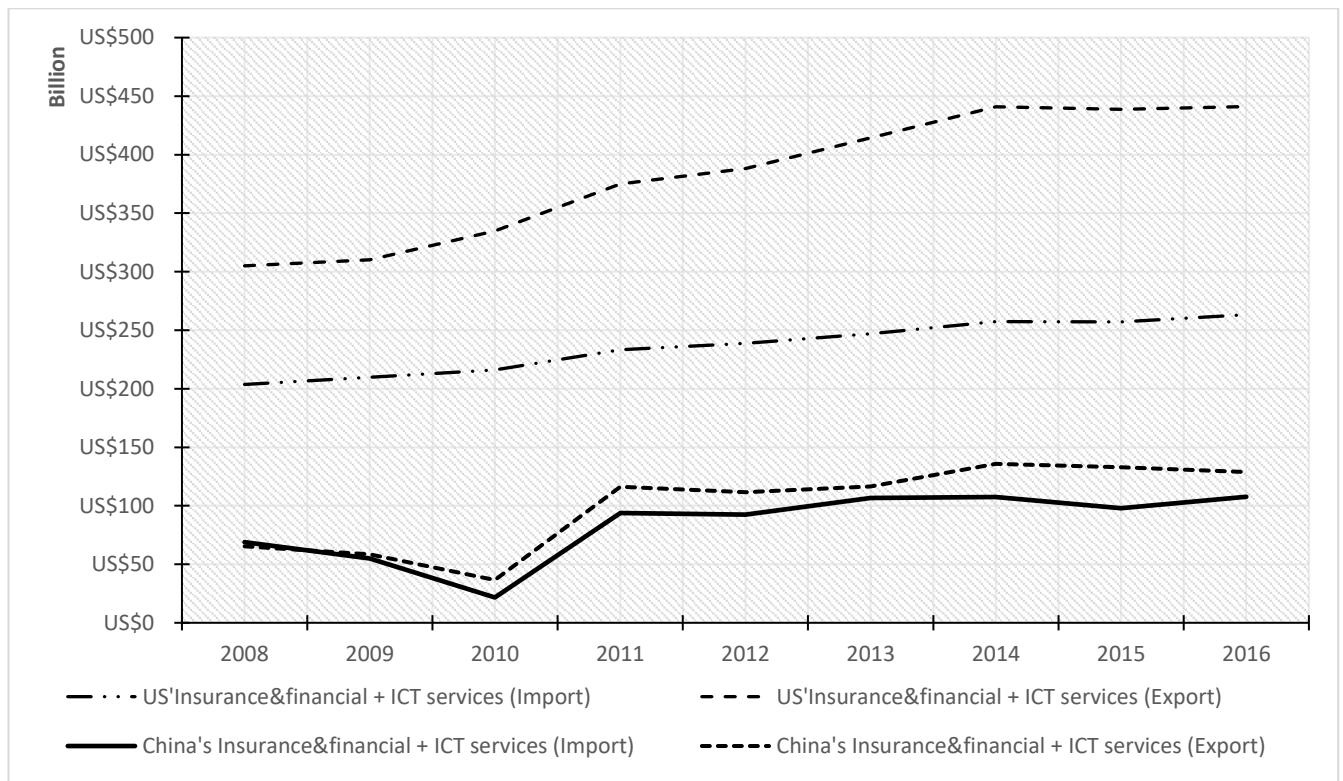
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Appendix

Figure 1A. Trade in insurance & financial services and ICT services: US and China



Source: World Integrated Trade Solution