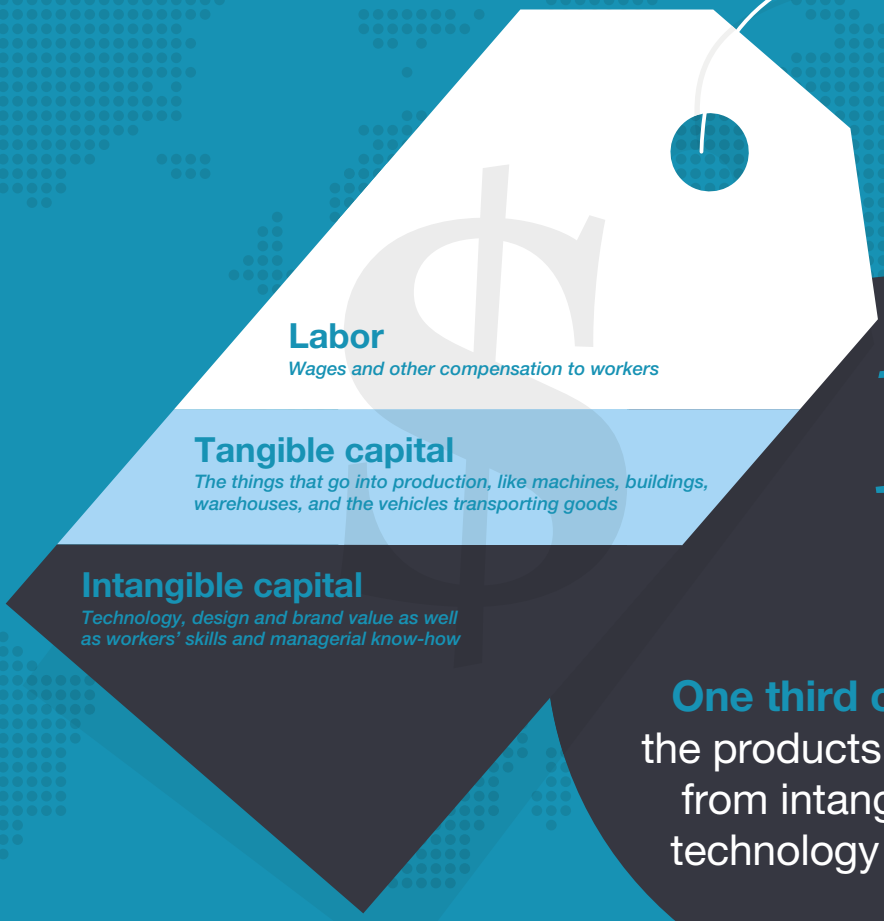
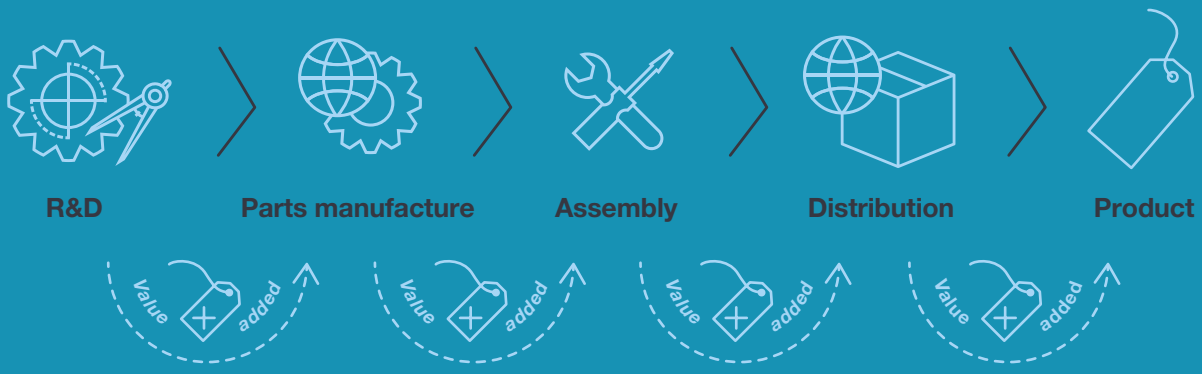
IP and other intangibles add twice as much value to products as tangible capital



1/3

One third of the value of the products you buy comes from intangibles such as technology and branding.



Value added = The difference between outputs and inputs at each stage of the global production chain.

Source: World Intellectual Property Report 2017

Chapter 1
Global value chains: the face of 21st-century international commerce

Technology, business innovations and falling trade costs have profoundly transformed the organization of global production. The production process has been unbundled, and different production stages spread across different locations. Complex international supply chains – also referred to as global value chains – have emerged, whereby firms ship intermediate goods across the world for further processing and, eventually, final assembly. Among the most far-reaching changes unleashed by the growth of global value chains has been the integration of selected developing economies into the global economy, coinciding with rapid economic growth in those economies. One prominent scholar has characterized this development as "perhaps the most momentous global economic change in the last 100 years."[1]

The rise of global value chains has gone hand in hand with the growing importance of intangible assets in economic activity. Previous editions of the *World Intellectual Property Report* have documented the rapid growth of investments in technology, design and branding – outpacing the growth of traditional bricks-and-mortar investments.[2] In fact, the two trends are directly connected. Intangible assets shape global value chains in two important ways. First, the organization of international supply chains – and especially the offshoring of labor-intensive manufacturing tasks to lower-wage economies – entails the transfer of technological and business knowledge from one location to another. Such knowledge is often subject to various forms of intellectual property (IP), including registered IP such as patents and industrial designs, and unregistered IP such as copyright and trade secrets. Second, technology, design and branding determine success in the marketplace and thus affect how value is distributed within global value chains.

Despite a large number of studies on global value chain trade, relatively little is known about how companies manage their intangible assets when offshoring production abroad, and how much production value derives from those assets. This report seeks to help fill that knowledge gap. It does so in two parts. First, it distills the insights from existing global value chain studies and reveals original research on the macroeconomic contribution of intangible assets to value added. Second, it explores the role of intangible assets at the microeconomic level in the case of three industries – coffee, photovoltaics and smartphones. These case studies will be presented in chapters 2, 3 and 4, respectively.

This opening chapter seeks to set the scene by reviewing how global value chains have come about, exploring economic research on their organization and providing new evidence on the contribution of intangible assets. In particular, section 1.1 provides a brief summary of the growth of global value chains over recent decades and section 1.2 introduces key concepts surrounding the organization and governance of global value chains. Against this background, section 1.3 presents original estimates of the returns accruing to intangible assets in global value chain production. Section 1.4 then takes a closer look at how firms participating in global value chains manage their intangible assets, and how firms in economies at early stages of industrial development may acquire them. This discussion provides the context for the case studies in chapters 2, 3 and 4. Finally, section 1.5 offers some policy-oriented reflections on the evolution of global value chains.

1.1 – Characterizing the growth of global value chains

The growth of global value chains is a key distinguishing feature of the so-called second wave of globalization that set in some time in the second half of the 20th century. The invention of the steam engine in the 18th century unleashed the first globalization wave, which peaked early in the 20th century. International commerce during the first wave mostly consisted of trade in commodities and fully assembled manufactured goods. Countries' export and import patterns at that time largely reflected their sectoral comparative advantages and disadvantages.[3] What stands out about international commerce in the second globalization wave is increased *vertical specialization* – countries concentrating on particular stages of production. As a result, trade patterns have shifted toward multidirectional trade in intermediate goods and services within particular industries.[4]

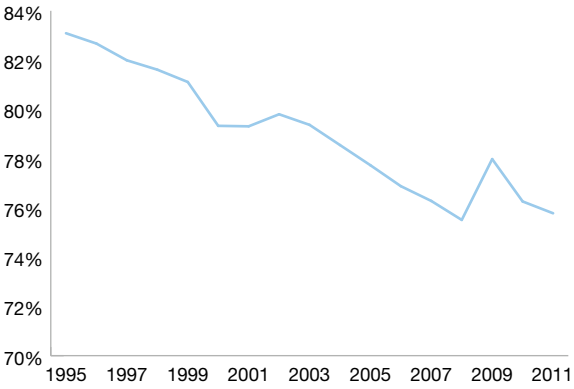
Several forces supported greater vertical specialization. Falling costs of international trade made it cost-effective to disperse production across a number of locations. Cheaper and faster transportation already propelled international trade during the first globalization phase. The advent of air transport, the spread of containerization and other innovations lowered transport costs even further. Progressively more liberal trade policies after the Second World War – following the proliferation of protectionist policies in the interwar period – also helped to lower the costs of shipping goods from one country to another. It is worth noting that even small declines in trade costs – whether due to cheaper transportation or less import protection – can have a strong effect on global value chain formation, because such costs occur every time different parts and components cross national borders before final assembly.[5]

Equally important, modern information and communication technologies (ICTs) were critical in enabling dispersed production across several locations. As will be further explained below, deciding whether or not to geographically separate production involves a trade-off between lower production costs offered by dispersed production and higher coordination costs associated with geographical separation. Rapidly falling communication costs and ever more powerful computing technology shifted this trade-off in favor of dispersed production.[6]

Figure 1.1

More gross exports for every dollar of export value added

Share of export value added in gross exports, world total



Note: Export value added refers to the domestic value added in countries' gross exports.

Source: Trade in Value Added Database, OECD.

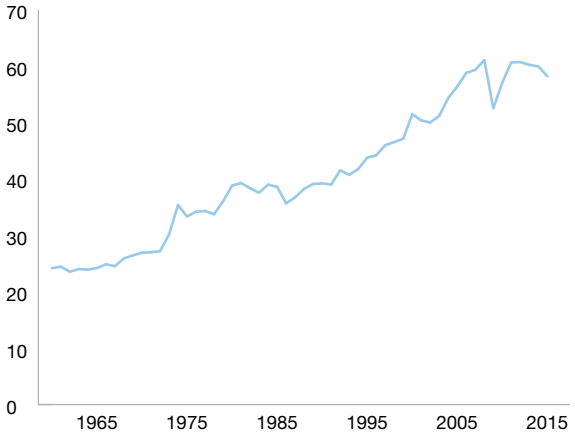
One way of illustrating the rise of global value chains is to calculate the share of export value added in overall gross exports. If products' parts and components cross national borders several times before they reach consumers, gross export values associated with these products will exceed the export value added in each of the production locations. Growing global value chain trade should thus prompt a decreasing share of export value added in gross exports; and figure 1.1 shows that this has indeed happened – globally, the share fell by 7 percentage points between 1995 and 2011.

Unfortunately, given the complexity of capturing value added in trade statistics, export value added data are not available before 1995 and after 2011. For both a longer-term and more recent perspective, figure 1.2 depicts the evolution of the world's trade-to-gross domestic product (GDP) ratio. Trade as a proportion of GDP rose nearly 240 percent between 1960 and 2015. Note that trade and GDP values are not directly comparable: trade captures traded output on a revenue basis whereas GDP measures total output on a value-added basis. Nonetheless, the sharp increase over the last half-century likely reflects the rise of global value chains – again, more gross trade for every dollar of output.

Figure 1.2

Growth in world trade outpaces growth in world output

Trade as a percentage share of GDP



Note: Trade is defined as exports plus imports.

Source: World Bank World Development Indicators.

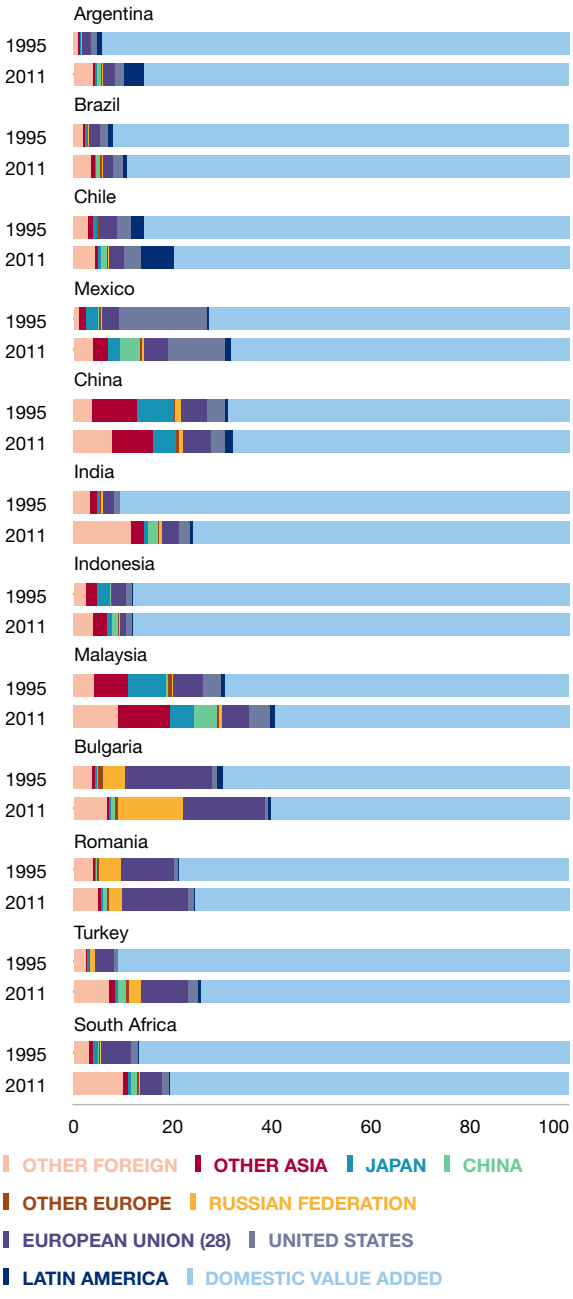
Figure 1.2 also shows that the trade-to-GDP ratio reached its peak in 2008, saw a sharp fall in the course of the global financial crisis, and has stagnated since. It is still too early to tell whether this is a cyclical phenomenon associated with the weak economic recovery from the financial crisis or a structural and lasting phenomenon. However, some evidence suggests that vertical specialization may indeed have reached its limits and global value chains may not further proliferate as they have over the past few decades.[7]

Notwithstanding the profound imprint of global value chains on world trade, it is worth asking whether global value chains have a truly global reach. Figure 1.3 offers a perspective on this question by showing the share of domestic and foreign value added in overall exports for selected middle-income economies. Foreign value added reflects the imports of intermediate goods and services used in the production of exported goods. The figure also offers a breakdown of foreign value added by source country.

Figure 1.3

Global value chains have a regional face

Value added share of exports, in percent



Note: The (foreign) shares shown are what are known as global value chain backward participation shares, defined as the ratio between the value-added content of imports from the source country and the gross exports of the exporting country.

Source: Trade in Value Added Database, OECD.

At least two insights emerge from figure 1.3. First, while virtually all economies have seen an increase in the share of foreign value added, some are more closely integrated into vertical production networks than others. For example, the foreign value added shares in Argentina, Brazil and Indonesia are substantially lower than those of Bulgaria, China, Malaysia and Mexico. India and Turkey stand out as having seen the largest increases in the foreign value added share of their exports from 1995 to 2011. Second, global value chains have a regional face: the United States accounts for the largest share of foreign value added in Mexico's exports; East and Southeast Asian countries account for the largest foreign value added shares in China, Indonesia and Malaysia; and European countries account for the largest shares in Bulgaria, Romania and Turkey.

More generally, studies have identified East Asia, Europe and North America as the three regional blocks with the strongest supply chain relationships. In a nutshell, within each of these blocks, high-income "headquarter" economies export technology-intensive intermediate goods and services to middle-income "factory" economies which then export assembled goods within and beyond the region. Japan, Germany and the United States have been the lead headquarter economies in the three blocks.[8] However, vertical production networks have evolved substantially over time, with China in particular increasingly entering the more technology-intensive upstream production stages.

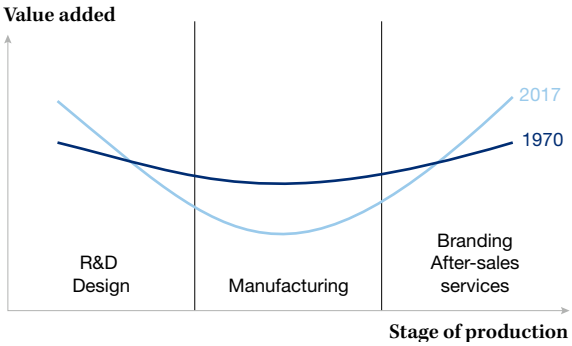
1.2 – How global value chains are organized and governed

The concept of production in the 21st century has evolved greatly from the first notions of mass production in the early 20th century. As epitomized by Ford's automotive assembly line, the focus back then was on converting raw materials into parts and components which were then manufactured into final products. There were relatively few stages of production and they took place within close geographical proximity, if not under the roof of the same factory.

Production in the 21st century is popularly characterized by the so-called smile curve – first proposed in the early 1990s by the chief executive officer of the company Acer, Inc. As illustrated in figure 1.4, the smile curve recognizes the increased importance of pre- and post-manufacturing stages and, in fact, submits that those stages account for ever-higher shares of overall production value.

Figure 1.4

Production in the 21st century – a growing smile



Note: Branding is shown as a post-manufacturing production stage, although certain branding activities may already occur at early pre-manufacturing stages.

The simple concept of the smile curve captures two important structural shifts:

- First, technological progress has been considerably faster in manufacturing than in services. As discussed in WIPO (2015), this trend has implied a shift of labor and capital from manufacturing to services and consequently a rising share of services in economic output. In terms of figure 1.4, the share of manufacturing in firms' overall cost structure has progressively fallen.

- Second, intangible assets – in the form of technology, design and brand value as well as workers' skills and managerial know-how – have become critically important in dynamically competitive markets. Firms continuously invest in intangible capital to stay ahead of their rivals. As economies have grown richer, consumers' preferences have shifted toward goods that respond to differentiated tastes and offer a broader "brand experience."[9]

Faced with 21st-century smile curves, how have firms organized production along the value chain? The answer depends in part on the nature of the final product and the technology underlying manufacturing. In this regard, one can broadly distinguish two basic supply chain configurations, as shown in figure 1.5. On the one hand, there are "snake-like" configurations, in which production proceeds sequentially from upstream to downstream, with value being added at each stage – not unlike in the classic Ford example.

On the other hand, there are "spider-like" configurations in which a variety of parts and components come together for assembly of the final product.[10] For example, as will be further discussed in chapters 2, 3 and 4, the coffee and photovoltaic supply chains tend to resemble a snake configuration, whereas the smartphone supply chain looks more like a spider. But most supply chains are a complex mixture of these two polar configurations.

In either configuration, firms face two overarching questions. Should they perform different production tasks themselves or outsource those tasks to other firms? And where should those tasks be located?

As to the first question, one important insight from economy theory is that firms outsource certain production tasks whenever the transaction cost of providing specific goods or services through the market is lower than the costs of coordination within a single organization.[11] In practice, firms are more likely to integrate different tasks whenever there are strong synergies from doing so – say, from combining product development and manufacturing. In addition, concerns about technology and business know-how leaking to competitors may also favor vertical integration (see section 1.4). Nonetheless, greater production complexity, the increased importance of pre- and post-manufacturing stages, the standardization of certain manufacturing processes, and improved information and communication technologies have, over time, favored greater firm specialization.

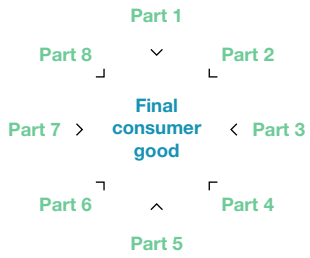
As to the question of where different production tasks should be located, some tasks – notably in agriculture and mining – depend closely on the location of natural resources. Where this is not the case, various trade-offs apply. On the one hand, combining different tasks in one location reduces coordination and trade costs. On the other hand, spreading those tasks to different locations – whether within the same country or abroad – allows firms to benefit from the advantages different locations can offer. These advantages may take the form of access to specialized skills, lower cost structures, or proximity to end-consumer markets.[12] The combination of technological advances, business innovations and falling trade costs has, over time, prompted the progressive unbundling and geographical dispersion of the production process.[13]

Figure 1.5

Supply chain configuration: snakes versus spiders

(a) Snake configuration

(b) Spider configuration



The most dramatic consequence has been the offshoring of labor-intensive manufacturing stages to developing economies with a relatively abundant supply of workers and thus lower wage costs. Greater vertical specialization across economies, in turn, has pushed the trough of the smile curve downwards – as illustrated in figure 1.4.[14]

Note that vertical specialization may occur within and across firms. In some cases, firms have offshored manufacturing by setting up a subsidiary in a foreign country. In other cases, they have outsourced and offshored manufacturing to independent firms. The precise shape of global value chains – the number of firms involved and their relationship to one another – differs substantially across industries. Nonetheless, it is possible to distinguish between different governance models of global value chains. In particular, academic research has juxtaposed buyer-driven chains with producer-driven chains.[15] In buyer-driven chains, large retailers and branded merchandisers lead value chains and set production and quality standards that independent suppliers need to meet. In supplier-driven chains, the lead firms possess advanced technological capabilities and are more vertically integrated, but draw on independent suppliers for specialized inputs.

Table 1.1

Different types of global value chain governance

Governance type	Complexity of transactions	Ability to codify transactions	Capabilities of supplying firms	Description
Market	Low	High	High	Buyers respond to specifications and prices set by suppliers; transactions require little explicit coordination; it is easy to switch suppliers.
Modular value chains	High	High	High	Buyers transmit complex but codified information, for example design files, to suppliers which the latter can flexibly accommodate; coordination remains low and switching partners remains possible.
Relational value chains	High	Low	High	Tacit knowledge must be exchanged between buyers and suppliers for transactions to occur; the buyer–seller relationship may rely on reputations, social and spatial proximity and the like; high levels of coordination make it costly to switch partners.
Captive value chains	High	High	Low	Low supplier capability requires significant intervention and control on the part of the lead firm, encouraging the latter to "lock in" suppliers to appropriate the benefits of growing capability.
Hierarchy	High	Low	Low	High complexity, low ability to codify and low supplier capability imply that the lead firm has to perform supply chain tasks in-house.

Source: Gereffi et al. (2005).

Gereffi et al. (2005) develop a more elaborate theory of global value chain governance based on how lead firms interact with other firms in the value chain. They consider three dimensions of such interactions: the *complexity* of information and knowledge transfer required for transactions in the value chain; the extent to which this information and knowledge can be *codified* and hence efficiently transmitted; and the *capabilities* of the firms in relation to the value chain transaction. On the basis of these three dimensions, they identify five types of value chain governance, as presented in table 1.1.

At one end of the spectrum, market-based governance models require little coordination between suppliers and buyers connected at a particular stage in the value chain, and both sides can switch partners relatively easily. As the complexity of transactions increases, the ability to codify relevant information and knowledge decreases and the capability of supplying firms diminishes, high levels of coordination are required and partner switching becomes progressively more difficult. At the limit, arm's-length relationships between firms connected at a value chain stage become impossible and lead firms have to perform supply chain tasks in-house.

1.3 – What return accrues to intangible assets?

While appealing and intuitive, the concept of the smile curve has its limitations. It may reasonably portray the distribution of value added for some global value chain lead firms, but it is more difficult to apply at the economy-wide level where firms' value chains intersect and overlap.[16] More importantly, it does not provide any insight into what generates value added at different production stages. In particular, higher value added does not necessarily coincide with underlying activities being more profitable, associated with better-paying jobs, or generally "more desirable." For example, higher value-added activities may be highly capital-intensive, in which case it is not clear that workers involved in them receive higher wages compared to lower value-added activities.[17] Similarly, value-added figures alone do not reveal how much intangible capital contributes to global value chain production – the focus of this report – as value added reflects the return of all the inputs into production.

Indeed, understanding what precisely generates value in global value chains requires analysis of how much income accrues to labor, tangible capital and intangible capital used in global value chain production. In research performed for this report, economists Wen Chen, Reitze Gouma, Bart Los and Marcel Timmer performed precisely such an analysis. Their approach consisted of two steps.

Box 1.1

Assembling and slicing up global value chains

There are no readily available macroeconomic data on global value chain production. Some information is available in national accounts and in trade statistics, but neither offer a full picture. National accounts statistics provide information on production value added, but are classified by industrial activity. For example, value added in the motor vehicle industry captures the manufacture of auto parts and components as well as the final assembly of cars. But it does not capture the upstream production of materials, the business services supporting production or the downstream distribution of cars to the end consumer. To complicate matters further, many parts and components come from abroad – which is precisely what makes value chains global. Trade statistics offer information on imported intermediate goods, but are classified by product and not industrial activity.

To assemble metrics of value added in global value chains, Chen et al. (2017) built on previous research that has sought to track the flow of products across industries and countries. Relying on concordances between industry and trade statistics, they combined national input-output tables with international trade data to construct a world input-output table (WIOT). This contains data on 55 industries – of which 19 are manufacturing – in 43 economies plus one rest-of-the-world region, which together represent more than 85 percent of world GDP. One can think of the WIOT as a large matrix which breaks down the value added of each industry in each country into either intermediate inputs flowing to other industries (either at home or in another country) or finished products for final consumption (again, either at home or in another country).

One complicating factor concerns the measurement of value added in the distribution stage. Input-output tables represent the distribution sector as a so-called margin industry, which means that the final products that wholesalers and retailers buy are not treated as intermediate inputs. To arrive at a measure of distribution value added, Chen et al. calculated a distribution margin as the ratio of the price paid by final consumers (less product taxes) to the price received by producers, then applied the resulting margin to a product's total sales.

The next step was to slice up the assembled value-added statistics according to the incomes accruing to the underlying production factors. First, labor income was calculated for each industry in each country, drawing on national labor force surveys and additional data sources. Second, Chen et al. estimated tangible capital income by applying a rental price for such capital to national accounts data on capital stock, again in each industry and each country. The rental price consisted of an industry-specific depreciation rate plus an assumed real rate of return of 4 percent. Importantly, Chen et al. removed selected intangible capital assets – notably R&D, computer software and databases, and artistic originals – from capital stocks wherever those assets were covered in national account statistics. Intangible capital income was then calculated by subtracting labor income and tangible capital income from value added.

Finally, using the industry-product flow relationships contained in the WIOT and the factor decomposition of value added in each industry and each country, it was possible to calculate the contribution of labor, tangible capital and intangible capital at the level of product global value chains.

First, they assembled macroeconomic data on value-added shares in 19 manufacturing product groups spanning 43 economies plus one rest-of-the-world region which together captured around one-quarter of global output. Their data allowed them to divide global value chain production into three stages: distribution, final assembly and all other stages. As an example, the resulting database showed the value added of the distribution stage in the sales price of cars for which the final assembly took place in Germany.

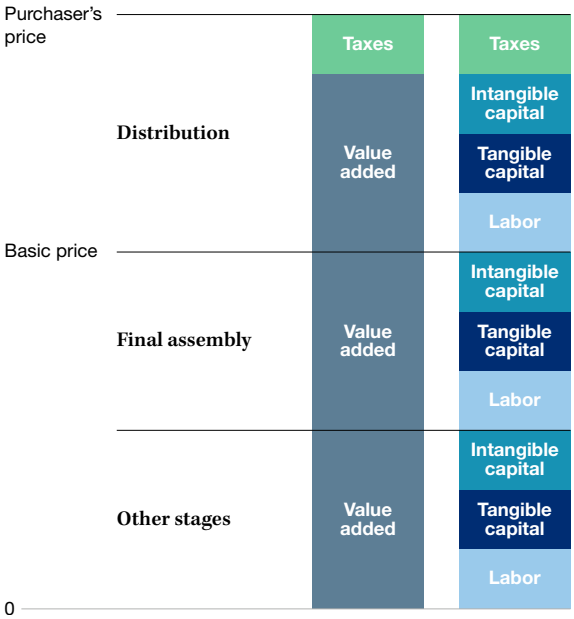
As a second step, Chen et al. (2017) decomposed value added at each stage and in each country into the incomes accruing to labor, tangible capital and intangible capital – as illustrated in figure 1.6. They did so by first subtracting labor income and imputed tangible capital income from value added – relying on available data on wages, employment, tangible capital asset stocks and an assumed rate of return on tangible capital of 4 percent. The remaining residual then represents the income accruing to intangible capital.

The logic behind this approach is to recognize that intangible capital is firm-specific and different from other factor inputs, because companies cannot freely order or hire it. In other words, intangible capital is the "yeast" that creates value from labor and market-mediated investment in assets.[18] Box 1.1 provides a fuller overview of the analytical steps performed by Chen et al.; their research paper offers more detailed technical explanations.

The research by Chen et al. (2017) breaks new ground in at least two respects. First, it offers for the first time an estimate of the return to intangible asset investments in global value chain production. Notwithstanding promising efforts to quantify such investments, their macroeconomic value has so far largely eluded measurement.[19] Second, it includes the distribution stage in the analysis, which is important as global value chains with major retailers – for example, Nike – will likely realize returns to their intangibles at this stage.[20]

Figure 1.6

Decomposing global value chains



Source: Chen et al. (2017).

Turning to the research findings, figure 1.7 presents the income shares accruing to the three production factors for all manufacturing products from 2000 to 2014. The intangibles share averaged 30.4 percent throughout this period, almost double the share for tangibles. Interestingly, it rose from 27.8 percent in 2000 to 31.9 percent in 2007, but has stagnated since then. Overall income from intangibles in the 19 manufacturing industries increased by 75 percent from 2000 to 2014 in real terms. It amounted to 5.9 trillion United States dollars (USD) in 2014.[21]

One interpretation of the rising share for intangibles is that global manufacturing firms benefited from increased opportunities for offshoring labor-intensive activities to lower wage economies. Intuitively, in competitive markets, wage cost savings will lower final output prices; if capital costs remain the same, the intangibles share must go up by virtue of its definition as a residual – intangibles will constitute a larger share of a smaller whole. However, this trend appears to have peaked in 2007 – just before the global financial crisis. This finding seems consistent with the stagnating trade-to-GDP ratio shown in figure 1.2 and empirical studies suggesting that vertical specialization may have reached its limits.[22]

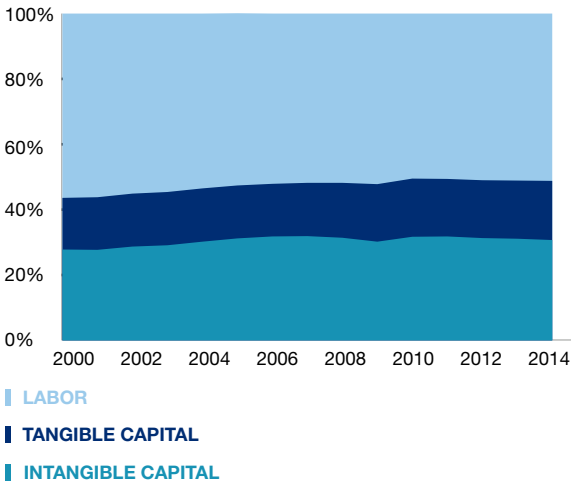
Which product global value chains use intangibles most intensively? Table 1.2 presents the factor income shares in 2014 for the 19 manufacturing product groups in descending order of their global output size. For all product groups, intangible capital accounts for a higher share of value added than tangible capital. The intangibles share is especially high – and more than double the tangibles share – for pharmaceutical, chemical and petroleum products. It is also relatively high for food products as well as computer, electronic and optical products. In terms of absolute returns, the three largest product groups – food products, motor vehicles and textiles – account for close to 50 percent of the total income generated by intangible capital in the 19 manufacturing global value chains.

While the intangibles share increased for almost all of the 19 product groups during the period 2000-2014, it did so more sharply for some than for others. Figure 1.8 depicts the trend for four of the largest product groups. As it shows, the intangibles share increased only slightly for food and textile products, but more substantially for motor vehicles and electronic products.

Figure 1.7

Intangible capital captures more value than tangible capital

Value added as a percentage of the total value of all products manufactured and sold worldwide



Source: Chen et al. (2017).

Table 1.2

Income shares by manufacturing product group, 2014

Product group name	Intangible income share (%)	Tangible income share (%)	Labor share (%)	Global output (USD bn)
Food, beverages, and tobacco products	31.0	16.4	52.6	4,926
Motor vehicles and trailers	29.7	19.0	51.3	2,559
Textiles, apparel and leather products	29.9	17.7	52.4	1,974
Other machinery and equipment	27.2	18.8	53.9	1,834
Computer, electronic and optical products	31.3	18.6	50.0	1,452
Furniture and other manufacturing	30.1	16.3	53.7	1,094
Petroleum products	42.1	20.0	37.9	1,024
Other transport equipment	26.3	18.5	55.2	852
Electrical equipment	29.5	20.0	50.6	838
Chemical products	37.5	17.5	44.9	745
Pharmaceutical products	34.7	16.5	48.8	520
Fabricated metal products	24.0	20.8	55.2	435
Rubber and plastics products	29.2	19.7	51.1	244
Basic metals	31.4	25.6	43.0	179
Repair and installation of machinery	23.6	13.2	63.2	150
Paper products	28.0	20.9	51.1	140
Other non-metallic mineral products	29.7	21.5	48.9	136
Wood products	27.5	20.0	52.5	90
Printing products	27.1	21.2	51.7	64

Source: Chen et al. (2017).

This may suggest that opportunities to offshore production of food and textiles were already largely realized, whereas the latter industries could still take advantage of such opportunities between 2000 and 2007.

At what stage of production does income accrue to intangible capital? The global value chain decomposition suggests that distribution and the final production stage each account for around a quarter of the intangibles income, and the other stages for the remaining half.[23] This division signifies the importance of intangibles in upstream activities – not only the production of parts, components and materials, but also a wide variety of business services as well as agriculture and mining activities.

The contribution of different production stages to intangibles income varies greatly across product groups, as shown in figure 1.9. Intuitively, the pattern that emerges seems to correspond broadly to the distinction between buyer-driven and producer-driven global value chains introduced in section 1.2.

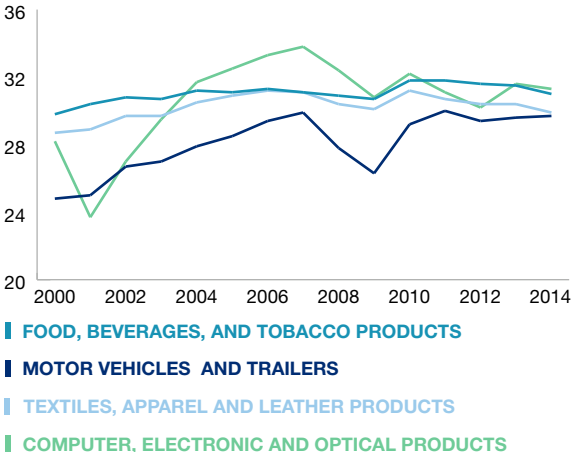
Buyer-driven global value chains such as textile, furniture and food products realize larger returns to intangibles at the distribution stage whereas producer-driven global value chains such as motor vehicles, electronics and machinery realize those returns before final production.

The findings by Chen et al. (2017) underscore the importance of intangible assets in generating value in global value chain production. However, they also leave a number of questions open and come with several methodological caveats. One unresolved question is what precisely accounts for the income attributed to intangibles. Under Chen et al.'s methodology, this income captures all the firm-specific returns that go beyond market-mediated returns to tangible capital and labor. That clearly includes brand reputation and image, technological edge and design appeal that sets apart the products of one firm from those of another – intangible assets for which firms seek different forms of IP rights. It also includes organizational and managerial know-how that may be protected by trade secrets.

Figure 1.8

Different product groups see different trends

Intangible income as a percentage of the value of all products manufactured and sold worldwide



Source: Chen et al. (2017).

However, it may also include other factors – beyond reputational and knowledge assets – that generate large economic returns. For example, the high intangibles share for petroleum products (see table 1.2) is likely to reflect the resource rents accruing to oil producers.[24] Supply-side and demand-side economies of scale may be other sources of market power that may not relate directly to intangible assets.

A second unresolved question is which economies harvest the returns from intangible capital. The question is obvious, but the answer is elusive. For one thing, through transfer pricing and related practices, companies can easily shift profits from one location to another (see box 1.2). Thus, an intangible asset may originate in one economy, but most of its returns may show up in another. More importantly, increasing cross-border ownership and sharing of intangibles is undermining the very notion of location-bound assets and earnings.

Finally, several caveats apply to the research by Chen et al. (2017) that should be kept in mind in interpreting their findings:[25]

- The validity of the findings relies heavily on the quality of the underlying data. While there has been important statistical progress in measuring global production networks, important measurement gaps remain. For example, it is hard to capture international trade in services adequately, and there are also challenges in measuring value added in the distribution stage. In addition, the use of international input-output tables relies on relatively strong assumptions, such as firms in a given industry and country exhibiting similar production structures.

- As already mentioned, transfer mispricing and related practices – in particular between related parties – may distort the distribution of value added along the global value chain (see box 1.2). This could lead to biases in the income share estimates by production stage, as shown in figure 1.9. However, to the extent that such practices merely shift profits from one production stage to another, they should not affect the estimates of income shares involving all production stages, as presented in figures 1.7 and 1.8 and table 1.2.

- The allocation of intangible capital to different production stages – as shown in figure 1.9 – may also be affected by how global value chain lead firms are classified statistically. For example, if "factory-free" goods producers are classified as retailers or wholesalers, returns to intangible assets will be recorded at the distribution stage; if they are classified as manufacturers, these returns will be recorded at one of the other production stages.

1.4 – How intangible assets permeate global value chains

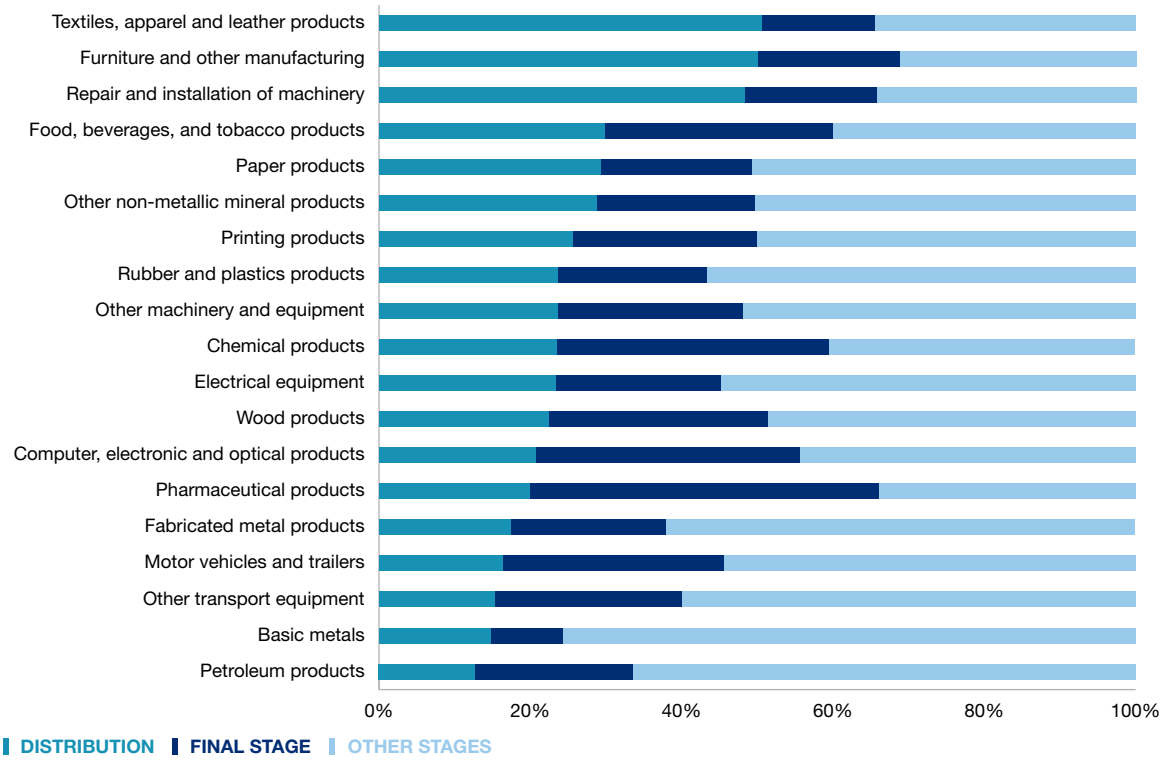
In light of the substantial value generated by intangible assets, a key question is how firms holding such assets manage them within their global production networks. A related and equally important question is how firms not holding intangible assets can acquire them. To address these questions, it is helpful to distinguish between two types of intangible assets:

- *Knowledge assets* cover technology and design as well as organizational, logistical, managerial and related know-how. A common characteristic of knowledge assets is that they are non-rival in nature and – in contrast to tangible assets – not necessarily tied to any particular location. For example, the R&D for a new car may occur in one location, but once the car is developed its production can be spread across a large number of locations.

Figure 1.9

Buyer-driven versus producer-driven global value chains

Intangible income by production stage, percentage shares in 2014



Source: Chen et al. (2017).

- *Reputational assets* consist of the goodwill that consumers extend to a company's brand – partly because of satisfaction derived from previous brand purchases and partly because of the image associated with different brands. Reputational assets are rival in nature: brands only have reputational value if used in relation to a single product or firm. In addition, while brands can sometimes gain an international reputation, they generally do not seamlessly flow across borders; companies may possess strong reputational assets in some markets, but not in others.[26]

Managing knowledge assets

In order to reap returns from investments in innovation, firms must be able to appropriate their knowledge assets. Ideally, they would want to capture the full rewards from those assets without any knowledge leaking to competitors.[27]

In practice, such "perfect appropriation" is typically not possible. How high a return a firm will reap will depend, among other things, on how it controls the flow of its knowledge.

At the outset, when generating new knowledge, firms face a well-known trade-off. On the one hand, they have incentives to keep their innovations secret to maintain their edge over competitors. Trade secrecy laws protect confidential information from unauthorized disclosure, though competitors may still be able to reverse-engineer products placed in the market. On the other hand, firms may be able to take out IP rights for their innovations, in which case they need to disclose them but benefit from exclusivity – at least for a limited time. Several factors will influence the preferred knowledge management strategy. Certain knowledge assets – such as process technology and organizational know-how – can easily be kept secret, whereas others – such as product design – cannot.

Box 1.2

How transfer mispricing and related practices distort global value chain measurement

National accounts and trade statistics seek to measure the real economic activity taking place in different countries as well as the real economic value of trade in goods and services taking place between countries. However, they rely on self-reported financial accounts and customs declarations by companies that do not always reflect the true market value of underlying economic transactions. An important source of measurement bias stems from strategies that seek to shift taxable profits from high-tax-rate to low-tax-rate jurisdictions. Intangibles – frequently in the form of IP rights – are often at the core of these strategies.

One widely noted practice is transfer mispricing. An example is shown in figure 1.10. Company A in a high-tax-rate country sells its IP to its affiliate B in a low-tax-rate country; affiliate B in turn licenses this IP to a related company, C, in another high-tax-rate country. To the extent that this multinational company (MNC) understates the price for the IP purchase and overstates the royalties for the use of IP, it is able to shift profits from the high-tax-rate jurisdictions to the low-tax-rate jurisdiction.

One key enabler of transfer mispricing is the difficulty of valuing intangible assets. Transfer pricing rules in financial and tax accounting frameworks have established the arm's-length standard, according to which transactions between related companies under common control are to be priced at a value similar to a comparable transaction with an unrelated third-party company. However, intangible assets are company-specific, and comparable third-party transactions typically do not exist, so transfer prices can only be imputed or estimated. In addition, the value of intangible assets can be highly uncertain, especially at an early stage when the resulting goods or services have not yet been commercialized. This uncertainty offers companies substantial leeway in setting IP sales prices and royalty rates between affiliated entities.

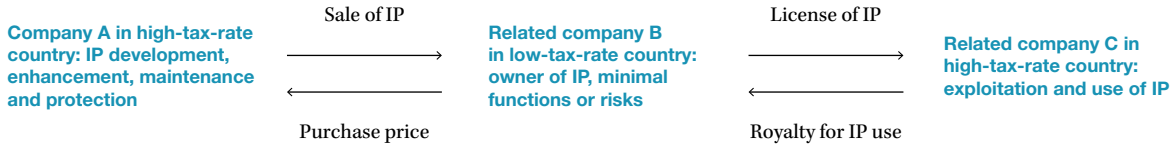
From a statistical perspective, transfer mispricing as outlined in figure 1.10 leads to an understatement of value added in the high-tax-rate jurisdictions and its overstatement in the low-tax-rate jurisdiction. In addition, it distorts trade statistics – the low-tax-rate country's imports of IP services would be understated and its exports of such services would be overstated.[28]

Profit-shifting may take other forms. Instead of transferring IP to a foreign affiliate, companies may also over- or under-invoice IP-intensive intermediate inputs traded within company supply chains and for which, again, there are no market-based reference prices. Such practices imply similar shifts in value added from one country to another, but the trade distortion would show up in goods trade statistics rather than those for services. Other related practices include the "merchanting of services" through Special Purpose Entities, and arrangements whereby MNCs establish a commercial presence in a country but are not considered permanent establishments for tax purposes and thus not included in a country's national trade statistics – as further discussed in Neubig and Wunsch-Vincent (2017).

While reliable figures are hard to come by, it is clear that tax minimization practices of MNCs lead to sizeable shifts in reported profits across jurisdictions. At the micro level, Seppälä et al. (2014) study the value chain of a Finnish MNC for a single precision machinery product. On the basis of invoice-level internal company data, they conclude that the geographical distribution of profits does not necessarily represent where the MNC's most valuable assets are located. At the macro level, using survey data from the United States (U.S.) Bureau of Economic Analysis, Rassier (2017) estimates the extent of profit shifting among U.S. MNCs; he finds that R&D-intensive firms are more inclined to book profits to foreign affiliates than non-R&D-intensive firms, underlining the important role played by intangible assets in tax minimization practices. Drawing on a variety of sources and making several assumptions, Neubig and Wunsch-Vincent (2017) conservatively estimate that global profit shifting associated with cross-border IP transactions alone could amount to USD 120 billion annually, or 35 percent of the reported total cross-border trade in IP services. Most prominently, Ireland's GDP registered a 26 percent increase in 2015 which largely reflected the inflow of intangible and other internationally mobile assets from MNCs locating their headquarters in Ireland.[29]

Figure 1.10

Shifting profits to an IP-owning intermediary



Source: Neubig and Wunsch-Vincent (2017).

Similarly, IP rights extend to certain knowledge assets – technological inventions in the case of patents – but not to others, for example many types of service innovations.

Knowledge assets can sometimes also take the form of specialized workers' skills. Retaining those skills is often an important part of a company's knowledge management strategy. Yet it is also constrained by law; there are limits, for example, on how far non-compete clauses in employment contracts can prevent workers from starting their own business or leaving to competitors.[30]

As mentioned in section 1.2, knowledge management considerations determine the organization of global value chains – in particular, whether firms vertically integrate different production tasks or whether they outsource those tasks to independent suppliers.[31] Outsourcing may generate substantial cost savings, but it may also risk key knowledge assets leaking to future competitors. Much depends on the relationships governing global value chains, as outlined in table 1.1. Knowledge leakage is bound to be a concern in relational and captive value chains, especially when global value chain lead firms transfer tacit knowledge to partner firms that might emerge as future competitors. For this reason, MNCs sometimes limit knowledge transfers to older technologies, leakage of which would not pose an immediate competitive threat.[32] At the same time, secure IP rights can help companies in transferring proprietary technologies within the supply chain and actually facilitate the outsourcing of different production tasks.

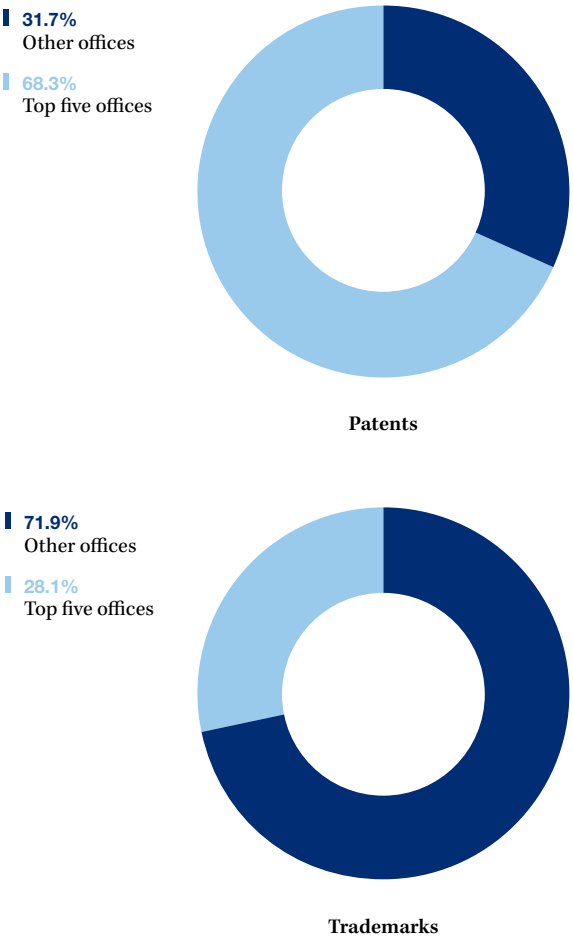
In yet other circumstances, firms may openly share or license some of their knowledge assets, partly to encourage adoption of new technologies and partly to obtain access to technology owned by other firms. The latter consideration has been important for so-called complex technologies – defined as technologies that consist of numerous separately patentable inventions with possibly widespread patent ownership. Complex technologies include most ICTs, which have seen the fastest growth in patenting over the past three decades. Through cross-licensing arrangements, companies negotiate access to technologies they require to commercialize their own innovations.[33]

In most circumstances, IP protection is a crucial element of a firm's knowledge management strategy. One study for the UK economy, for example, found that slightly more than one-half of investments in intangible assets were in assets protected by different IP rights.[34]

Figure 1.11

International patent filings focus on fewer offices than international trademark filings

Share of the top five offices in world total non-resident patent and trademark filings, 2015



Note: To account for different trademark filing systems around the world, trademark statistics refer to the number of classes specified in trademark applications.

Source: WIPO IP Statistics Database, July 2017.

However, deciding for which knowledge asset to seek IP rights, and in which countries, requires careful planning. Obtaining patent rights in particular is costly, especially when pursued in many countries. For this reason, companies often limit their patent coverage to countries hosting the largest economies and countries in which global value chain production takes place.

This explains why the world's five largest recipients of patent filings from abroad – the national patent offices of China, Japan, the Republic of Korea, and the United States as well as the European Patent Office – account for close to 70 percent of the world total in non-resident patent filings (see figure 1.11).[35] Other than China, relatively few patents flow to low- and middle-income economies.

Notwithstanding these general observations, the knowledge management strategies of firms depend crucially on the nature of their knowledge assets and their business models, which differ widely from industry to industry. The case studies presented in chapters 2 to 4 offer more concrete perspectives on prevailing strategies – at least for the global value chains under consideration.

Managing reputational assets

Like knowledge assets, reputational assets can play an important role in shaping the organization of global value chains. Outsourcing parts of the production process risks losing control over the quality of parts and components. Defective or underperforming inputs might expose a lead firm to substantial reputational risks – especially when discovered after products have been placed in the market. Similarly, consumer perceptions of a lead firm might be influenced by how its suppliers treat their workers and protect the environment. These considerations favor either outright vertical integration or, at least, far-reaching intervention by lead firms in the business operations of their suppliers. Product standardization and independent supplier certification are additional mechanisms that help firms to lower reputational risks arising in globally fragmented supply chains.

The principal IP instruments protecting reputational assets are trademarks and geographical indications (GIs). While acquiring trademark rights is relatively cheap, managing a global portfolio of trademarks also requires careful planning and strategic decision-making. To begin with, trademarks may not only cover product names, but also two- and three-dimensional shapes, sounds, colors and other features associated with them. In contrast to patents, which companies mostly protect in countries where global value chain production takes place, companies have strong reasons to protect at least their main trademarks in all the markets in which they are or plan to be active. Uncertain trademark ownership can prove costly, especially once new products have been commercialized.

For this reason, the global trademark portfolios of large multinational enterprises often consist of tens of thousands of trademarks. In addition, the distribution of non-resident trademark filings is less concentrated compared to patents: the five largest offices – the national trademark offices of Canada, China, the Russian Federation and the U.S. as well as the European Union Intellectual Property Office – account for less than 30 percent of the world total (see figure 1.11).

Catch-up and industrial development

As pointed out in the introduction to this chapter, the growth of global value chains has coincided with both rapid industrial development in certain low- and middle-income economies and the integration of these economies into the global economy. Above all, China has been at the forefront of this transformation, with its economy often referred to as "the world's factory," but a number of other economies in Asia, Eastern Europe and other parts of the world have also seen far-reaching industrial development through participation in global value chains. The causal relationship between these developments is not clear-cut, however. Has global value chain participation spurred industrial development in a way that would not have been possible otherwise, or did the successful economies just happen to have the right preconditions for industrial development which prompted their participation in global value chains?

Most likely, the answer lies somewhere in the middle. Global value chains arguably embraced those economies offering the most conducive environments – including competitive access to capital and labor, needed skills, reliable infrastructure and fast-growing markets. At the same time, the transfer of production capacity to those economies likely offered opportunities for industrial upgrading that otherwise might not have come about. One critical question in this context is how firms in successfully industrializing economies were able to "catch up" and acquire the knowledge and reputational assets that enabled their global value chain participation.

Economic research has long analyzed how knowledge assets diffuse to catch-up economies. In particular, it has distinguished among four main diffusion channels:[36]

- Firms in catch-up economies acquire knowledge through *reverse engineering* products and technologies available in the marketplace.

This form of knowledge diffusion may be seen as the reverse side of the imperfect appropriability of knowledge assets by lead firms, as discussed above. IP rights may limit the use of reverse-engineered technologies by catch-up firms – at least insofar as they are protected in a given jurisdiction. At the same time, publicly available patent records offer a rich source of technological knowledge that catch-up firms can and do employ in their own R&D activities.[37]

- Partnerships between global value chain lead firms and catch-up firms can entail the transfer of knowledge from the former to the latter. Such partnership may take the form of *technology licensing* contracts, which – in addition to licensing patented knowledge – often entail the transfer of relevant non-codified knowledge. Instead of licensing their technology to independent firms, global value chain lead firms may insist on taking an equity stake in the knowledge-acquiring firm, leading to *joint venture arrangements*. At the limit, they may only be willing to transfer knowledge to a catch-up economy by establishing a *wholly-owned subsidiary*. A key question involving this diffusion channel is whether acquisition of the knowledge asset is limited to the local partner firm or whether it diffuses beyond that firm, for example through customer and supplier linkages or skilled worker movements (see below).

- Firms in catch-up economies can gain access to knowledge assets by *importing capital goods* which embed technological knowledge. In particular, the import of production equipment can allow catch-up firms to upgrade their manufacturing capabilities to the state-of-the-art. Foreign sellers of such equipment may also train local workers to use and maintain it – building up an important complementary knowledge base.

- Finally, to the extent that knowledge assets take the form of human skills, the *movement of skilled workers* represents an important channel through which knowledge diffuses from one firm to another. Skilled workers may move from foreign global value chain lead firms to catch-up firms, or they may start their own firm. Equally important, they may move from locally established foreign subsidiaries to local firms, thereby helping to diffuse knowledge throughout the catch-up economy.

Public policies in relation to trade, investment, migration and IP have a bearing on diffusion outcomes, although the effects are not always clear-cut. For example, restricting trade may inhibit diffusion through importing technology-intensive capital goods, but could also promote diffusion by encouraging foreign investment.

Whatever the diffusion channel, successful technology diffusion relies critically on the *absorptive capacity* of catch-up economies to understand and apply foreign-grown knowledge. Effective absorptive capacity relies on human capital able to understand and apply technology, organizational and managerial know-how, and institutions that coordinate and mobilize resources for technology adoption. In many cases, absorptive capacity also entails the ability to undertake incremental technological and organizational innovation in order to adapt technology to local needs. Some countries have been more successful at creating absorptive capacity than others. In particular, economists have argued that at least part of the success of the fast-growing East Asian countries lay in their ability to ignite a process of technological learning and absorption that provided the basis for economic catch-up.[38]

Economists have paid less attention to how firms in catch-up economies can acquire reputational assets. In addition to building product portfolios of high and consistent quality, it is clear that strong brand reputation and image require substantial and often market-specific investments in advertising. Inducing consumers to switch brands may be especially challenging in mature industries with long-established competing brands. Firms' branding strategies often evolve in line with their growing manufacturing capabilities. For example, companies in Japan, the Republic of Korea and more recently China at one time pursued a low-cost and low-price strategy; over time, they were able to raise prices and quality, thus moving from largely generic products into premium brands. Other companies, including companies in the ICT industry, have made a name as providers of certain components, or as assembly and contract manufacturers – for example, Asus, Acer and Foxconn; alternatively, they may have focused on business customers before entering the end-consumer markets with a more established brand, such as in the case of Huawei. Yet other companies have bought established brands from companies in high-income economies.[39]

Again, the opportunities and challenges for industrial catch-up vary markedly from industry to industry and the case studies presented in chapters 2 to 4 offer at least selective perspectives on what has contributed to catch-up in the global value chains under consideration.

1.5 – Concluding reflections

Global value chains have emerged as the 21st-century face of international commerce. They have tied together national economies as never before and have helped integrate numerous developing countries into the global economy. How will they further evolve, and what role is there for policy to ensure that they support economic growth and rising living standards around the world? Drawing on this chapter's discussion, this final section seeks to offer some policy-oriented reflections on these two questions.

The future of global value chains

As described in section 1.1, the world's trade-to-GDP ratio has more than doubled over the past 50 years, but it has not seen any growth since the global financial crisis unfolded in 2008. This may well reflect the persistent shortfall in aggregate demand to which many economists attribute the weak recovery from the crisis.[40] Indeed, preliminary data for 2017 suggest trade growth is again outpacing global output growth.[41] At the same time, several studies suggest that the stagnating trade-to-GDP ratio may well have structural foundations and that vertical specialization may have reached a natural limit (see sections 1.1 and 1.3). There is also some evidence that the scope for further improvements in transport technology to increase trade may be exhausted.[42]

Should policymakers worry about the trade "slowdown" having structural foundations? At one level, yes. Greater vertical specialization in the world economy may not provide the same growth impetus in the future as it has throughout the second globalization wave. At the same time, technological and business innovations as well as shifting consumer preferences will continue to transform global production. Most prominently, developments in 3D printing, robotics and automated manufacturing have already reconfigured supply chains in a number of industries, and further progress in these areas may well unleash more profound change. These developments may well lead to the "re-shoring" of certain production tasks. Such an outcome would imply less cross-border trade in intermediate goods. However, the deployment of such technologies could help spur economic growth. A declining trade-to-output ratio in this case would be a sign of progress, rather than a source of concern.

Another key factor shaping global value chains is the upgrading of production capabilities in catch-up economies. Chiefly, evidence suggests that Chinese firms increasingly source parts and components domestically, rather than importing them from abroad.[43] This development similarly reduces reliance on cross-border trade and may well have contributed to the world's stagnating trade-to-GDP ratio. However, upgraded production capabilities should again ultimately enhance growth.[44]

Whatever their causes, shifts in global value chains disrupt prevailing patterns of production – and this should arguably be the chief concern of policymakers. Production tasks offshored abroad may lead affected workers to lose their jobs. More generally, evidence suggests that greater vertical specialization has put pressure on unskilled labor in high-income economies and contributed to rising income inequality. One prominent study, for example, estimates that import competition explains one-quarter of the decline in U.S. manufacturing employment between 1990 and 2007.[45] One important question in this context is how the growing role of intangible capital in global value chain production affects the compensation of workers at different skills levels. One hypothesis is that the growing role of intangibles has been especially beneficial for the most talented workers – so-called superstars.[46] However, there is no systematic evidence supporting this hypothesis.

How should policymakers respond to the disruption brought about by shifting global value chains? Trade protection is not the answer. As discussed in section 1.1, progressive trade liberalization has been one of the factors enabling the growth of global value chains. As global value chain formation is highly sensitive to underlying trade cost, reversing open markets could be highly disruptive in and of itself. In addition, it would not re-establish old production patterns, as today's production technology has evolved greatly. Instead, economists generally advocate providing a social safety net that cushions the adverse effects of unemployment and instituting measures that facilitate the retraining of affected workers. Indeed, policies aimed at addressing disruption arising from global value chain shifts are, in principle, no different from policies that seek to address disruption naturally arising in any economy that undergoes structural transformation as part of the economic growth process.

Upgrading global value chain capabilities

For policymakers in low- and middle-income economies, a key question is how they can support the upgrading of global value chain production capabilities by local firms. This question is sometimes phrased in terms of "moving up the value chain" or "capturing more value from global value chain participation." However, such value-oriented perspectives can be misleading. As pointed out in section 1.3, value added may not be the right metric to evaluate the profitability or rewards accruing to capital and labor from global value chain participation. In addition, the notion of "value capture" may suggest that global value chain participation is "zero sum", generating large profits for some participants – presumably lead firms – at the expense of others. However, while differences in bargaining power may well affect the vertical distribution of profits, global value chain income largely accrues to the capital and labor employed in global value chain production. The returns to capital and labor, in turn, depend on economies' endowment with these production factors and how productively they are employed.

Indeed, the question of how to upgrade global value chain capability is in principle no different from the more general question of how to spur industrial development. Thus, policy prescriptions that economists have formulated to promote industrial growth also apply to global value chain upgrading. These include, notably, building up institutions that promote technological learning and a growing absorptive capacity, as described in section 1.4. Nonetheless, the growth of global value chains raises some special considerations for both industrial and trade policy.

As to the former, industrial policy strategies have seen much evolution over the past decades – both in practice and in academic thinking.[47] Yet, if there is one evolving consensus, it is that governments have an important role to play in identifying pre-existing industrial capabilities – often at the level of sub-regions – and leveraging them by removing constraints on entrepreneurial activity and appropriately targeting complementary public investments.[48] Depending on the industry in question, it may be important to adopt a global value chain perspective when analyzing the opportunities and challenges faced by local entrepreneurs. Such a perspective may be relevant, for example, in identifying niche capabilities that could be further developed for new or upgraded global value chain participation, or in monitoring trends in end-consumer markets around the world that create opportunities for local firms.

At this analytical stage, it is also useful to ask what role different forms of IP can play in supporting opportunities for global value chain upgrading.

As for trade policy, opportunities for successful global value chain participation rely, of course, on open markets that allow companies to seamlessly import intermediate inputs and export processed goods. Equally important, they rely on deeper integration measures that facilitate the conduct of business along the supply chain. Such deeper integration measures include promoting the compatibility of regulatory measures, harmonizing product and technology standards and opening markets for business services supporting global value chain production. In the area of IP, for example, businesses face considerable costs in protecting their different IP rights across a large number of jurisdictions. Cooperation initiatives – such as the WIPO filing systems for patents, trademarks and industrial designs – help IP users lower these costs, while leaving the final decision on whether to grant an IP right to participating member states.

As a final note, successful global value chain upgrading in all likelihood does not entail a zero-sum game among national economies. While it may lead to the displacement of some global value chain participants – and can thus create disruption, as pointed out above – it is inherently a dynamic phenomenon. Technological change and new product cycles invariably prompt continuous reconfigurations of global value chains that create entry opportunities for some firms and may force the exit of others. In addition, successful global value chain upgrading generates economic growth that enlarges the market for global value chain outputs as a whole.

Notes

1. See Baldwin (2012).
2. See WIPO (2011, 2013, and 2015).
3. See, for example, Krugman (1995) for a more in-depth discussion of the two globalization waves.
4. Hummels et al. (2001) estimate the contribution of vertical specialization to the growth of international trade in selected countries.
5. See Yi (2003) for a formal exposition of this point.
6. See Baldwin (2012) for further discussion.
7. Constantinescu et al. (2016) document a decline in long-run trade-GDP elasticity.
8. See Baldwin (2012).
9. See WIPO (2011, 2013, and 2015) for further discussion of how competitive market forces incentivize investments in intangible assets and the growing role of branding.
10. Baldwin and Venables (2013) first introduced the distinction between snake- and spider-type supply chain configurations.
11. See Coase (1937) and Alchian and Demsetz (1972).
12. Baldwin and Venables (2013) show that the type of supply chain configuration – whether snake or spider – has complex implications for the balance between centrifugal forces favoring dispersed production and centripetal forces favoring the co-location of different production tasks.
13. Fort (2016) provides evidence of how improved ICTs have favored production fragmentation in the case of U.S. firms. Interestingly, the effect seems even stronger for domestic outsourcing than for foreign outsourcing.
14. Differences in wage costs are not the only reason for firms to source goods from foreign economies. The economic literature has long recognized that economies of scale and product differentiation are an important force behind specialization and trade, especially between high-income economies with comparable wage costs. See Helpman and Krugman (1985).
15. See Gereffi and Fernandez-Stark (2016) for a recent overview.
16. See Baldwin et al. (2014).
17. Krugman (1994) pointed this out long ago.
18. This approach follows Prescott and Visscher (1980) and Cummins (2005).
19. For estimates of intangible asset investments in selected economies, see Corrado et al. (2013).
20. In this respect, Chen et al. (2017) extend the earlier global value chain accounting exercise presented in Timmer et al. (2014).
21. Final output values of manufacturing goods were deflated using the U.S. Consumer Price Index.
22. See, in particular, Constantinescu et al. (2016) and Timmer et al. (2016).
23. The precise shares in 2014 were 27.0 percent for distribution, 26.6 percent for final production and 46.4 percent for other stages. The distribution share declined slightly from 2000. The share of final production fell by 4.2 percentage points whereas the share of other stages rose by 5.5 percentage points.
24. In fact, the intangibles share for petroleum products seems to correlate closely with the global oil price. See Chen et al. (2017).
25. See Chen et al. (2017) for an elaboration of these and additional caveats.
26. See chapter 2 in WIPO (2013) for further discussion on the special characteristics of reputational assets.
27. See Teece (1986) for an elaboration of the appropriation concept.
28. In balance-of-payment statistics, IP-related services appear as "charges for the use of intellectual property not included elsewhere" and "sale of proprietary rights arising from research and development," as further detailed in the *Manual on Statistics of International Trade in Services 2010* produced by the Interagency Taskforce on Statistics of International Trade in Services (2011).
29. See "Ireland's 'de-globalised' data calculate a smaller economy," *Financial Times*, July 18, 2017.
30. See chapter 1 in WIPO (2015) for further discussion.
31. In fact, knowledge management is at the heart of modern theories of the multinational enterprise. See Teece (2014) for a recent review of the literature.
32. See Maskus et al. (2005) for survey-based evidence to this effect.
33. See chapter 2 in WIPO (2011) and chapter 4 in this report for further discussion.
34. See Goodridge et al. (2016).
35. This share refers to 2015 patent filings, as reported in the WIPO IP Statistics Database: www3.wipo.int/ipstats.
36. For more comprehensive literature reviews, see Hoekman et al. (2005) and Arora (2009).
37. See WIPO (2011).

38. See chapter 1 in WIPO (2015) and Nelson and Pack (1999) for further discussion.

39. See chapter 1 in WIPO (2013) for further discussion.

40. See chapter 1 in WIPO (2015).

41. The International Monetary Fund's July 2017 update of its World Economic Outlook predicts trade growth of 4 percent and output growth of 3.5 percent.

42. Cosar and Demir (2017) find that containerization has prompted significant cost savings in maritime shipping, which in turn explains a significant amount of the global trade increase. However, most of the trade-increasing effect of containerization has already been realized.

43. Constantinescu et al. (2016) report a falling share of Chinese imports of parts and components in merchandise exports.

44. Samuelson (2004) shows in a theoretical model that a low-income economy upgrading production capabilities activities in which a high-income economy previously held a comparative advantage can, under certain circumstances, lower per capita income in the latter. However, world per capita income would always rise.

45. See Autor et al. (2013).

46. See Rosen (1981) for the seminal discussion on the economics of superstars. Haskel et al. (2012) offer a theoretical framework that explains how economic integration can boost the real earnings of superstars.

47. See Rodrik (2004).

48. See the approaches to industrial and innovation policy formulation advocated by Foray (2014) and Rodrik (2008).

References

Alchian, A.A. and H. Demsetz (1972). Production, information costs, and economic organization. *American Economic Review*, 62(5), 777-795.

Arora, A. (2009). Intellectual property rights and the international transfer of technology. In WIPO (ed.), *The Economics of Intellectual Property*. Geneva: WIPO, 41-64.

Autor, D.H., D. Dorn and G.H. Hanson (2013). The China syndrome: local labor market effects of import competition in the United States. *American Economic Review*, 103(6), 2121-2168.

Baldwin, R. (2012). Global Supply Chains: Why They Emerged, Why They Matter, and Where They Are Going. *CEPR Working Paper No. 9103*.

Baldwin, R. and A. Venables (2013). Spiders and snakes: offshoring and agglomeration in the global economy. *Journal of International Economics*, 90(2), 245-254.

Baldwin, R., T. Ito and H. Sato (2014). The Smile Curve: Evolving Sources of Value Added in Manufacturing. Mimeo available at: www.uniba.it/ricerca/dipartimenti/dse/e.g.i/egi2014-papers/ito.

Chen, W., R. Gouma, B. Los and M. Timmer (2017). Measuring the Income to Intangibles in Goods Production: A Global Value Chain Approach. *WIPO Economic Research Working Paper No. 36*. Geneva: WIPO.

Coase, R.H. (1937). The nature of the firm. *Economica*, 4(16), 386-405.

Constantinescu, C., A. Mattoo and M. Ruta (2016). The global trade slowdown: cyclical or structural? *Journal of Policy Modeling*, 38(4), 711–722.

Corrado, C., J. Haskel, C. Jona-Lasino and M. Iommi (2013). Innovation and intangible investment in Europe, Japan, and the United States. *Oxford Review of Economic Policy*, 29(2), 261-286.

Cosar, K. and B. Demir (2017). Shipping Inside the Box: Containerization and Trade. *CEPR Discussion Paper No. 11750.*

Cummins, J.G. (2005). A new approach to the valuation of intangible capital. In Corrado, C., J. Haltiwanger and D. Sichel (eds), *Measuring Capital in the New Economy*, NBER Book Series Studies in Income and Wealth, 47-72.

Foray, D. (2014). *Smart Specialisation: Opportunities and Challenges for Regional Innovation Policy*. London: Routledge.

Fort, T.C. (2016). Technology and Production Fragmentation: Domestic *versus* Foreign Sourcing. *NBER Working Paper 22550*.

Gereffi, G., J. Humphrey and T. Sturgeon (2005). The governance of global value chains. *Review of International Political Economy*, 12(1), 78-104.

Gereffi, G. and K. Fernandez-Stark (2016). *Global Value Chain Analysis: A Primer* (2nd edition). Durham, NC: Duke University Center on Globalization Governance & Competitiveness.

Goodridge, P., J. Haskel and G. Wallis (2016). UK Intangible Investment and Growth: New Measures of UK Investment in Knowledge Assets and Intellectual Property Rights. Research commissioned by the UK Intellectual Property Office.

Haskel, J., R.Z. Lawrence, E.E. Leamer and M.J. Slaughter. (2012). Globalization and U.S. wages: modifying classic theory to explain recent facts. *Journal of Economic Perspectives*, 26(2), 119-140.

Helpman, E. and P. Krugman (1985). *Market Structure and Foreign Trade*. Cambridge, MA: MIT Press.

Hoekman, B.M., K.E. Maskus and K. Saggi (2005). Transfer of technology to developing countries: unilateral and multilateral policy options. *World Development*, 33(10), 1587-1602.

Hummels, D., J. Ishii and K.-M. Yi (2001). The nature and growth of vertical specialization in world trade. *Journal of International Economics*, 54(1), 75-96.

Interagency Taskforce on Statistics of International Trade in Services (2011). *Manual on Statistics of International Trade in Services 2010 (MSITS 2010)*. Geneva, Luxembourg, Madrid, New York, Paris and Washington D.C.: United Nations/International Monetary Fund/ Organisation for Economic Co-operation and Development/Statistical Office of the European Union/United Nations Conference on Trade and Development/ World Tourism Organization/World Trade Organization.

Krugman, P. (1994). Competitiveness: a dangerous obsession. *Foreign Affairs*, 73(2), 28-44.

Krugman, P. (1995). Growing world trade: causes and consequences. *Brooking Papers on Economic Activity*, (1), 327-377.

Maskus, K.E., S.M. Dougherty and A. Mertha (2005). Intellectual property rights and economic development in China. In Fink, C. and K.E. Maskus (eds), *Intellectual Property and Development: Lessons from Recent Economic Research.* New York: Oxford University Press and World Bank, 295-331.

Nelson, R.R. and H. Pack (1999). The Asian miracle and modern growth theory. *The Economic Journal*, 109(457), 416-436.

Neubig, T.S. and S. Wunsch-Vincent (2017). A Missing Link in the Analysis of Global Value Chains: Cross-Border Flows of Intangible Assets, Taxation and Related Measurement Implications. *WIPO Economic Research Working Paper No. 37*. Geneva: WIPO.

Prescott, E.C. and M. Visscher (1980). Organization capital. *Journal of Political Economy*, 88, 446-461.

Rassier, D. (2017). Intangible Assets and Transactions within Multinational Enterprises: Implications for National Economic Accounts. *WIPO Economic Research Working Paper No. 38*. Geneva: WIPO.

Rodrik, D. (2004). Industrial Policy for the Twenty-First Century. *CEPR Discussion Paper No. 4767*.

Rodrik, D. (2008). Normalizing Industrial Policy. *Commission on Growth and Development, Working Paper No. 3*. Washington, DC: World Bank.

Rosen, S. (1981). The economics of superstars. *American Economic Review*, 71(5), 845-858.

Samuelson, P.A. (2004). Where Ricardo and Mill rebut and confirm arguments of mainstream economists supporting globalization. *Journal of Economic Perspectives*, 18(3), 135-146.

Seppälä, T., M. Kenny and J. Ali-Yrkkö (2014). Global supply chains and transfer pricing: insights from a case study. *Supply Chain Management*, 19(4), 445-454.

Teece, D.J. (1986). Profiting from technological innovation: implications for integration, collaboration, licensing and public policy. *Research Policy*, 15, 285-305.

Teece, D.J. (2014). A dynamic capabilities-based entrepreneurial theory of the multinational enterprise. *Journal of International Business Studies*, 45, 8-37.

Timmer, M., A.A. Erumban, B. Los, R. Stehrer and G.J. de Vries (2014). Slicing up global value chains. *Journal of Economic Perspectives*, 28(2), 99-118.

Timmer, M., B. Los, R. Stehrer and G.J. de Vries (2016). An Anatomy of the Global Trade Slowdown Based on the WIOD 2016 Release. *Groningen Growth and Development Centre Research Memorandum No. 162*, University of Groningen.

WIPO (2011). *World Intellectual Property Report 2011: The Changing Face of Innovation*. Geneva: World Intellectual Property Organization.

WIPO (2013). *World Intellectual Property Report 2013: Brands – Reputation and Image in the Global Marketplace*. Geneva: World Intellectual Property Organization.

WIPO (2015). *World Intellectual Property Report 2015: Breakthrough Innovation and Economic Growth*. Geneva: World Intellectual Property Organization.

Yi, K.-M. (2003). Can vertical specialization explain the growth of world trade? *Journal of Political Economy*, 111(1), 52-102.