What do Multinationals do?
The structure of multinational firms' international activities

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Abstract

Analyses of multinational enterprises have generally shifted from a capital-market perspective to viewing them as real production units. Yet we still have difficulties in answering a basic question: what do multinational enterprises do? Here we seek some broad, general answers about the structure of multinational firms' international activities. By structure, we include (a) the geography distribution of a firm's activities, (b) activities performed by various branches, (c) where do foreign affiliates sell their outputs and purchase their inputs, and (d) interactions among establishments. Much of our analysis relates to which of two archetypes is dominant: (1) horizontal structures in which foreign affiliates replicate the firm's core activities and serve local and regional markets, (2) vertical structures in which foreign affiliates perform different activities and act as links in a global production chain. Examining this from a variety of perspectives, we find that horizontal replication dominates vertical fragmentation. The final section of the paper discusses intangible assets and other service flows between parents and affiliates. Smoking-gun evidence suggests that these are large, particularly compared to intra-firm trade in goods. Despite this, their importance is undervalued, likely due to severe measurement difficulties.

Key Words: multinational firms, horizontal replication, vertical fragmentation, global value chains, intangible assets.

JEL codes: F23, F12

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Introduction

When thinking about multinational enterprises (MNEs) several questions come to mind, including why some firms become multinationals, how policies influence a country's attractiveness to firms, and how MNEs affect both the home countries from which they come and the host countries where they go. Central to the answers to these questions is how multinationals structure their global activities. One way to envision that structure is as a snake. Each part of the snake performs a separate activity, all of which adds up to a well-functioning whole. The head decides where to go, the mouth swallows food, and the spine twists for movement. Similarly, a firm may organize itself so that different affiliates perform different activities which combine together to produce a finished output.

Alternatively, the structure can be more like an octopus. Each of the octopus's arms does essentially the same thing, with its head coordinating the movements. Here, the MNE's various affiliates replicate each other with guidance from the home headquarters. Thus, just as animals can be structured in different ways, so too can firms.

Understanding the firm's structure helps explain why the bulk of activity is in developed countries, why trade policy can have conflicting effects on investment, why some firms (but not all) die when an affiliate runs into trouble, and how increased foreign direct investment (FDI) potentially affects labor markets.

In this paper, we provide a broad framework describing how different parts of an MNE fit into one another and what the data suggest about the relative importance of alternative structures. This exercise points toward a particularly important role for horizontal FDI, an octopus-like structure in which the MNE performs a roughly similar activity in its different affiliates, that is, it replicates its activities across borders. Knowing that can then help explain all sorts of key issues, such as why, despite decades of warnings, a negative link between outbound FDI and home wages is not generally evident.

This paper begins with definitions, concepts, and clarifications of some basic terms. First, a multinational firm has equity interests in establishments, such as plants or offices, in foreign countries. The key here is ownership, with a standard definition of ownership as when a single individual owns at least 10 percent or more of the equity. When that owner is in a different country than the establishment, this counts as FDI. Some large firms have extensive business with foreign customers and suppliers via contracts and other arrangements, but do not actually own those activities. As such, they are not normally defined as MNEs and, importantly, they are not included in the multinational data sets that are the focus in this paper.

Abstracting from the considerable heterogeneity among firms, the most primal form of an MNE consists of a headquarters (parent) in the home country and at least one foreign affiliate in a host country. A key aspect of this relationship is that the parent generally supplies intangible assets and other services (for example, management, technology, intellectual property, marketing and finance) to the foreign affiliate. The firm's headquarters is a net exporter of these intangibles and services to affiliates and those affiliates are net suppliers of goods (final or intermediate) or services (for example, legal, accounting, advertising affiliates, etc.) to customers. Profits, or the returns to intangibles and other services, flow from affiliates to parents. Thus, much intra-firm trade is not in physical intermediate or final goods.

These service flows are often or even typically poorly measured and documented, confounding attempts to fully understand the functioning of multinationals. The headquarters can of course also produce goods or services that it sells at home and/or exports to affiliates or third parties.[1] Affiliates produce goods and/or services and occasionally conduct some of

[1] When we say "production" we mean the production of goods and/or services, unless otherwise noted.

their own research and development (R&D). Many affiliates are exclusively in service industries, though their services tend to be more customer oriented than are headquarter services. This, however, is a description of what the different parts of the firm do, not how they relate or compare to one another, in other words, the structure of the MNE's global activities.

Four characteristics help define the structure of a multinational firm. The first is the geographic distribution of a firm's establishments. The second is the activities performed by the various establishments, including their value added and whether outputs are final or intermediate goods and services. A third is where the foreign affiliate sells its outputs (locally in the host market, exported to the home country, and/or exported to third countries) and from where it purchases inputs. A final characteristic is the interactions among establishments, that is, the intra-firm flows of goods, services, and intangibles. The first goal of this paper is to bring these together into a handful of archetypes that provide a lens for viewing the data. Doing so generates two main MNE structures: the snake-like vertical MNE (where different affiliates do different things) and the octopus-like horizontal MNE (where affiliates replicate activities).

The second aim is assembling and analyzing broad quantitative and qualitative data on these two structures for US MNEs and their foreign affiliates. Although we focus on US data, both because of data quality and to simplify exposition, it includes the experience of other nations as appropriate to show that what is found for the United States the other major sources of FDI. In doing this, we identify general characteristics and patterns rather than emphasizing the specific experience of individual firms, industries, or countries. Our goal is to highlight which general concepts are most important to the data (including beliefs perhaps widely held but not supported by data) as well as areas where the data are as yet underdeveloped. The data analysis therefore operates on a more aggregate level than is done

with case studies in order to arrive at this broad vision. When doing so, the bulk of the evidence suggests horizontal FDI plays a dominant role in the aggregate data.

Finally, in focusing on the structure and patterns of multinational activity, we do not consider several other important firm decisions. These could be characterized as earlier-stage firm choices. Specifically, we do not examine the firm's choice of whether to produce at home or abroad, generally referred to as the offshoring decision. We also set aside the ownership decision, also known as outsourcing versus vertical integration, which concerns whether to own the foreign affiliate or contract with local firms for the work. These topics are dealt with elsewhere in this volume. Further, we do not explore the choice of where to locate foreign affiliates in detail except insofar as it relates to the central discussion of MNE structure. Therefore, issues such as the role of tax policy in the location decision are omitted.

The next section lays out two main MNE structures: horizontal (activity is replicated across borders) and vertical (the production process is fragmented). It also discusses some of their more prominent offshoots and develops a set of predictions for which patterns in the data are most consistent with one structure or another. The third section analyzes primarily US data to gain an insight into which structure appears to dominate the FDI landscape, finding that most FDI is horizontal. The fourth section introduces a new approach based on global value chains (GVC), which supports and extends the insights of the third section. The fifth section focuses on the issue of intangible assets in order to point to the limitations of the current data and the need for future research. The final section concludes by suggesting how understanding these structures is likely important for policy.

Structural Archetypes and Predictions

Two main structures for MNE activity have been developed over the past forty years:

horizontal and vertical FDI.[2] The fundamental difference between the two is one of differentiation versus replication. Most people's initial instinct is to imagine that an MNE is vertical (a snake), performing different activities across its different affiliates, fragmenting its production process. The classic example of a vertical MNE is an apparel company such as Nike. It designs apparel in the United States, produces it in countries like China or Vietnam, and then ships it to a Nike-owned store in Europe for sale to consumers. This vertical structure is a natural embodiment of the GVC with each step in the process contributing to a final good. The key to this structure is that each stage of the GVC performs a different activity, with the different stages located in different countries.

In contrast, a horizontal MNE (an octopus) replicates key parts of its production process across borders. For example, Toyota may design its car in Japan and use this blueprint to produce cars in Japan, the United States, and the United Kingdom. While the cars are designed in one location, and thus there is still an element of a supply chain in the firm's structure, the major part of its activities, here the manufacturing of the cars, is repeated in different countries.

In addition to manufacturing industries such as autos, cement and chemicals, many service firms and industries closely fit the horizontal structure. Fast food restaurants, hotels, accounting, and consulting and legal services all perform roughly the same activities in many countries and as well as within countries. Indeed, replication is a key attraction of chain fast food; its familiarity appeals to customers even when the chain is foreign-owned. As an example, in 2018, there were 5,910 KFC outlets (Xinhua, 2019) and 2,700 McDonald's in China (Ross, 2020). Vertical examples include the maquiladora factories in Mexico, where

[2] The seminal horizontal model was laid out in Markusen (1984) while the vertical model was formalized in Helpman (1984). Since then numerous extensions and variants have been developed, too many to adequately cover here except the main updates to the models discussed below.

parts, components and other intermediates are assembled and the final output exported. Domestic value added is about 15 percent of output, imported intermediates are about 80 percent to 90 percent of all intermediates used by these plants, and virtually all output is exported. Business-process outsourcing is an example of vertical production in services. Industries ranging from banks to airlines can locate routine white-collar activities ranging from payroll, to data entry to call centers in places like India, the Philippines or Ireland.[3]

While this distinction may initially seem minor, it has fundamental implications for what would be expected in the data. There are three differences between the two structures: relative input costs in the home and host countries, the location of sales, and the relationship between FDI in one host and FDI in other hosts. The first two build from the same question: why choose FDI rather than simply producing at home? That last is more relevant to why the firm has invested in a particular host as opposed to another one.

Why do firms choose to become a multinational in the first place? The answer is somewhat different for horizontal and vertical MNEs. A common assumption is that firms choose to become MNEs because labor is cheaper overseas than at home. This idea naturally extends to any inputs the firm uses in its production process (including raw materials), but the intuition is the same: An input is cheaper in the foreign country than at home. If this were true for the entire production process, the firm might be best off entirely relocating to that foreign location. But then it would not be an MNE since it would entirely operate in the host,

[3] For many cases of both horizontal and vertical international production, firms do not actually own the foreign production partner. Some fast food restaurants and hotel are franchises. Many firms outsource relatively simple and low-skilled production and final assembly to independent contractors or licensees. This includes manufacturers of clothing and footwear as well as the assembly of sophisticated electronic goods such as smart phones. When the multinational does not have an equity interest in the foreign producer, that activity is not in the foreign affiliate data we exploit in this paper, and there is no obvious way to measure it.

without cross-border ownership. Instead, for FDI to make sense, it must be that *some* inputs are cheaper at home while *other* inputs are cheaper in the host. Put differently, firms locate different stages of the production process in various countries because each location is the least expensive for that particular stage of production. Thus, differences in costs across borders drive vertical FDI.

If cost differences are indeed a driving force, then vertical FDI makes sense only when countries are different from one another. The classic example, Helpman (1984), is when a firm in a highly skilled developed country invests in a host country where low-skill labor is abundant. In this case, the developed country serves as the home since its abundance of high-skill workers makes it the natural place to focus on innovative activity, including the development of intangible assets. Assembly workers in the less-developed country, meanwhile earn low wages, making it the natural location to produce the finished good. Thus, vertical FDI will flow from developed to developing countries since this allows the firm to fragment its GVC and take advantage of the production-cost differentials across borders. The output can then be sold wherever consumers are located. In particular, given the relative wealth in the home country, a good deal of MNE output would be exported from the host back to the home country. This structure then closely fits the example of Nike.

Note that this cost savings is driven by production costs. A second source of costs is delivering output to consumers. In some cases, these costs can be quite daunting. One example is when the good is very difficult to transport because of its weight (for example, concrete) or its delicacy (such as fresh foods). Another example of trade costs are policy barriers such as quotas or tariffs. For example, when the United States imposed severe trade restrictions on Japanese auto imports in the 1980s many Japanese firms jumped the tariff wall and began producing in the United States for US consumers rather than continuing to import from elsewhere. Third, it may be that to effectively compete in a market, a firm must have a

local presence to read the market's desires and effectively distribute its product to local consumers.

In each these cases, even if producing in the host does not bring cost savings, there can be a significant savings in terms of serving the market. Just as these savings encourage production in the host, they likewise encourage production at home since it would be comparably costly to serve the home market from a distance. These factors then result in a horizontal MNE structure where the firm produces its final product in both home and host with each production location's output geared toward local sales. This replication is the trademark of the horizontal MNE. In addition, the parent of the MNE generates intangibles such as designs or trademarks and uses this joint input across the two affiliates (where the jointness refers to its use in multiple locations at once). Since the parent produces both output and the joint input, the affiliate is not a carbon-copy of the parent. Instead, the horizontal MNE is marked by a significant overlap in the activities of the parent and affiliate, with similar activities being carried out across borders.

As with the vertical MNE, this pattern generates two predictions for where horizontal FDI is most likely to thrive. Vertical FDI, in which different production processes occur in different countries, works best between developed and developing countries, that is, when countries differ from one another. Horizontal FDI, however, replicates processes across borders. This makes sense when costs are *not* very different across countries. Thus, horizontal FDI should be found when the home and host are similar to one another. This is one of the key insights of Markusen (1984), who shows that horizontal FDI can even happen when the two countries are identical to one another. Further, given the importance of developing intangible assets, a skill-intensive endeavor, horizontal FDI tends to be a found between developed countries. In addition, there is a clear difference in where affiliate output is sold. In vertical FDI, a sizable share of output is shipped back to the rich home consumers. In

contrast, horizontal affiliate output is sold locally since the desire to access those consumers is the entire point of this MNE structure.

There are thus two ways to distinguish between the horizontal and vertical structures in the data: a comparison of the costs between the home and host country (often proxied by differences in skill levels or other measures of the development of the home and host) and analysis of whether affiliate output is sold locally or exported to home.

Up to this point, these two archetypes have focused on a setting with only two countries, the home and host. This is obviously a simplification and one which, when relaxed, offers a third way to distinguish between vertical differentiation and horizontal replication. When opening the model to third countries, vertical FDI can be broadened by introducing further fragmentation of the GVC. It is most natural to think about linear GVCs, for example, where silicon is converted into computer chips which are then exported to a factory where they are installed on motherboards that are then shipped to another facility for assembly into a laptop. Another possibility is that the chips and motherboards are produced separately and then the installation and assembly happen in a central location.

Baldwin and Venables (2013) discuss these alternative vertical structures, labeling the first, linear structure a "snake" and the second, hub-and-spoke approach a "spider." The spider differs from a horizontal MNE since, in a spider, the intermediates flow to the central "body" whereas in the horizontal GVC intermediates flow from the central parent to the affiliates. In any case, both complex vertical structures are again based on differentiation since each affiliate performs a different part of the overall process which is brought together through international trade.[4]

Opening the basic horizontal structure to third countries means gaining access to more

[4] See the work of Bergstrand and Egger (2007) for a complete treatment of complex vertical FDI.

consumers.[5] These additional consumers can be served by not only exporting from the parent or producing in this new third country, but also by exporting from an affiliate in a nearby host. For example, a US firm operating in Ireland has access to Irish consumers but also, and perhaps more importantly, consumers in the European Union who can be served by the Irish affiliate without being troubled by the tariffs and quotas that apply to imports from non-member countries. Thus, this export-platform investment is attracted not only by the host's consumers but by those in nearby countries, what is sometimes referred to as surrounding market potential.

For example, as detailed by Barry (2004), US software firms including Microsoft have affiliates in Ireland that duplicate and package software, provided by the parent firm, with that output destined for the European market.[6] Likewise, to achieve "just in time" manufacturing, Dell has located affiliates in the United States, Ireland, China, and other countries so it can assemble the same computers near regional consumers. Nevertheless, the central feature of export-platform FDI is the same as in the simpler horizontal structure—the replication of key activities across barriers. In the Microsoft example, it is still the case that the Irish affiliate is designed to replicate US production for overseas consumers. This then fits well with the octopus analogy in which the central head guides the activities of the arms all of which are capable of essentially the same thing.[7]

Together, these extended versions of the horizontal and vertical models provide two additional predictions for the data. The first relates to the substitutability or complementarity of investment across hosts (as opposed to between a given host and the home country). If an

[5] For a full discussion, see the work of Ekholm, et al. (2007).

[6] He notes a similar strategy for pharmaceutical companies, including Pfizer and Merck.

[7] Indeed, since affiliates generally operate with a fair degree of autonomy, the giant Pacific octopus is especially relevant since it has nine brains: one central and one for each of the somewhat autonomous arms.

MNE has a complex vertical structure, it is integrated via trade between its affiliates (either from one link to the next in a snake structure or from various links to the central node in the spider structure). This works best when trade barriers are low between hosts, suggesting that investment in one host makes the most sense if there is also investment in other nearby hosts. This results in a complimentary relationship in FDI across hosts. If an MNE has an export-platform structure, FDI in one host is a substitute for FDI in another nearby host. The reason is that the consumers in one country can be served reasonably well by the affiliate in the proximate host. Thus, examining the complementary or substitutability of FDI across hosts offers another way of judging whether FDI structures fragment the GVC or replicate it. In addition, since the export-platform structure is again geared for local sales (where "local" now refers to the host's region), then significant sales in third countries provide a further clue to the nature of MNE structures.

The next section develops a set of stylized facts that provide insight into which of the two core structures—vertical fragmentation or horizontal replication—dominates FDI activity. It is important to recall that the flow of intangibles is a critical aspect of the overall integration of a firm. In the vertical MNE, the parent firm often provides services to the next link in its GVC. The same is true for the horizontal firm, with the difference being that in the horizontal MNE those services are used jointly across affiliates. Thus, neither of these models require actual physical exports by the parent to its affiliates nor do they contradict the description of the prototypical MNE. Both structures, however, do suggest a critical role in the export of intangibles from the parent to the affiliate, which the fifth section addresses.[8]

Using US Data to Distinguish Structures

This section discusses, in turn, three methods of distinguishing across FDI

[8] This flow refers to where the intangible is generated not where it is "located" for tax purposes, an issue at the heart of the taxation of FDI taken up elsewhere in this volume.

structures—differences between the home and host, the destinations of affiliate sales, and the substitutability or complementarity of affiliate activity.

The early work attempting to distinguish horizontal from vertical FDI often relied on differences in factor endowments, such as land, labor, and capital, as a proxy for cost differences. This work predicted that horizontal investment should be more common between developed countries whereas vertical FDI should be prevalent from developed to developing countries. Even a brief look at the data finds that the bulk of FDI is between developed countries, consistent with horizontal FDI. Figure 1 presents the United Nations Conference on Trade and Development's (UNCTAD's) data on US stocks of inbound and outbound FDI, decomposed between developed and developing countries.[9] From this, two things are readily apparent. First, most US investment comes from and goes to other developed countries, strongly suggestive of horizontal FDI. Second, although the United States does invest a growing amount in developing countries, showing that vertical FDI is important, FDI in the United States from developing countries remains negligible. This is consistent with the idea the vertical FDI should primarily originate in skill-abundant developed countries but be hosted by developing nations.

Further, these patterns are not only evident in the US data. Figure 2 also uses UNCTAD data but looks at inbound and outbound FDI stocks by country group. This figure

[9] These data come from https://unctad.org. Stocks measure the value of foreign-owned equity, retained earnings, and net loans, at their historical cost value. While this can roughly be considered the "capital" of the MNE, it should be taken as an approximation because of depreciation. In addition, it is only a rough approximation of the value of investment since the productivity and intensity of capital can vary across countries and industries. These issues do not arise for affiliate sales, however, which are potentially more prone to year-on-year fluctuations relative to more stable FDI stocks. The two give fairly similar pictures of FDI, although as discussed by Davies (2008), the stocks may give more prominence to investment in developing countries.

is unable to break the investment down by origin (for inbound) or destination (for outbound) investment, since the bulk of FDI comes from and goes to developed countries. But the figure shows that MNEs operate primarily between developed countries. While simple data analysis such as this can mask other underlying forces, these same patterns are found in econometric analyses that specifically control for other factors such as the wealth of consumers and the geographic distribution of developed countries.

Studies building from the integrated horizontal and vertical analysis of Markusen (2002) find that the bulk of investment is between countries with similar shares of skilled labor (see, for example, Markusen and Maskus (1999) or Blonigen, Davies, and Head (2003)). While evidence of vertical FDI can be found by using this approach (for example, Davies (2008)), the empirical evidence strongly suggests FDI is primarily between the skilled countries, a result most consistent with horizontal FDI as the dominant structure for MNE activity.

The second approach to distinguishing horizontal from vertical is via affiliate sales. Tables 1 through 3, which use publicly available data drawn and condensed from the US Department of Commerce's Bureau of Economic Analysis (BEA), provide some evidence and answers.[10] The data are for majority-owned foreign affiliates, that is, for US outbound FDI. The BEA data also provide a quick perspective on the importance of foreign-affiliate production in total. The upper right panel of Table 1 shows the value of US foreign affiliate supply of goods and services as a proportion of total US exports of goods and services, respectively. The supply of goods from US majority-owned foreign affiliates is about 2.8 times the total value of US exports, and the supply of services by foreign affiliates is about 2.3 times the value of US exports. Some affiliate sales embody imports from the United

[10] These can be found at https://www.bea.gov/data/intl-trade-investment.

States so there is some double counting, but affiliate imports from the United States are small and, conversely, some foreign content is embodied in US goods exports.

Table 1 presents data on the destination of affiliate sales in the top left panel. Sales to the host-country market are about 60 percent of total affiliate sales, with the share for goods lower and the share for services higher. While this means a large proportion of sales (about 40 percent) is exported, the second and third columns of Table 1 show that most of the exports go to third countries, not back to the United States. Sales back to the United States account for only about 11 percent of total sales. Detailed statistics on intra-firm trade are not reported, but the available data show that both intra-firm imports and exports of goods by affiliates are a very small proportion of total affiliate goods sales. Exports of goods from parents to affiliates are only 5.6 percent of total affiliate-goods sales, while exports of goods from affiliates to parents are only 8.5 percent of affiliate-goods sales.[11] These numbers on intra-firm trade and total affiliate exports likely are smaller than what many would guess. In any case, the primary market for US affiliates abroad clearly is not the United States as the vertical model would suggest.

The bottom panel of Table 1 digs deeper by showing the relative importance of goods versus services in affiliate production. The motivation for including this is that many international economists, perhaps because of data availability, continue to focus empirical analysis on goods, specifically manufacturing. But that focus has distorted the view of MNE activity. The bottom panel shows that goods account for 72 percent of affiliate sales. That said, goods production uses many more purchased intermediate inputs than services do. This is why the second column reveals that, measured by value added, the value of goods and services are about the same. This suggests a "double counting" of sales in goods because of

[11] In French data, Davies, et al. (2018) find that, even when there is an affiliate in a destination country, one-third of MNEs engage in no intra-firm trade to those countries and export only at arms-length.

trade in intermediates. Indeed, this double counting of trade is one reason why trade fell so sharply following the economic crisis of 2007 (Behms, Johnson, and Yi (2011)) even though services trade did not fall sharply (Ariu (2016)). Finally, services are more labor intensive than goods (the authors' interpretation), and the third column shows that, measured by affiliate employment, services are much more important than goods. So, focusing on trade in goods misses a crucial aspect of MNE activity.

Table 2 provides more detail on the destination of affiliate sales by dividing the world into six regions. The first row gives the world total for reference and is the same as the first row in Table 1. The first column of Table 2 emphasizes that US affiliate production abroad is a first-world phenomenon. Furthermore, sales are highly concentrated in the rich regions of the world.[12] This is generally interpreted as another hint that foreign affiliates are likely dominated by horizontal affiliates that are producing goods and services similar to those produced in the (rich) United States.

The second column of Table 2 shows the local (host country) share of sales in each region. These numbers are similar across the regions. The share for Europe is low, but the third column, which lists the share sold to third countries, reveals the cause. Much European production is sold to third countries, a result suggestive of export-platform FDI and something examine more in Table 3 below. The fourth column shows the share exported back to the United States (including all US customers, not just intra-firm exports). These numbers are also consistently small and continue to tell the same story: multinational affiliates are not primarily created for low-cost production to ship back home.

The biggest share for exports back to the United States is for Canada (at 20 percent), which is not surprising. Economists have emphasized the importance of within-plant

[12] It should be noted that the Asia-Pacific data do not have information for most of the poorer countries of southeast, south and central Asia, with Indonesia being the lowest income country in the data.

specialization between the United States and Canada, with, for example, plants in the auto industry dedicated to limited numbers of models and parts that are then freely traded across the border (a fairly horizontal structure). It is worth noting that this share of US sales outstrips that of Latin America where the lower wages would be the most fertile ground for vertical investment. Thus, again the sales data suggest horizontal dominance.

The lower panel of Table 2 provides some historical perspective on the shares of affiliate sales. What is interesting and important is that these shares have changed little over thirty years. In particular, the share of sales back to the United States has remained at 10 percent to 12 percent over the entire period. The local share of sales has declined some, but this has been offset by sales to third countries. A conjecture is that falling trade barriers and transport costs have allowed firms to more easily serve nearby countries from a single plant or office in one country (that is, export-platform FDI).

The data in this lower panel of Table 2 belie an expectation—from discussions among economists and in the business press about growing fragmentation and global value chains—that cross-border trade by multinationals has grown considerably. However, even if all the increase in sales to third countries is part of complex vertical FDI, Table 2 confirms that serving local and regional markets remains the principal task of foreign affiliates. Thus, even as technological and policy changes have made vertical FDI easier, the data indicate that horizontal FDI's importance has held steady for a very long time.[13]

Table 3 sheds light on third-country sales by foreign affiliates, which account for about 30 percent of total sales. Here Canada, where third-country sales are understandably very small, is excluded so as to concentrate on own-region third-country sales. The first column of Table 3 lists the share of third-country sales that are generated in each region and

[13] Just in case you were interested, the first octopuses appeared on earth roughly 500 million years ago; snakes arrived on the scene only 100 million years ago.

shows that the overwhelming portion of third-country sales are by affiliates in Europe and the Asia-Pacific region. Together, these two regions account for 90 percent of total third-country sales by US affiliates, considerably larger than their proportion of total sales (74 percent).

The real insight of Table 3, however, is in the second column, which shows that the most of these third-country sales are intra-regional, that is, what is produced in Europe is sold in Europe. Overall, 75 percent of world third-country sales stay in the same region. For Europe and Asia-Pacific the figure is 80 percent. This is again indicative of export-platform investment, particularly in wealthy Europe (which as illustrated by Figure 1 is a major destination for US FDI).

Although the BEA data do not identify the specific country that is the destination of third-country sales, the regional numbers point toward US MNEs establishing affiliates in one country to serve all of Europe, that is, export-platform FDI. Firms determine which specific country (or countries) based on cost and other considerations. These could include centrality, labor costs, taxes and so forth. While some business leaders argue that tax issues are second-order considerations, three European countries are particularly export-platform oriented as shown here:

	Local share	Third-country share
Ireland	18	61
Netherlands	40	52
Switzerland	24	67

All three countries have low taxes, with Tørsløv, Wier, and Zucman (2018) counting them among the top ten tax havens. As discussed elsewhere in this volume, their tax structure has the potential for distorting the value of sales. Nevertheless, the source of revenues clearly remains local. Similar results could potentially be found for the Asia-Pacific, with multinationals choosing a specific location such as Singapore, Hong Kong, or Taiwan to serve the much-larger region. Indeed, third-country sales are 59 percent of Singapore's total,

compared with local sales of 34 percent (and much of the local total likely is sales to other local downstream firms for further processing and export). Overall, the data again suggest that horizontal motives for foreign investment seem to dominate vertical ones.

Finally, extending the basic horizontal and vertical models to multiple host countries yields a third way of distinguishing between replication and fragmentation, namely, by looking at whether FDI in nearby countries is a substitute for (consistent with export platform and replication) or a complement to (consistent with complex vertical fragmentation) FDI in a given host. Blonigen, et al. (2007), using spatial econometric techniques for US outbound FDI, find some variation. US FDI in Europe in particular is characterized by substitution of FDI across borders. They also find a positive effect for surrounding market potential. These two patterns are strongly indicative of export-platform FDI, further supporting the notion that MNEs are replicating their activities across countries to gain access to consumers. Comparable results can be found for other parent countries in the results of Baltagi, Egger, and Pfaffermayr (2007), Garretsen and Peters (2009), and others.

Thus, building from the various methods the models of FDI suggest, the data consistently point to a major role for horizontal investment in which most FDI takes place between wealthy, developed nations to better compete for local consumers by replicating key activities. The next section presents an additional method for examining MNEs and their place in global value chains.

FDI and Global Value Chains

This section presents a new way of differentiating between horizontal and vertical FDI by using data on global value chains. The idea is that, whereas vertical FDI is explicitly designed around intra-firm trade, horizontal FDI, by the nature of its replication, relies less on intra-firm trading of intermediate inputs. Thus, the two MNE structures use GVCs differently. This section offers a new window on FDI's strong horizontal aspect by examining

how FDI fits into GVCs. It uses two measures of GVC participation, the Output Index (which measures the inputs an industry in a given country provides to other firms) and the Input Index (which measures how much the country-industry pair relies on inputs from the GVC). We find that FDI in developed countries is concentrated in industries where these measures are relatively small compared with FDI in developing countries. This is consistent with the notion that developed countries (which are the major hosts) attract mostly horizontal investment while developing countries host more vertical FDI.

For vertical FDI, the MNE's GVC is evident since the snake-like structure of this type of MNE is designed to fragment the production process across borders. The parent and affiliate are obviously links in a GVC. Horizontal firms' GVC is less obvious but is still present in the form of joint input produced in the headquarters and used across various production affiliates. Both vertical and horizontal GVCs, however, are internal and do not describe how MNE activity fits into the production of other firms.

In the early models of FDI, such as Helpman (1984) and Markusen (1984), production technologies were simplified so that only MNEs used intermediate inputs and those inputs were made by the MNE itself. In practice, many MNEs purchase intermediate inputs from other firms. Further, those inputs can originate in the home, host, or third countries. In addition, although the early models of FDI described the foreign affiliates' customers as being end-use consumers, this does not have to be true. Instead, the multinational's output can serve as an input into the production activities of other firms. That said, the location of unrelated purchasers would still vary across MNE structures: that is, at home (vertical), in the host (horizontal), or to firms in third countries (export platform). While, as discussed in Box 1, the distinction between intermediate and final goods is somewhat hazy in practice, the intuitive difference and what it means for describing GVCs is clear.

With that in mind, the location of parents and affiliates in GVCs can help explain the structure of MNE activities. Although data on intra-firm GVCs is unavailable, industry data developed by Antràs and Chor (2018), which positions an industry in a given country in the global GVC, can be used. Their work explicitly recognizes that the production of a final good can involve many stages across industries and countries. Their industry data can be used to construct two measures: one capturing how much an industry feeds into GVCs by supporting the production of others and one measuring how much the industry draws its inputs from GVCs. Both measures are constructed for an industry as a whole.[14] Thus, for a given country, they combine the local production of domestically-owned MNEs, foreign-owned MNEs, and purely domestic firms.

That said, MNEs feature heavily in the construction of the Antràs and Chor (2018) measures. Roughly one-third of global output, two-thirds of worldwide exports, and half of imports are attributable to MNEs (OECD, 2018).[15] Thus, MNEs undoubtedly form a major part of their construction, particularly when it is focused on the cross-border aspects of GVCs. Further, the inclusion of non-MNEs is potentially advantageous since MNEs can both buy and sell intermediates with unrelated firms.[16] Thus, the inclusion of all firms rather than just MNEs may be necessary to accurately describe GVCs' operation.

The *Output Index* captures the degree to which an industry's sales contribute to the production process of other firms.[17] One way to do this is to simply measure the percentage

[14] This is because the input-output data that are available combines all firms within an industry.

[15] This is particularly impressive since they only account for 23 percent of global employment (OECD, 2018).

[16] For US firms, Ramando, Rappaport, and Ruhl (2016) find that intra-firm trade may be the exception rather than the rule.

[17] In the World Input-Output Database (WIOD) data used by Antràs and Chor (2018), sales are precisely that and as such combine the contributions of labor, capital, intellectual property, and intermediates (which are at the

of an industry's sales that are intermediates. This method, however, misses the chain part of the GVC since it ignores what happens beyond the next link in the chain. As a result, it would understate the industry's contribution to the GVC.

For example, consider the aluminum industry in three hypothetical countries. In Country A, the industry produces aluminum that is sold directly to final consumers as aluminum foil. Thus, for Country A's aluminum industry, there is no subsequent link in the GVC. Country B's aluminum industry, meanwhile, produces aluminum for beverage companies that turn it into cans that are then filled and sold to final consumers. In comparison, Country C's aluminum industry sells to a screw manufacturer that in turn sells its screws to an airline company which uses them to make planes which are delivered to final consumers. Unlike Country A's industry, both Country B and Country C producers have subsequent links, one link for Country B and two for Country C. Obviously, the GVC that the Country A sector feeds into is the shortest—there is one step between it and the final consumer. This would then get the lowest value for the Output Index among the three. Even if both the Country B and Country C industries sell the same share of their output as intermediates, Country B's Output Index value would lie between Country A's and Country C's because the value chain for the Country B sector is shorter (two steps away from the final consumer).

Thus, the Output Index accounts for the number of steps between an industry's production and the final consumer.[18] In addition, as detailed in Box 2, it controls for the

heart of the GVC measures). The WIOD data also break down the sales into the contributions of labor, capital, and intermediates. Recent work by Chen, Los, and Timmer (2019) suggests that this may misallocate the importance of intellectual property to capital. This is further discussed in Section 5.

[18] These steps include reaching consumers themselves, that is, the distribution network. The WIOD database builds from supply-use tables based on national accounts data. Using wholesale and retail trade data, margins

varying shares of output sold as intermediates in each link in the GVC. In broad strokes, the Output Index is higher when a country-industry sells more as intermediates itself and when its customers sell more as intermediates to a longer GVC chain. Thus, the higher the Output Index for a nation's industry, the more it contributes to GVCs.[19] As discussed in Box 2, some industries such as mining contribute heavily to GVCs whereas others (for example, real estate) contribute little.

In contrast to the Output Index, which measures contribution, the *Input Index* measures a country-industry's reliance upon the GVC, that is, the degree to which the GVC contributes to its own output. One simple way of doing so would be to measure the cost of purchased intermediates relative to output. However, just as using only the share of output sold as intermediates understates the contribution to the GVC, doing this would understate the reliance on the GVC since a given country-industry's suppliers may themselves purchase intermediates from links further back in the chain. The Input Index accounts for this by decomposing a country-industry's value-added across the various links in the GVC.

As an example, consider the electronics industry in three hypothetical countries: Country D, Country E, and Country F. Country D electronics use no inputs other than their

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for these activities are constructed and gathered into two industries: wholesale services and retail services. These are then treated as an industry in and of themselves, with the share of purchases/sales linked to another industry based on relative purchase/sale levels. In the iPhone example of Table 8, this stage in the GVC is worth $90 which, when combined with the physical components and miscellaneous costs, amounts to a total "cost" of $329.99.

[19] It is not necessary that the output be sold to another country-industry for further processing. Instead, it is certainly possible that the output is sold to another firm (including a related affiliate) in the same industry in the same country. Thus, this is specifically not a measure of internal/external transactions, but rather a measure of how the output is used.

own labor.[20] Because it uses nothing from the rest of the GVC, its Input Index would be low. Country E's electronics industry, on the other hand, purchases wiring from suppliers that it uses to make components that go into its electronics. It therefore has one link before it in the GVC. Finally, Country F's computer industry purchases its components from a supplier which itself purchases the wires from a third firm, that is, it has two links before it in the GVC.[21]

Comparable to the Output Index, an industry drawing from a longer GVC would have a higher Input Index score, that is, Country F's score is greater than Country E's which is greater than Country D's. Further, as detailed in Box 2, the Input Index also accounts for variation in the amount of purchased intermediates. Thus, the more that a country's industry relies on the GVC for producing its output, the higher its Input Index. As discussed in Box 2, reliance on GVCs varies considerably across countries and industries. The electrical equipment and transport equipment industries are especially reliant on GVCs. Real estate, as was true in the Output Index, is fairly self-contained.

Together, the Input and Output Indices provide a method of describing how a foreign affiliate fits in to the GVC and with the pattern varying across MNE structures. To visualize this, a part of the multinational (either parent or affiliate) is located in the GVC Box in Figure 3. The box is constructed so that the higher a part of the MNE's Output Index score (contributions to the GVC) the closer to the top of the box it is and the higher its Input Index score (reliance on the GVC), the further to the right it is.

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[20] As such, their value added would equal their sales.

[21] Since a country-industry can sell intermediates to itself, so too can it purchase inputs from itself, something relevant in this specific example, since electronics and electronic components are combined into a single industry.

In the simplest vertical MNEs, the firm has a two-stage GVC in which an affiliate in a low-skill country imports high-skill inputs from the parent firm, processes them, and then sells that to final consumers at home. This affiliate would rank low on the Output Index (since it sells to final consumers) and high on the Input Index (due to its need for inputs from the parent). In contrast, the parent would rank high on the Output Index since most of its sales are inputs to the affiliate and low on the Input Index because it purchases no intermediates. The parent part of the firm would then place in the top left corner of the GVC box and the foreign affiliate in the lower right-hand corner, as shown in Figure 3.

This configuration can be extended to more-complicated vertical structures.[22] For example, consider the iPhone. It is designed in the United States, its components such as the screen are made in Japan, and the components are assembled in China.[23] The US parent would rank highly on the Output Index since its output (the design) is used exclusively by the other stages in the iPhone production line. In addition, the Japanese affiliate's sale of inputs to China further boosts the parent's Output Index score. The Japanese affiliate also exclusively sells intermediates, however since it is closer to the end of the GVC (only the Chinese assembly remains), it would have a more-moderate Output Index score.[24] The Chinese affiliate, meanwhile, is at the end of the chain and would have a low Output Index score.

For the Input Index, the reverse ordering holds. The US affiliate is essentially self-contained and does not use inputs from the GVC. Both the Japanese and Chinese affiliates,

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[22] In addition to this three-stage production process, as with the horizontal model, adding more intermediate inputs to parent or affiliate production can increase the Input Index.

[23] For details on iPhone production, see https://www.lifewire.com/where-is-the-iphone-made-1999503.

[24] Indeed, this would be true for any affiliate selling intermediates, including the final one in the MNE's production chain.

however, are very reliant on the United States for the value added (60 percent of profits are attributable to the US affiliate as discussed in Table 8). Therefore, both would rank fairly high on the Input Index with the Chinese value somewhat higher because it has two links in the chain before its stage in the production process. As Figure 3 illustrates, this would then show the beginning and end of the iPhone GVC matching the simple vertical MNE, with the middle link in between.

For a simple horizontal structure, the parent produces the joint input used in production both locally and in the foreign affiliate, with all output going to final consumers (some at home, others abroad). As with the vertical foreign affiliate, the horizontal foreign affiliate sells no output as an intermediate and ranks low on the Output Index. Unlike the vertical parent, the horizontal parent sells both intermediates and final goods. Therefore, although it has an Output Index score higher than its affiliate, it is not as high as the exclusively intermediate-selling vertical parent.

On the Input Index side, as with the vertical parent, the horizontal parent purchases no intermediate inputs and has a low score. The foreign horizontal affiliate, meanwhile, does purchase intermediate inputs (the joint input from the parent). In contrast to the vertical affiliate in a low-skill developing country, however, the horizontal affiliate is located in a high-skill abundant country and carries out significant skill-intensive production tasks (tasks which replicate some of those in the parent). Thus, while the horizontal affiliate relies on the inputs provided by the parent, it provides more of the final product's value than a low-skill intensive vertical affiliate does. Together, these factors would tend to place the two parts of the simple horizontal MNE in the lower left corner of the box, when compared with a vertical MNE.

This simple horizontal baseline can also be extended. One way to do so is to assume that the affiliate sells its output as an intermediate to an unrelated firm rather than a final

consumer (for example, the MNE's various affiliates produce concrete which is sold to local construction firms). This added link in the GVC, after the affiliate's production stage, would increase the Output Index score both for the affiliate and its parent (who is now linked to a longer GVC). It would still be the case, however, that the parent part of the firm would have a higher Output Index than the affiliate because of the joint input the parent provides to its affiliates. In a similar way, additional intermediates can be added to the replicated production stage. This would increase the Input Index for the parent and all of its affiliates since they all engage in this activity. In contrast, incorporating intermediates into the development of the joint input (for example, technical machinery needed for the R&D behind the design) would increase the Input Index for the parent directly and then indirectly for its affiliates as they are tied to a longer input GVC.

Finally, one can alter the importance of the inputs obtained from the parent. For example, suppose that knowledge of local consumer desires is important to producing in each country. As the importance of local knowledge rises, the value generated by the affiliate would grow, lowering its Input Index. For the parent, where the joint input and distribution are done locally, this shift in value generation from the joint input to distribution would net out, leading to no change.

Analyzing where parents and affiliates are located in the GVC Box can then provide yet another indication of the structure of MNE activities. FDI concentrated in the top-left (home) and right-hand side (host) of the box would generally be vertical FDI. FDI in the middle and bottom-right of the box would indicate horizontal investment. In practice, since both horizontal and vertical FDI exist (and have much more complex possibilities than the stereotypical models), this distinction will be less clear-cut. However, comparing the index placement in developed and developing countries reveals some suggestive patterns.

Figure 4 positions inbound and outbound US investment for different industries in the GVC box. It uses affiliate sales data so that the size of a blue circle corresponds to the relative size of sales by foreign affiliates in the United States. Similarly, the size of the red circles indicate the relative value of sales by US-owned affiliates abroad.[25] To position each of these in the GVC box, the industry's Output and Input Indices for the United States are used since the sales data do not distinguish between the origin of inbound FDI or the destination of outbound investment.

As discussed in Box 2, compared to the global average, the average US industry is both less reliant on GVCs (with a mean across industries of 0.36 relative to the global mean of 0.42) and contributes less to them (the US industry average is 0.26 whereas the global average is 0.32). This would place US industries toward the lower-left corner of the GVC box compared to the global average. This is also the region of the box where horizontal FDI is most likely to be found. Given the large role that US inbound and outbound FDI plays in global FDI, this pattern provides additional support to the conclusion that the horizontal FDI plays a considerable role in overall FDI activity.

The figure itself shows two things. First, the sizes of the blue inbound and red outbound circles are similar to one another.[26] This indicates that, for the United States, the major outbound FDI industries are also its major inbound ones. This pattern again suggests replication, that is, horizontal FDI, in the data since vertical investment should move primarily in one direction or the other, not both. The second feature in Figure 4 is that, even accounting for the fact that overall US activity skews toward the lower-left corner, the bulk of FDI (the larger circles) tends toward the middle left of the GVC box. Thus, compared to the

[25] These are all foreign affiliates (some US-owned and some not), not the parent part of the MNE.

[26] Since the coordinates for both inbound and outbound FDI are those for the US industry, the circles by definition have the same location in the GVC box.

United States as a whole, more FDI is found in those industries that require relatively few inputs from GVCs and yet contribute in a fair way to them. This pattern again fits the horizontal notion illustrated in Figure 3. That said, there are three notable exceptions to this pattern illustrated by the three large circles with Input Index measures above 0.5. These are (moving from left to right) chemicals and chemical products; food, beverages and tobacco; and transport equipment. All of these seem to suggest the potential for relatively more vertical activity. Although these sectors make up 16.2 percent of outbound sales and 32.8 percent of inbound sales, the overall picture nevertheless suggests that US-involved FDI is predominately horizontal.

The dominance of horizontal FDI in the United States, however, does not rule out the existence of vertical FDI. Instead, vertical FDI is more likely to be found in relatively less-developed hosts. One limitation of Figure 4 is that it does not use bilateral information, that is, it does not show where investment into the US originates or the location of US-owned affiliates. As such, it uses the US values of the two indices for its outbound investment and does not contrast the GVC positioning of US outbound FDI to developed hosts versus developing hosts.

A different dataset from the BEA does provide such bilateral information, albeit for a limited number of countries and industries. Figure 5 plots US outbound investment, unlike Figure 4, using the Input and Output Index values of the host rather than the United States. In addition, it differentiates between two broad groups: developing hosts (Brazil, Mexico, and China) and developed hosts (Canada, France, Germany, the United Kingdom, the Netherlands, Australia, Japan, and Switzerland).

Distinguishing between developing and developed hosts is important because they have significant differences in the GVC patterns, as illustrated in the lower part of Table 4. Developed countries have an average Input Index score of 0.44 and an average Output Index

score of 0.34. Both scores are lower, but only slightly, than the average of the three developing countries. However, when weighting by the relative share of US FDI of an industry within each group of countries, the differences become more pronounced. The developing-countries Input Index is 56 percent higher and the Output Index is 23 percent higher than the comparable averages for the developed countries. Put simply, the US FDI in developing countries is directed much more toward industries that are both more reliant upon GVCs and feed more into them.

This pattern can also be seen in Figure 5.[27] Even after accounting for the fact that the developing countries overall tend toward the right-hand side of the box, their FDI-dominated industries have higher Input Indices than the country-specific average. If outbound FDI to developing countries is more vertical, this is what would be expected. Nevertheless, since FDI activity is larger in the developed hosts, this pattern suggests that, although vertical FDI does occur, the bulk of FDI is still found in the lower-left, horizontal region of the GVC Box.

Figure 6 focuses specifically on the US investment in the three developing countries for which data are available: Brazil, China, and Mexico. While there is overlap, China is different from the other two countries due to its high Input and Output values (see Box 2 for more discussion). Thus, even among these emerging nations, US FDI China appears to be an outlier in that it tends to be in industries that rely heavily on GVCs.

While this paper has largely focused on US data because of availability, it is worthwhile to try to broaden the picture because the United States may be a special case due to its size and position as the largest destination for, and recipient of, FDI, at least when measured as stocks of FDI (China currently is first in FDI inflows and the United States second). With this in mind, data from the Organization for Economic Co-operation and

[27] Note that here we do not weight the size of the circles by the amount of FDI for the sake of legibility. Size-weighted figures are available on request.

Development (OECD) provides information on total inbound and outbound FDI stocks in 2011 where, just as in Figure 4, these data lack bilateral information.[28] Despite switching the measure of FDI from affiliate sales to FDI stocks, as shown in Figure 7, the US picture in the OECD data looks similar to the 2014 BEA sales data in Figure 4. Thus, the lessons learned for the United States from the BEA data likely carry over to the OECD data and vice versa. The purpose of switching datasets, however, is not to compare different FDI measures but to look at the experience of other countries.

Figure 8, as with Figures 6 and 7, focuses on inbound FDI and uses the host country Input and Output Index values to compare the United States with four other major OECD FDI hosts: the United Kingdom, Germany, Canada, and France—collectively, "the Big Five." To ease comparison to the US baseline, the US values are denoted by X's rather than circles. These countries' industries are generally found in the same lower-left corner of the box as the US industries. Figure 9, meanwhile, compares the US baseline to four relatively less developed OECD host countries (the Czech Republic, Korea, Poland, and Spain). As in Figure 5, these relatively developing hosts are situated further to the right than is the United States, that is, industries in these countries rely more on GVCs than those in the United States. As in Figure 6, this pattern suggests that, as the level of development lags, vertical FDI becomes more important. The GVC Box approach of these figures— and the fact that the

[28] These can be found at https://data.oecd.org/fdi/fdi-flows.htm. Due to data availability here we use stocks, not sales, and information for 2011 rather than 2014. One issue with using stocks of FDI is that it increases the relative importance of capital-intensive industries. Further, when comparing across countries, Davies (2008) finds that vertical hosts of FDI seem to be more capital intensive than horizontal hosts. Finally, the industry breakdown is less fine in these data and therefore fewer data points per country are shown.

Big Five are both the sources of and destinations for a significant share of global FDI — further supports that the dominant structure of FDI activity is horizontal.[29]

Evaluating Intangible Asset and Other Service Flows

As we note in the introduction, intangible and other services supplied by parent firms to affiliates are generally unobserved and unmeasured. Multinational supplies of management, technology, R&D, intellectual property, marketing and finance to affiliates are believed to be large and a crucial part of MNE activity. International business literature emphasizes them and they are a cornerstone of theoretical models of multinational firms as embodied in the idea of the horizontal model's joint input. Thus, data on these services are all the more crucial.

In theoretical models, intangibles, particularly those that are knowledge based, are assumed to possess a "joint" or non-rivaled nature that is not found in physical capital such as plant, equipment, and property. A knowledge-based asset, a blueprint, for example, can be used in multiple locations without reducing its value in any one location. In other words, intangibles and specifically knowledge-based assets create firm-level scale economies as opposed to or in addition to any plant-level economies of scale. These firm-level scale economies give the multinational a powerful tool and incentive for adding additional plants or offices abroad at low additional cost, thereby giving the multi-plant multinational a competitive advantage over local single-plant firms.

[29] Although they do not control for the size of investment, Davies, Desbordes, and Ray (2018) analyze the number of affiliates established from 2003 to 2010. Using this, the Big Five countries account for 38.3 percent of outbound cross-border mergers and acquisitions and 32.6 percent of inbound M&As. In terms of greenfield investment, which is more often found hosted by developing countries, the Big Five are the home for 50.2 percent of new affiliates and host to 21.1 percent of them. Thus, both as home and hosts, these five nations make up a substantial portion of FDI activity.

The importance of intangible assets to understanding multinationals is acknowledged but remains a conceptual and theoretical curiosity due to the difficulties in observing and measuring the existence and contribution of these assets. Generally, their role shows up as simply the profits earned by foreign affiliates rather than payments to the parent for its services. Table 5 makes this point by using the BEA data. Two measures of profits or income are given in the data and a short description of these are given below the table. “Profits” tends to be in line with what economists would call profits, while “Net Income” is more in line with accounting definitions of profits. For example, profit here includes taxes paid but excludes capital gains while net income is the other way around.

The second column of Table 5 shows that profits and net income are significant but not especially large relative to total affiliate sales. Column 3, however, shows that profits and net income are a large share of value added. Unfortunately, comparable numbers for the US corporate sectors a whole are not available. The BEA reports profits as a share of revenues as 3.4 percent in 2018, while Federal Reserve data shows the share as 10-12.0 percent of value added (Federal Reserve Bank of Saint Louis (2020)). But it is not clear whether this Federal Reserve number is closer to the (economic) definition of profits in Table 5 or to the (accounting) definition of net income. In addition, the Federal Reserve figures are for complete corporations, while Table 5 (BEA data) gives only numbers for affiliates. Thus, a statement to the effect that foreign affiliates are, as a whole, highly profitable cannot be supported.

Nevertheless, profit and net income as shares of sales, and especially value added, are included for two reasons. First, these high numbers are often quoted by critics of multinational firms, who assert the firms earn excessive monopoly profits, move jobs abroad and are not repatriating profits. Second, and regardless of whether these figures are significantly higher than the US corporate averages, this paper will argue that they are likely

much inflated by failing to take into account the value of knowledge-based and other intangible assets.

One obvious approach to evaluating the importance of intangibles is to look at royalties, fees and R&D figures for affiliates and parents. While BEA data provide these numbers for affiliates, it does not provide figures for parents and corporations as a whole. Thus, that data cannot shed light on whether multinational corporations are R&D- and intellectual-property intensive compared with the corporate sector as a whole (though all researchers are confident that this is true). Second, reported royalties and fees for intellectual property are only a small part of intangible assets and services. Management and engineering services, marketing, finance, and brand values may in total reduce formal licensing fees to a small part of this unmeasured capital.

Rows 5-7 of Table 5 report figures from BEA data. Royalties received and paid by affiliates and R&D performed by them are quite small, though not trivial, shares of value added. A second concern about using reported fees and royalties (and for that matter profits on an individual country basis) is that they can be affected by income shifting and double counting. This paper concentrates on real production and supply decisions and it is beyond its scope to discuss financial and accounting questions.

That said, the lower panel of Table 5, which gives statistics for Irish affiliates of US multinationals, illustrates the issue. As is widely known, US multinationals establish subsidiaries in Ireland to serve the whole EU (recall its earlier noted high levels of third-country sales). While Ireland has many advantages for US firms, including an English-speaking and skilled labor force, favorable land prices, and modest regulation, it also has highly advantageous tax policies for US firms. For perspective, Ireland's population is about 0.06 percent of the world's population, yet Irish affiliates of US firms account for about 6 percent of all US foreign affiliates sales, 5 percent of affiliates' value added and R&D,

though a modest 1 percent of affiliates' employment worldwide.

These numbers are not surprising given Ireland's status as an export platform. But Table 5 shows that Irish affiliates' share of all US affiliates' profits worldwide is 11 percent, double Ireland's share of sales and value added, suggesting profit shifting to this low-tax jurisdiction. However, the truly impressive numbers in Table 5 are that Irish affiliates receive a full 50 percent of all fees and royalties received by US foreign affiliates and pay 42 percent of all fees and royalties paid by US affiliates. This is partly because of Irish affiliates' industry composition, which is heavily weighted toward computer hardware and software and pharmaceuticals. Still, it likely also suggests financial and accounting manoeuvres. Although these issues are beyond the scope of this paper, the data on profits and income are important insofar as they lead into the next issue, which is the overestimation of affiliate profits due to the omission of intangibles.

A promising new approach is to measure intangibles in GVCs as a residual difference between values of final goods and payments for all tangibles. This is found in a recent analysis by Chen, Los, and Timmer (2019). As they discuss, the World Input-Output Database (WIOD), as is typical of all input-output tables, lumps many things into one item simply called payments to "capital."[30] This is in part a residual balancing item that includes actual payments to capital but also pure profits, possible types of Ricardian rents, and so forth. The authors, independently of the input-output capital number, construct a traditional measure of physical and tangible capital such as property, plant and equipment. They then calculate the difference between their measure of tangible capital and the WIOD number to determine a residual value that they label intangible capital. They are careful to emphasize that this is a residual measure and thus can, of course, include some income that is not a

[30] These can be downloaded from http://www.wiod.org/home. The WIOD data also form the basis for the data used for this paper's Input and Output Indices.

return to intangibles. One advantage of their methodology is that all returns from all countries are included, and thus their measure is immune to profit shifting and other accounting maneuvers by multinationals.

Table 6 shows results from their working paper. They divide world factor income into payments to labor, tangible capital, and intangible capital. The share they attribute to intangible capital is very large at 30.7 percent of total factor payments, which is 1.7 times the share of payments to tangible capital. The second row of the upper panel shows the changes in the three shares from 2000 to 2014. As the authors state, the fall in labor share has been well documented and is widely known. What has not been identified however, is that much of the share growth in capital has been in the share of intangible capital.

The lower panel of Table 6 divides the share of intangible capital into stages of production. The biggest share is found in upstream production stages, which is assumed to include many headquarter services, as well as parts and components which are often more skill intensive than final assembly and distribution. Not only do these upstream stages account for the largest share of intangible capital income, but that share has grown significantly from 2000 to 2014 while the shares to both labor and tangible capital have shrunk. While the data in Table 6 are for all industries in all countries aggregated and by no means specific to multinational firms, they suggest a high level and growing importance of intangible capital in the world economy.

Attempts to document and measure intangible service flows within multinational firms are scarce and the Chen, Los, and Timmer study estimates the contribution of intangible capital as a residual value for the world economy as a whole. Nevertheless, their numbers are large enough that they surely motivate more research specifically on MNEs. Several attempts make some progress at a restrictive level, either looking at a particular intangible or at a single firm. Tables 7 and 8 provide results in this vein.

Table 7, with information from the website of a consulting firm, shows brand value for large firms.[31] While the data are for 2009, making some rankings out of date, they are nevertheless provide a feel for the size of the asset values involved. The elements that go into brand value are listed on the right side of Table 7. Although the firm's precise methodology is somewhat obscure, the size of these numbers are nonetheless impressive. Coca-Cola tops the list at $69 billion followed by IBM at $60 billion. While some of these totals surely just reflect the accumulated effects of many years of advertising, the list also suggests large amounts of reputation capital for product quality, reliability and sophistication. These intangible brand values have almost assuredly grown considerably since their publication.

Table 8 gives data for a specific product, an Apple iPhone 4, taken from Brennan and Rakhmatullin (2015).[32] Some critics love to hate these numbers, either because they believe they show excess profits or because they believe US content is too low. We disagree with both of these views. The first numbers in Table 8 are a cost breakdown of the physical components in the phone plus assembly costs, which total $194. Then distribution and miscellaneous is added to arrive at a total cost of $324. The US content measured in this way is rather small, even if most of the distribution and miscellaneous costs are US content. The iPhone sells for $600, leaving a residual "profit" of $270 per phone.

However, many items are missing from this breakdown. For example, it does not include the software in the phone, a significant omission as Apple is as much a software company as a hardware firm. Further, the iOS ecosystem (including iTunes) is one of the major attractions of Apple products. On the right-hand side of Table 8, we have provided a list of just some of the long-term firm investments that are contributing to this "profit." This

[31] These come from https://www.b2binternational.com/publications/value-of-brands/.

[32] Several analogous case studies seem to come up with roughly similar stories, both for Apple and other products.

is our list, not Brennan's and Rakhmatullin's. Their decomposition makes no attempt to value any of the items on the list. Assuming that Apple makes just a "normal" return on investment, it could be argued that the contribution of intangible assets is as much as 45 percent of the retail price. Further, it seems likely that most of this value is American content since the parent firm produces intangible services while foreigners make parts and assemble them.

While there is a need for more work in this area, a recent working paper from the World Bank Group by Ayyagari, Demirguc-Kunt and Maksimovic (ADM) (2019) makes substantial progress in estimating the value of intangible capital more directly. It does not focus on multinational firms specifically, but instead uses a sample of large US firms. This working paper in turn builds on the methodology and empirical results of Peters and Taylor (2017). At issue is the often-documented high returns on invested capital (ROIC) for the most successful firms, with a particular run-up starting around 1990.

The authors' show that these high measured profits are largely caused by the mismeasurement, or rather non-measurement, of intangible capital in the denominator of standard ROIC calculations. To correct this, they calculate intangible capital as the sum of two measures: knowledge capital and organizational capital. The methodology they use to calculate both knowledge capital and organizational capital is similar to the perpetual inventory method used to calculate physical capital stocks. Past investments in R&D and other measures for knowledge capital are summed and depreciated to measure knowledge capital, and a portion of selling, general and administrative expenses are summed and depreciated to measure organizational capital.

Table 9 shows some of their results. The top two rows show the conventional measure of ROIC and the corrected measure which accounts for intangible capital in the denominator of the measure (it also affects the numerator but that effect is small). The right-hand column gives the percentage point difference between the conventional measure and the corrected

measure for firms in the 90th percentile and up. Accounting for intangible capital lowers the ROIC by 29 percentage points for the top firms.

They then divide the industries into those with high and low levels of routine manual labor in their workforces (RMAN) and industries with high and low levels of intangible capital (ICAP). Industries with low labor-force shares of routine labor (and therefore more cognitive skill requirements) have higher ROIC returns with and without the correction (Table 9 rows 3-6). Within each group, the correction lowers the measured ROIC much more in the low-RMAN industries: 49 percentage points for the low-RMAN industries, 22 percentage points for the high-RMAN industries.

Rows 7-10 of Table 9 show similar figures for high- and low-ICAP industries. The high-ICAP industries (which may overlap a lot with low-RMAN industries) have substantially higher returns than the low-ICAP industries. The correction for intangible capital lowers the ROIC considerably—by 41 percentage points—for the 90th percentile of firms.

Table 9 illustrates two main points that underscore the sizable role of intangibles. First, the more successful firms have high returns on invested capital and the correction for intangible capital lowers those returns much more than for less successful firms. Second, among the most successful firms, the intangible correction lowers returns much more for those with a low share of routine manual labor and those with a high share of intangible capital.

The work of Chen, et. al. (2019) and Ayyagari, et. al (2019) does not distinguish multinational firms from non-multinationals. But a lot of work, summarized and extended most recently in Bernard, Jensen, Redding and Schott (2018), consistently and convincingly shows that the most internationally engaged firms are the highest productivity firms and in turn are the most profitable. The top decile of firms account for a very large share

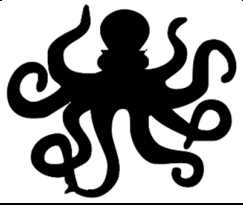
international trade and production. While the current state of knowledge does not allow for a definitive statement, there likely is a substantial overlap between the top decile of firms in Bernard et. al. and the top decile of firms in Ayyagari et. al. Thus, the low-RMAN and high-ICAP firms in the Ayyagari et. al. paper likely are dominated by multinationals. This in turn suggests that the high returns to multinational affiliates discussed in connection with Tables 5, 8 and 9 may be due to mismeasurement, with some of the value of US-generated intangibles misallocated to affiliate profits.

Assuming a high correlation between mutlinationality and intangible capital, several important policy conclusions follow. First, overseas affiliates are probably less profitable than they currently appear. Second, the US content of foreign affiliate production likely is much higher than has been asserted by some politicians, business journalists and claimed in case studies such as the iPhone example. Accounting for intangible capital and its supply from parents to affiliates potentially shifts the location of measured activity and profits from the affiliates and host country to the parents and parent country. That said, this is about re-judging the importance of joint inputs. Even reallocating the value of production toward the parent firm is unlikely to overturn the understanding that FDI is a developed-country phenomenon and therefore has a strong replicative, horizontal nature.

Conclusions

When discussing foreign direct investment, several hot button issues arise, including its effect on labor markets, technology spillovers, and its implications for competition with domestic firms. Addressing these issues, however, requires an understanding of the structure of multinational activity. This paper has provided a framework based on theory that divides investment structures into those that replicate activity across borders (the octopus-like horizontal MNE) and those that fragment the production process into different stages in different countries (the snake-like vertical MNE). These two structures and their more recent

expansions all suggest patterns in the data that can help differentiate between the two. As shown in table below, the different structures generate very different predictions on where MNEs operate, sell their output, and how they connect to their supply chains. The first two columns show the predictions of the horizontal model and the vertical model, while the third column reflects the data.

	Horizontal	**Vertical**	**Data**
	(Replication)	*(Different)*	
Country Pairs	Developed-Developed	Developed-Developing	Developed-Developed
Sales	Regional	Global	Regional
GVC	Self-contained	Long	Self-contained
Parent Intangibles	Joint Input	First Link in GVC	Important but need more data
			

The data point toward a dominant role for horizontal investment. This conclusion arises from both the identities of major parent and host countries (and the comparison across the two), the location of affiliate sales, and the interaction of affiliates with parent firms and other affiliates. In addition to these techniques, which academic literature has explored, this paper introduces a new methodology based on positioning within global value chains. In each case, although evidence of vertical-style investment can be found, the bulk of the data suggests the horizontal motive. This indicates that a significant share of MNE activity is replicative, occurs between wealthy countries, and is in no small part geared toward servicing local consumers and nearby countries, both final customers and customers who use intermediates purchased to produce for other customers. Many of these findings differ from the common public perception of FDI.

Recognizing that MNEs have both internal and external GVCs means that policies aimed at FDI can affect both the local and overseas firms connected in GVCs. These effects are far from hypothetical. Starting in 2017, the Committee on Foreign Investment in the United States (an inter-agency body of the US government with the power to halt investment) significantly increased its examination of inbound investment. In 2018, the number of investments scrutinized was 40 percent higher than in 2016.[33] Among the investments it blocked was Singaporean Broadcom's acquisition of Qualcomm, a US manufacturer of computer chips. This acquisition would have been horizontal (as Broadcom affiliates produce chips globally, that is, replication) and would have involved the sale of intermediates to local purchasers. In 2018, Qualcomm sold $603 million of its output in the United States, Wagner (2019). Thus, if this acquisition would have increased efficiency and lowered chip costs, blocking the investment may well have negatively affected other US firms.

These effects extend to other countries as well. When Qualcomm chips sold in the United States contribute to the assembly of smartphones in China, blocking Broadcom's investment and halting the cost reductions that may have resulted can negatively affect Chinese production. This effect can occur even when the assembly plants in China are unrelated to either Broadcom or Qualcomm. Thus, it is possible for FDI policy in a host country to spill over to third nations with consequent political effects. Indeed, since Qualcomm had sales of more than $15 billion in China in 2018, the US decision to block the investment from Singapore might have had more to do with China than Singapore itself.

The value of understanding the structure of MNE activity extends beyond just understanding individual firms. For example, the fact that a significant share of FDI is replicating skill-intensive activities across skill-abundant countries suggests that offshoring

[33] See Sherman (2018) for discussion.

via FDI may be less about eliminating the low-skill domestic work force and more about gaining access to new markets. Thus, the notion that outbound FDI ships production jobs overseas may not be as well-founded as the typical political rhetoric would suggest. In addition, just as an octopus can survive after losing an arm, a horizontal MNE may be fairly resilient to local events that negatively affect one of its subsidiaries.

Vertical MNEs are less likely to be resilient to local events since, just as the whole snake will die if you cut out a short middle part of its length, losing a key affiliate can have significant implications across the entire vertical MNE. Indeed, Davies and Studnicka (2018) link changes in the stock market valuations of British firms following the Brexit referendum to their vertical GVCs. An additional example from early 2020 was the affect of the novel coronavirus. When Apple's iPhone suppliers were shuttered for health concerns, it sent ripple effects across Apple's whole GVC (Feiner, 2020). Thus, understanding an MNE's risks may require understanding its overall structure.

However, it is important to acknowledge that limitations on the data can affect our ability to draw conclusions. In particular, challenges in measuring intra-firm intangible assets affect the data on FDI since these assets are hard to quantify and quite mobile for tax and other purposes. New papers by Chen, Los and Timmer (2019) and Ayyagari, Demirguc-Kunt and Maksimovic (2019), while not about multinational firms per se, make a very strong case that unmeasured intangible capital is of major important, particularly for large and successful companies. Reporting unmeasured intangible services as "profits" skews the measured and reported US content of foreign production downward. That potentially throws off the understanding of multinationals and the resulting public policy debates. More work on intangibles is therefore most welcome.

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Box 1: The final word on final goods

Despite the importance of defining what is an intermediate and what is a final good, the distinction is blurred to say the least. By definition, a final good is one sold to the ultimate consumer, that is, the person who uses the output without producing anything else that is provided for another's use. While this may seem straightforward, it is not. Some products, such as gasoline, can easily be a finished good (when sold to a private driver) or an intermediate (when sold to a taxi driver). When one pushes the point, what might seem like a finished good (a steak eaten by a hungry worker) can be thought of as an input (into the production of muscle strength by that worker). All of this is to say nothing of the issue of aggregation where the "automobile" sector includes minivans (relatively on the final good end of the spectrum) and tour buses (more on the intermediate end). Therefore, when

approaching the data, the interpretation of the share of final goods in sales should be taken as an overall guide of the relative degree to which final users consume a product rather than as a hard and fast definition.

Box 2: Details on the Output and Input Indices

For our Output and Input indices, we utilize the data provided by Antràs and Chor (2018). Although we refer readers to their study (as well as the seminal papers of Fally (2012) and Antràs and Chor (2013)) for details, here we provide a brief overview of the technical construction of the measures and their underlying data.

For both of these the starting point is the 2013 version of the World Input-Output Database.[34] This lists the sales and purchases for 35 sectors (indexed by *s*) across 40 countries (indexed by *j*) as well as the value added of each country-industry.[35] For a sector *r* in country *i*, denote Y_i^r its gross output, F_i^r the value of gross output sold to final consumers, and Z_{ij}^{rs} the dollar value of sales sold as an intermediate to sector *s* in country *j*. Thus, $Y_i^r = F_i^r + \sum_s \sum_j Z_{ij}^{rs}$, that is, the sum of what is sold to final consumers and other producers. In addition, denote $\alpha_{ij}^{rs} = \frac{Z_{ij}^{rs}}{Y_j^s}$ which is the cost of inputs that sector *s* in country *j* needs from sector *r* in country *i* to produce one dollar of its own output. This can be used to rewrite output in industry *r* in country *i* as:

$$Y_i^r = F_i^r + \sum_s \sum_j \alpha_{ij}^{rs} F_j^s + \sum_s \sum_j \sum_t \sum_k \alpha_{ij}^{rs}\, \alpha_{jk}^{st} F_k^t + \ldots$$

The first term is one stage from the final consumer, the second is two stages away (that is, *ri* sells to another industry which then sells to the final consumer), the third is three stages away, and so forth. Then multiplying each of these terms by the number of stages away from the consumer and normalizing by gross output, we obtain a measure of how much *ri* contributes to the GVC:

$$U_i^r = \frac{F_i^r}{Y_i^r} + 2\frac{\sum_s \sum_j \alpha_{ij}^{rs} F_j^s}{Y_i^r} + 3\frac{\sum_s \sum_j \sum_t \sum_k \alpha_{ij}^{rs}\, \alpha_{jk}^{st} F_k^t}{Y_i^r} + \cdots \geq 1$$

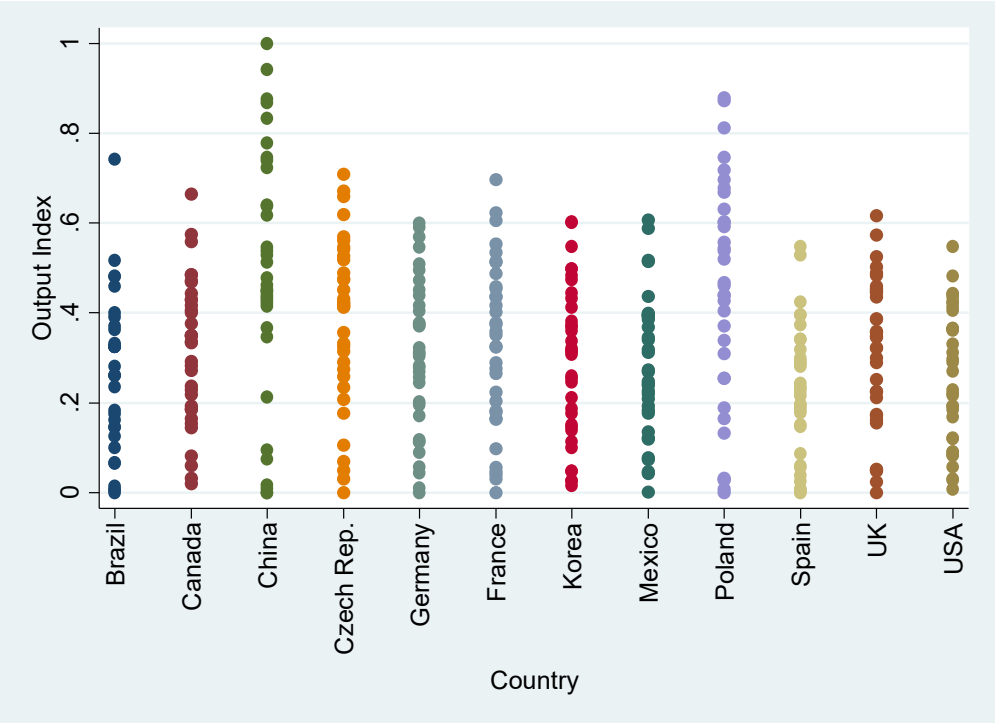
In this, firms that sell more as inputs (have higher α_{ij}^{rs}s) which are used in processes further removed from the final consumers will have a higher value. Our Output Index takes this U_i^r and normalizes it so that it runs from 0 to 1.

There is considerable variation both across industries within a single country and across countries within a single industry. Figure 1B plots the values of the Output Index for several countries, with the US values in the final group. From this, three things can be seen. First, within a country, there is a range of values for the Output Index (that is, within a group, there is variation in the vertical dimension). Second, the average value for a given country varies nation to nation (that is, the within-group center varies horizontally). Globally, the average value is 0.32. For the US, the average is 0.26. China, meanwhile, has an average of 0.49. This means that the average US industry contributes less to GVCs than the average industry globally which itself contributes less than the average Chinese industry. Third, the range of values also varies across countries. Whereas the standard deviation for the US is 0.15, the standard deviation for China is 0.28.

[34] This can be found at http://www.wiod.org/home.

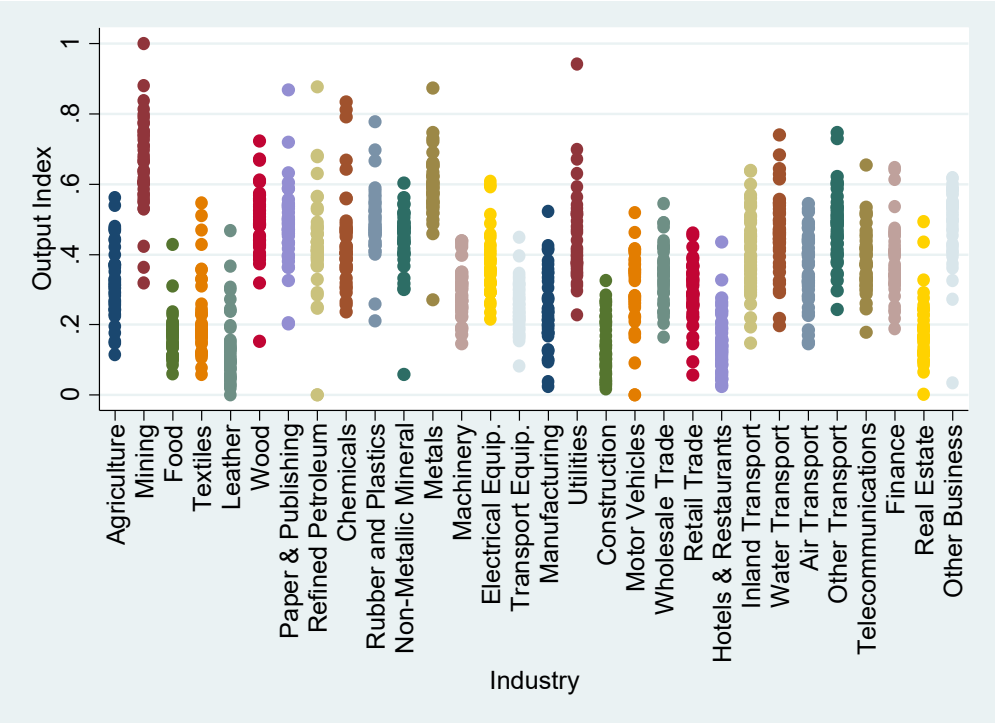
[35] It does so from 1995-2011, however, we ignore the time dimension and only use the 2011 values.

Figure 1B: Output Index Within Countries



This should not be taken to mean that the only variation is across countries. In Figure 2B, we illustrate the values across countries within a given industry. As one might expect, there are clear differences in the average value of the Output Index across industries. However, this figure also shows that there is considerable variation within an industry but across countries (again, the vertical variation within a group). Thus, although some industries on average contribute more to GVCs than others, the extent to which this occurs depends highly on the country in question. There are two sources of the variation in these two figures. First, there is the share of a country-industry's output sold as an intermediate where higher shares lead to a higher Output Index. Second, there is the matter of who buys those intermediates, since selling to another industry that itself sells intermediates links to a longer GVC and generates a higher Output Index. As these two figures show, there is a great deal of heterogeneity across industries and countries.

Figure 2B: Output Index Within Industries



For the Input Index, define $b_{ji}^{sr} = \frac{Z_{ji}^{sr}}{Y_j^s}$, which is share of *sj*'s output used as an input by industry *ri*.[36] With this, gross output can be written as $Y_i^r = VA_i^r + \sum_s \sum_j b_{ji}^{sr} Y_j^s$, that is, gross output for *ri* equals its value added and the sum of its expenditures on non-processed factors of production and on intermediate inputs. Expanding this, we see that:

$$Y_i^r = VA_i^r + \sum_s \sum_j b_{ji}^{sr} VA_j^s + \sum_s \sum_j \sum_t \sum_k b_{kj}^{ts} b_{ji}^{sr} VA_k^t + \ldots$$

that is, output is the sum of value added along the different links in the production chain feeding into *ri*'s output. The first term is one step before *ri*'s output, that is, what it does itself. The second term is the value added coming from the intermediates *ri* uses, making that value added two steps away from output, the third term is three steps away and so on. Multiplying each stage by the number of links in the chain before it reaches *ri*'s output and dividing by the value of output, we obtain:

$$D_i^r = \frac{VA_i^r}{Y_i^r} + 2\frac{\sum_s \sum_j b_{ji}^{sr} VA_j^s}{Y_i^r} + 3\frac{\sum_s \sum_j \sum_t \sum_k b_{kj}^{ts} b_{ji}^{sr} VA_k^t}{Y_i^r} + \cdots \geq 1$$

where again, the greater the importance of inputs (higher b_{ji}^{sr}s) and the more links before output, the higher this score. To arrive at our Input Index we normalize this value so that it runs from 0 to 1.

As with the Output Index, the Input Index varies within a country across industries and within and industry across countries. Figure 3B is the counterpart to Figure 1B excepting that it uses the Input Index. Globally, the average industry has an Input Index of 0.42, with different countries having different within country averages. As with the Output

[36] The difference between α and *b* is that the first is what *ri* sells to *sj* as an input while the second is what *ri* buys from *sj* as an input.

Index, the United States is somewhat below this average at 0.26 and China is somewhat higher with an average of 0.63. Further, as shown in Figure 4B, there is again variation both across industries (the average for each of the groupings varies across them) and within an industry but across countries (the vertical variation). As with the Output Index, this variation is generated by the use of intermediates and where those intermediates come from (that is, the length of the GVC that is tapped into).

Figure 3B: Input Index Within Countries

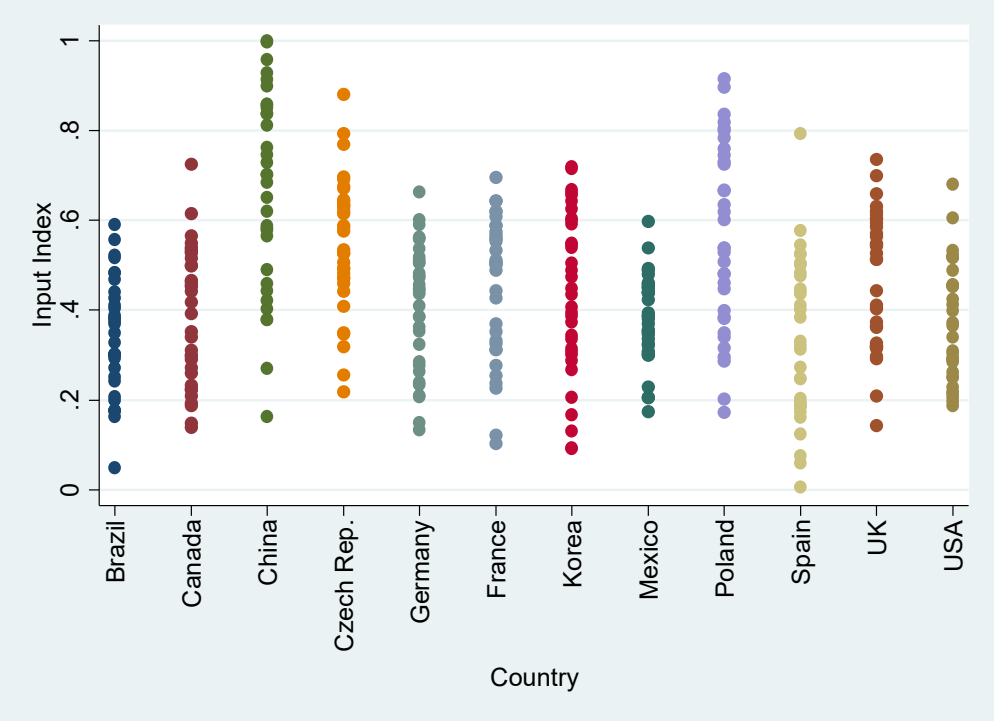


Figure 4B: Input Index Within Industries

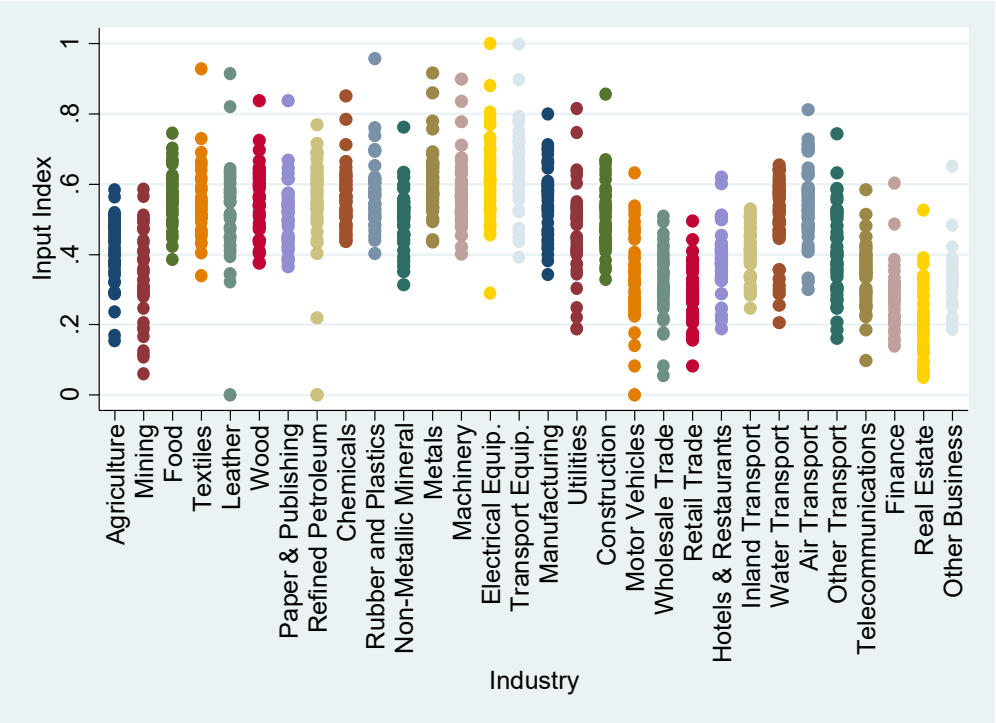


Figure 1: US FDI Stocks by Country Group

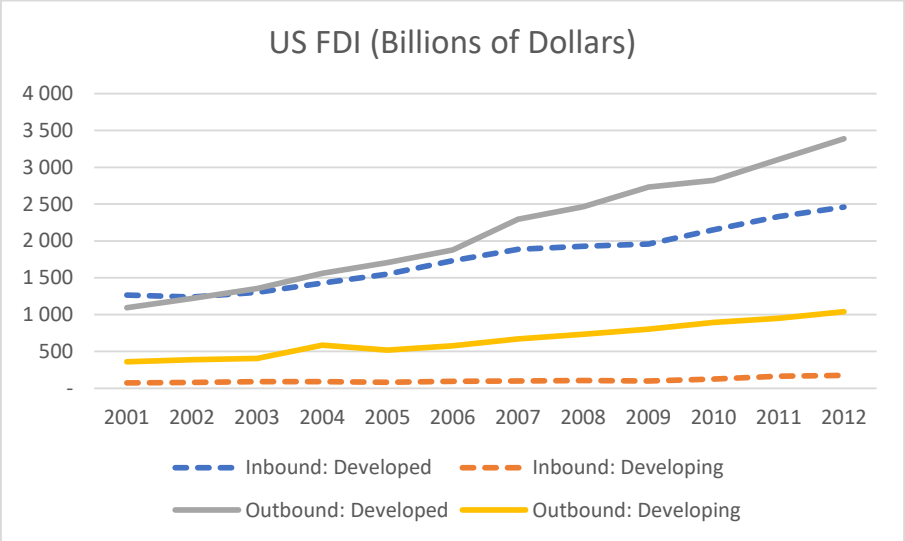


Figure 2: Total FDI Stocks by Country Group

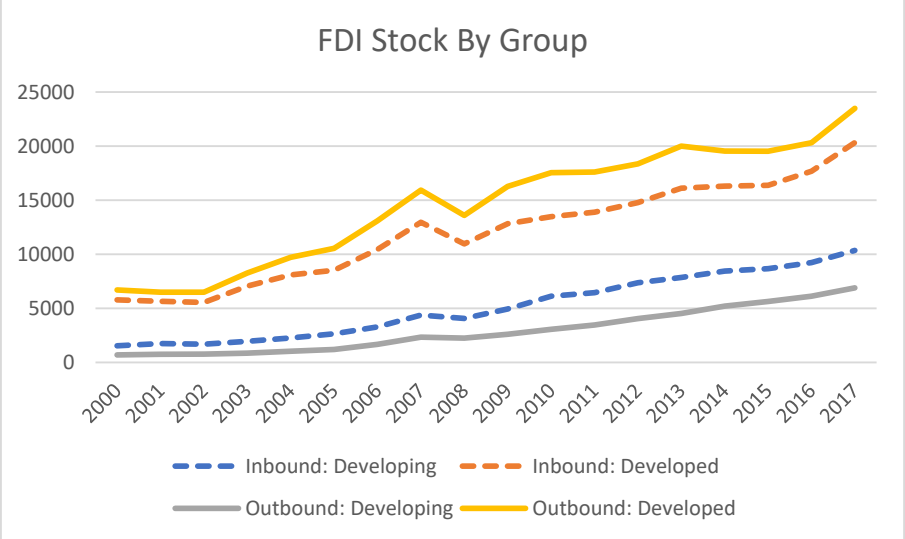


Figure 3: FDI in the GVC Box

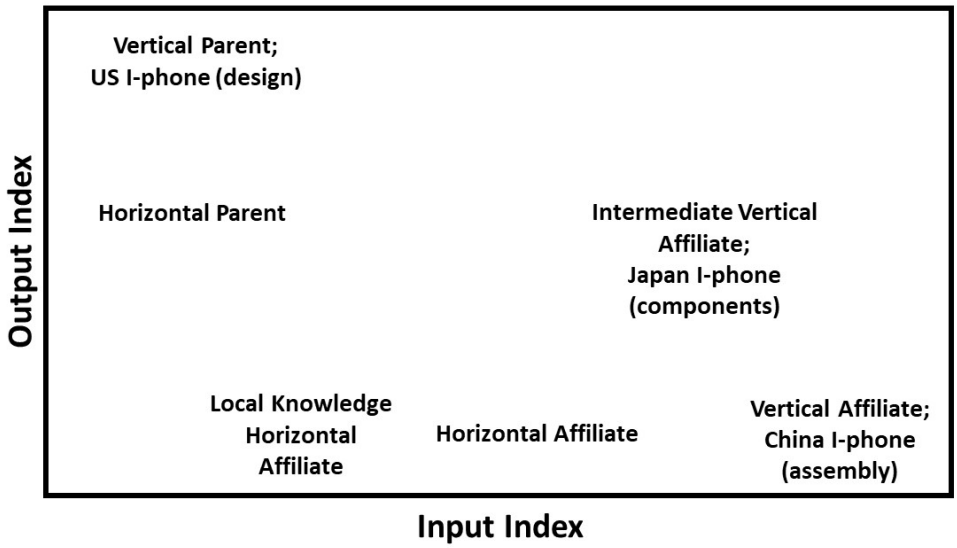
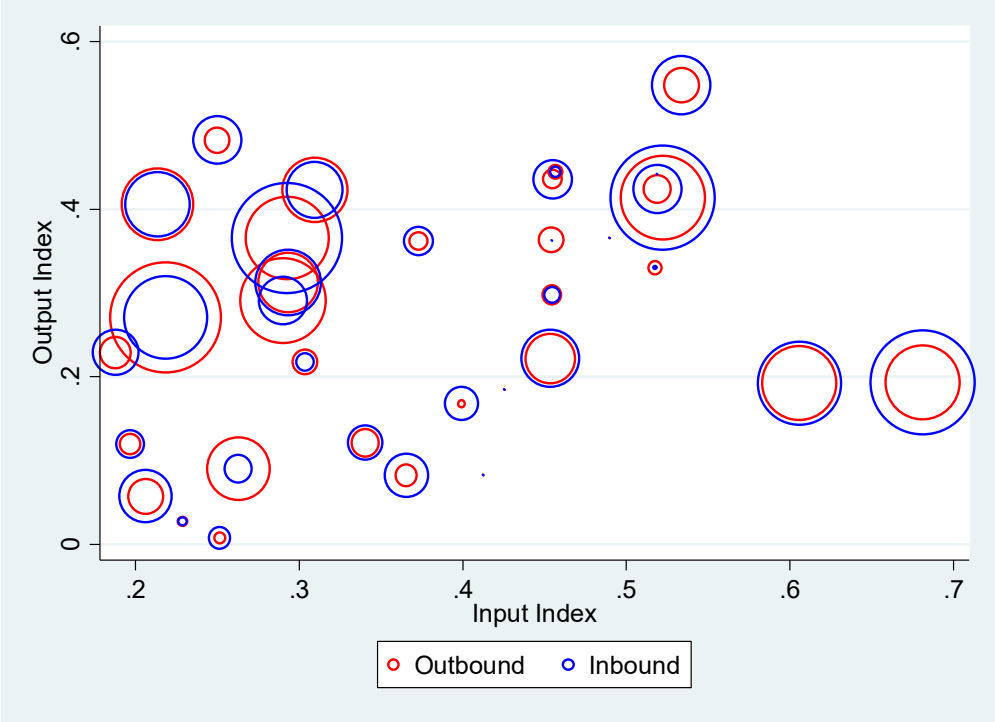
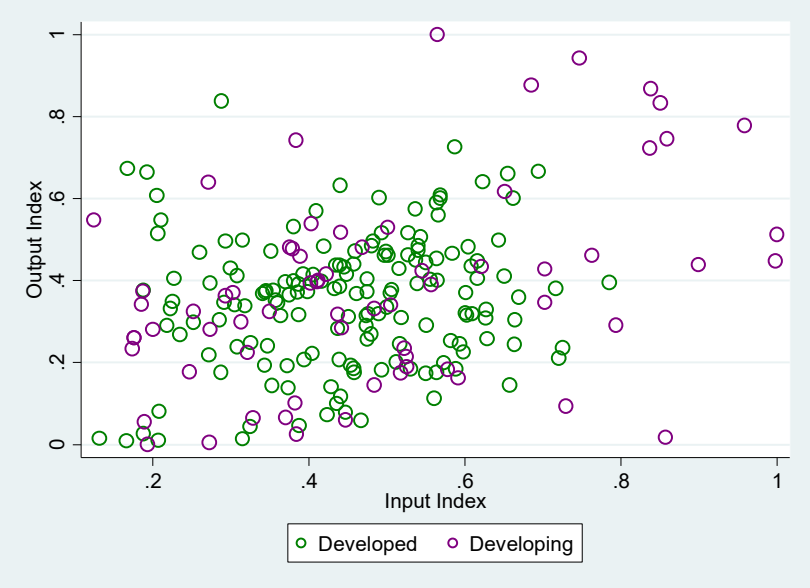


Figure 4: Total US FDI in the GVC Box



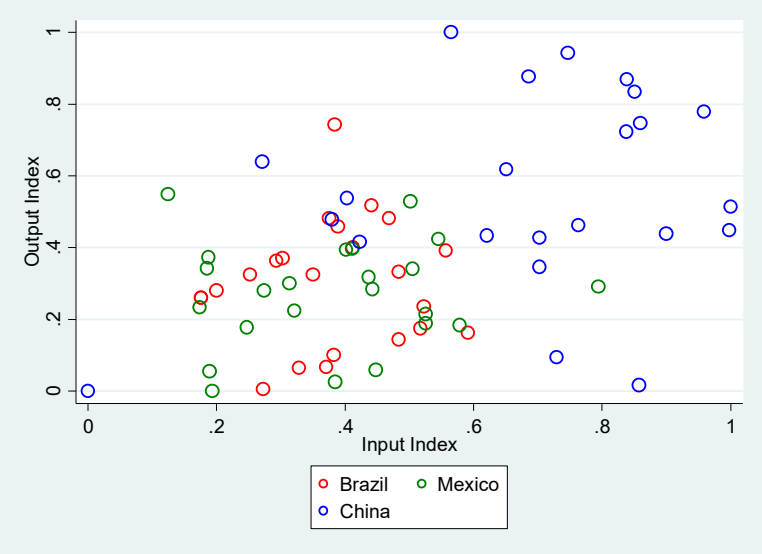
Notes: A higher Input Index score indicates more reliance on GVCs. A higher Output Index score indicates more contribution to GVCs. The size of the bubble indicates the relative size of the industry in affiliate sales.

Figure 5: US Outbound FDI using Host GVC indices



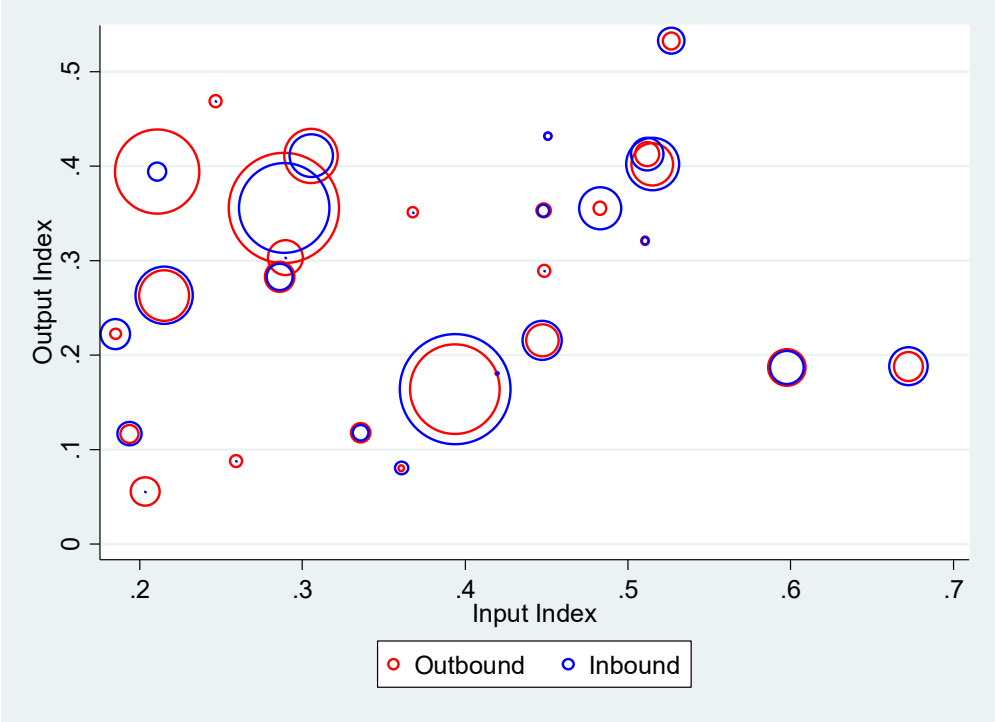
Notes: A higher Input Index score indicates more reliance on GVCs. A higher Output Index score indicates more contribution to GVCs. The size of the bubble indicates the relative size of the industry in affiliate sales.

Figure 6: US Outbound FDI to Brazil, Mexico, and China



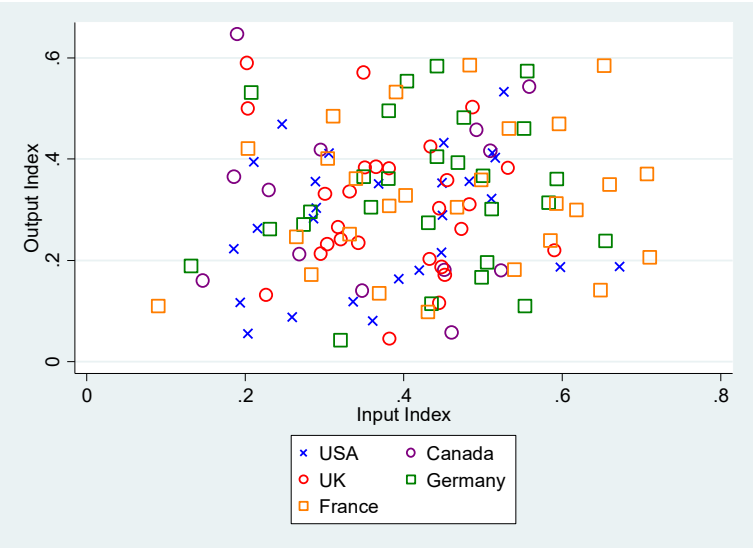
Notes: A higher Input Index score indicates more reliance on GVCs. A higher Output Index score indicates more contribution to GVCs. The size of the bubble indicates the relative size of the industry in affiliate sales.

Figure 7: US Stocks of FDI in the GVC Box



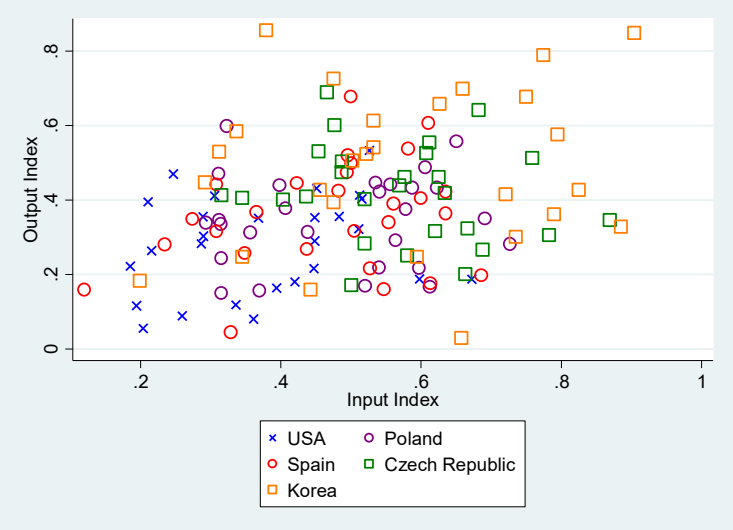
Notes: A higher Input Index score indicates more reliance on GVCs. A higher Output Index score indicates more contribution to GVCs. The size of the bubble indicates the relative size of the industry in affiliate FDI stock.

Figure 8: Inbound FDI of the Big Five in the GVC Box



Notes: A higher Input Index score indicates more reliance on GVCs. A higher Output Index score indicates more contribution to GVCs. The size of the bubble indicates the relative size of the industry in affiliate FDI stock.

Figure 9: Inbound FDI of Developing OECD in the GVC Box



Notes: A higher Input Index score indicates more reliance on GVCs. A higher Output Index score indicates more contribution to GVCs. The size of the bubble indicates the relative size of the industry in affiliate FDI stock.

Table 1: Goods and Services Supplied by Foreign Affiliates of US MNEs

Destination of affiliate sales
[2014 BEA benchmark survey, Table II.E.1 abridged]

	Share host country	Share other foreign	Share US
Shares	**0.594**	**0.297**	**0.109**
Goods	0.562	0.331	0.107
Services	0.676	0.209	0.115

Goods & sevices supplied by affiliates
relative to total US exports of goods & services
[2014 BEA benchmark survey, BEA international trade data]

	as proportion of total US exports of goods	as proportion of total US exports of services
Affiliate supply of goods	2.761	
Affiliate supply of services		2.339

Importance of goods versus services - foreign affiliates
[2014 BEA benchmark survey, Table II.E, F, G abridged]

	Share of sales	Share of value added	Share of employment
Goods**	0.723	0.516	0.406
Services**	0.277	0.484	0.594

** "goods " includes mining. "services" includes some that are arguably not services:
agriculture, forestry, fishing (very small numbers), construction, utilities

Table 2: Regional concentration of affiliate activity; shares of affiliate sales

[Millions of dollars, 2014 BEA benchmark survey, Table II.E.1 abridged]

Region	Share of total world affiliate sales	Of regional total, share to host country	Of Regional total, share to third countries	Of regional total, share to US
World	1.00	0.59	0.30	0.11
Europe	0.47	0.51	0.40	0.09
Asia-Pacific	0.27	0.63	0.28	0.09
Canada	0.11	0.77	0.03	0.20
Latin America, other Western Hem.	0.12	0.68	0.17	0.15
Africa	0.02	0.57	0.28	0.14
Middle East	0.01	0.57	0.27	0.16

World - 2014		0.59	0.30	0.11
World - 2004		0.62	0.27	0.11
World - 1994		0.67	0.23	0.10
World - 1984		0.64	0.24	0.12

Table 3: Sales by Affiliates to Countries other than the Host Country
Third-Country sales are largely Intra-Regional or to other high-income countries

[Share values, 2014 BEA benchmark survey, Table II.D.5 abridged]

	Proportion of total world third-country sales by US affiliates	Proportion of region's third-country sales that are intra-regional
World	1.00	0.75
European affliates third-country sales	0.64	0.80
Asia-Pacific affliates third-country sales*	0.26	0.80
Latin America, Western Hemisphere affiliates third-country sales	0.07	0.43
African affiliates third-country sales	0.02	0.17
Middle East affliate third country sales	0.01	0.22

Proportion of world third-country sales that are intra-European or intra-Asia-Pacific	0.72

* Asia-Pacific data consists of high and middle-income countries only, no observations for the poorest

Table 4: Input and Output Indices

	Input Index	Output Index
Unweighted		
All countries	0.427	0.320
USA	0.365	0.260
Major US Hosts		
Unweighted		
Developed	0.443	0.347
Developing	0.474	0.365
% difference (Developing vs. Developed)	7.0%	5.2%
Weighted by Industry FDI Share		
Developed	0.410	0.335
Developing	0.642	0.413
% difference (Developing vs. Developed)	56.7%	23.1%

Notes: Weights are the share of FDI for this country-industry within the group of countries.
The developed and developing country subsets are those used in Figure 5.

Table 5: Foreign Affliates of US MNEs: sales, value added, profits and net income

[2014 BEA benchmark survey, Table II. D,F,I abridged]

	Total million US$	As a Share of Total Sales	As a Share of Value Added
Sales (1)	6504909		
Value Added (2)	1490153	0.229	
Profit (3)	554226	0.085	0.372
Net Income (4)	1166223	0.179	0.783
Royalties and fees received (5)	67786	0.010	0.045
Royalties and fees paid (6)	107096	0.016	0.072
R&D performed by affliates (7)	55278	0.008	0.037

Ireland - affliate activity as a proportion of US affiliates worldwide	
Royalties and fees received (5)	0.507
Royalties and fees paid (6)	0.415
Affiliate sales (1)	0.057
Value added (2)	0.053
R&D performed by affliates (7)	0.051
Employment (8)	0.009
Profit (3)	0.110

Table 5: Footnotes

(1) Sales from Table II.D.1
(2) Value Addded from Table II.F.1
(3) Profit from Table II.F.7

Profit-type return is an economic accounting measure of profits from current production.
Unlike net income, it is gross of foreign income taxes, excludes
capital gains and losses and income from equity investments,
and reflects certain other adjustments needed to convert profits
from a financial accounting basis to an economic accounting basis.

(4) Net income from Table II.D.1

Net income receipts include not just sales from production, but also (unlike profits)
income from equity investments in affliates, from other equity investments,
capital gains and losses and other income, and (unlike profits) subtracts foreign taxes paid

(5) Royalties and fees reeived from Table II.I.8
(6) Royalties and fees paid from Table II.I.8
(7) R&D performed by affiliates from Table II.I.1
(8) Employment from Table II.G.1

Table 6: The Role of Intangibles in Global Value Chains

Chen, Los and Timmer, NBER WP 25242

Shares of factor income in Global Value Chains of Manufactured Goods 2014	Labor share	Tangible capital share	Intangible capital share	Ratio of intangible to tangible
Factor shares	51.2	18.1	30.7	1.7
Percentage point change 2000-2014	-5.2	2.3	2.9	

Shares of stages of production in intangible capital income 2014	Distribution stage	Final production stage	Upstream production stages	
Share of intangible capital	27.0	26.6	46.4	
Percentage point change 2000-2014	-1.3	-4.2	5.5	

Table 7: Brand Value as an example of intangible assets

Name	Brand Value ($ billion) 2009 survey
Coca-Cola	69
IBM	60
Microsoft	57
GE	48
Nokia	45
McDonald's	32
Google	32
Toyota	31
Intel	31
Disney	28
Hewlett-Packard	24
Mercedes-Benz	24
Gillette	23
Cisco	22
BMW	22
Louis Vuitton	21
Marboro	19
Honda	18
Samsung	18
Apple	15

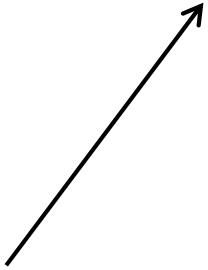
From B2B international:
Assess brand value on a variety of issues such as:
strategic brand management
marketing budget allocation
marketing ROI
portfolio management
brand extensions
M&A,
balance sheet recognition
licensing,
transfer pricing
investor relations

https://www.b2binternational.com/publications/value-of-brands/

Table 8: Apple iPhone breakdown:
unmeasured services and intangibles,
mislabeled as simply "profit"

Physical components and assembly

Korea	80.05
Germany	16.08
France	3.25
Japan	0.70
Other	62.79
USA	24.63
China VA	6.54
Factory gate price	194.04
Distribution	90.00
Misc	45.95
Total "cost"	**329.99**
Retail price	**600.00**
Apple "profit"	**270.01**
(45% of retail price)	



Services and intangibles

- software
- management
- marketing
- finance
- R&D and intellectual property
- brand value & goodwill
- contracts and customer lists
- trained and assembled workforces

www.researchgate.net/publication/303523378

Table 9: Return on Invested Capital (ROIC), Conventional and Corrected for Intangible Capital (RMAN - routine manual labor, ICAP - intangible capital)

from Ayyagari, Demirguc-Kunt, and Maksimovic (ADM) (2019)_

Return on invested capital, 1990-2015	25th percentile	median	75th percentile	90th percentile	90th percentile: percentage point difference: corrected minus conventional
ROIC as conventionally measured	9.3	19.9	36.9	69.1	
ROIC corrected for intangible capital	1.6	11.9	23.3	40.3	**-28.8**
ROIC conventional low RMAN industries	9.0	21.8	45.1	98.1	
ROIC corrected low RMAN industries	1.9	13.2	27.6	48.9	**-49.2**
ROIC conventional high RMAN industries	9.5	19.1	33.1	55.7	
ROIC corrected high RMAN industries	1.5	11.2	20.8	33.9	-21.8
ROIC conventional low ICAP industries	7.0	14.8	25.6	41.9	
ROIC corrected low ICAP industries	2.1	11.1	20.6	34.5	-7.4
ROIC conventional high ICAP industries	11.4	23.8	44.1	85.7	
ROIC corrected high ICAP industries	0.9	12.4	25.0	45.3	**-40.5**