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Rent appropriation in global value chains: The past, present, and future of intangible assets

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Abstract

Research Summary: The argument of this article is that global strategy research should devote greater attention to rent appropriation in global value chains (GVCs). We discuss the concept of intangible assets, emphasize their scalability at low marginal cost and highlight strategies for the appropriation of rents from these assets. Returns captured by intangible assets are shown to be much greater than those captured by tangible assets in GVCs of manufactured products. Regions in the world are found to be specializing in different GVC stages, with China rising as a key location for rent generation in upstream and production activities. We conclude that the rents from intangible assets are major drivers of economic development and of corporate success and offer insights into rent appropriation trends in the future.

Managerial Summary: Intangible assets include computerized information (such as databases and software), innovative property (such as patents, trademarks, and copyrights), and economic competencies (such as brand equity and organizational capital). Our analysis shows that the returns to intangible assets in the GVCs of manufactured goods have risen substantially in importance over the past 20 years. A further finding is that within GVCs, the rent share of upstream stages has been

increasing at the expense of rents shares of both the production and downstream stages. These findings suggest that the effective deployment, management, and protection of intangible assets is of critical importance to the ability of firms to create and maintain sustainable competitive advantages in global markets. In GVCs, intangibles matter, big time!

KEYWORDS

competitive advantage, global value chains, intangible assets, multinational enterprises, rents

1 | INTRODUCTION

The early years of the 21st century witnessed the seemingly inexorable expansion of globalization, and the ever-wider geographic dispersion of economic activities within the global economy (Buckley & Strange, 2015). One manifestation of these developments has been the increasing importance of global value chains (GVCs), notably in manufacturing industry, where goods are produced and distributed through a series of inter-connected stages that are often located in different countries, and involve significant international flows of intermediate goods and services (Pananond et al., 2020). Each of these stages typically involves different combinations of factor inputs, viz: labor, tangible capital, and intangible assets. This contemporary reality raises important issues about how much of the total value-added generated in manufacturing GVCs is provide by different activities, in which countries that value-added is generated, what returns are earned by the different factor inputs, and ultimately how the value-added is distributed between the GVC participants. In this article, we are particularly concerned with the importance of intangible assets, and how the rents accruing to intangible assets form an increasing proportion of the value-added in manufacturing GVCs. Our argument is that, in order to maintain sustainable competitive advantage and compete effectively in global markets, firms need to nurture, exploit, and protect their intangible assets. This echoes Teece (1998, p. 76) who noted two decades ago that "knowledge, competence and related intangibles have emerged as the key drivers of competitive advantage in developed nations. This is not just because of the importance of knowledge itself, but because of the rapid expansion of goods and factor markets, leaving intangible assets as the main basis of competitive differentiation in many sectors."

The paper is structured as follows. In Section 2, we highlight the key attributes of intangible assets, emphasize their scalability at low marginal cost and explain how different types of intangible assets are involved in different GVC stages. The main aim of the paper is to show that existing statistics can provide new insights on the importance of intangible assets in production and rent appropriation. In Section 3, we show that returns captured by intangible assets are much greater than those captured by tangible assets in GVCs of manufactured products. Mudambi (2008) usefully categorizes firms' GVC activities to one of three stages: upstream, production, and downstream. The three stages differ greatly in their reliance on particular sets of intangible assets. The activities in the upstream stage include R&D, product design, process engineering, and technical services. The activities in the production stage include the provision

of the intermediate goods, as well as the assembly, testing, and packaging of the final product. The activities in the downstream stage include sales, marketing, distribution, and after-sales service. In Section 4, we analyze the distribution of the value-added across these three GVC stages and, particular, the returns to intangible assets, or rents,[1] in each stage. We then consider in Section 5 how the geographical distribution of the returns to intangible assets has changed over the past two decades. We find that regions in the world are specializing in different GVC stages, with China rising as a key location for rent generation in upstream and production activities. We next turn in Section 6 to the question of how contemporary developments in the global economy are likely to impact the future importance of intangible assets. Finally, in Section 7, we consider the implications of intangible assets for corporate strategy and for research on global strategy, outlining five directions for future research. It is important to note that our empirical analysis has, in the absence of appropriate firm-level data, been conducted using country-level data. We argue that future comprehensive assessment of the distribution of the value-added generated in GVCs must take account of the fact that, while some GVC activities may be indigenously owned and controlled, other domestic activities may be controlled by foreign multinational enterprises (MNEs) either through Foreign Direct Investment (FDI, internalization) or through outsourcing (externalization) arrangements. Buckley and Strange (2015), Kano (2018), and Strange and Humphrey (2019) provide further discussion of these issues.

2 | THE KEY ATTRIBUTES OF INTANGIBLE ASSETS

An appreciation of the nature, location, and control of intangible assets[2] is vital for any investigation into rent appropriation in GVCs. Intangible assets include not just intellectual property, but also a wide range of investments in the knowledge and capabilities of the organization. An influential OECD study (OECD, 2011), following Corrado et al. (2005), categorized intangible assets into three groups: (a) computerized information (such as databases and software); (b) innovative property (such as designs, R&D, patents, trademarks and copyrights); and (c) economic competencies (such as brand equity, organizational capital, firm-specific human capital, networks, and aspects of marketing and advertising). Both tangible assets and intangible assets have the potential to generate future economic benefits for their owners, but intangible assets possess five key attributes which differentiate them from both physical and financial assets.

First, intangible assets produce services that *need to be combined* with other goods and services to yield value (Teece, 1998). From this perspective, intangible assets may be viewed as the firm-specific "yeast" that enables the creation of value in GVCs (Chen et al., 2021; Karabarbounis & Neiman, 2019).

Second, intangible assets are *difficult to value* using traditional accounting methods (Nakamura, 2010). They are often not traded, and hence do not have a market price, while it is typically impractical to estimate a price from a comparator asset—as suitable comparators are hard to identify. Lev (2005) notes that it is often difficult to identify the costs and benefits of individual intangible assets, even though their combined value can be revealed by a comparison of the market capitalization of the firm and the book value of its assets. These difficulties in valuation mean that there will be significant information asymmetries between the owners of the intangible asset and any outsiders (such as GVC partners or tax authorities) and that any fees or internal transfer prices charged for the use of intangible assets will be subject to a large degree of discretion (OECD, 2014).

Third, intangible assets are typically *not location-bound* and this creates arbitrage opportunities. The revenues and costs that accrue to intangible assets are ambiguous and cannot easily be attributed to a single geographic location, in contrast to tangible capital and labor that have a physical presence. As Bryan et al. (2017, pp. 65–66) comment, the "fiscal attributes (location of assets, costs and revenue streams) associated with intangible capital have proven very easy to shift across national and corporate borders." This is a strong argument to study the returns to intangibles in GVCs that combine all stages of production, as is done in this study, rather than at the individual firm or industry level (Chen et al., 2021).

Fourth, intangible assets are non-rivalrous in consumption in that their use in a given activity does not preclude use in another activity. Put differently, this means that intangible assets are *scalable with low marginal costs* of exploitation once they have been created or acquired, unlike physical capital (Haskel & Westlake, 2018). This suggests that whoever controls the intangible-intensive stages of the GVC will receive a disproportionate share of any gains as GVC output expands (Durand & Milberg, 2020).

Fifth and arguably most important, intangible assets are typically difficult for rivals or even partners to imitate and are hence highly *appropriable* (Teece, 1998; Villalonga, 2004) in the sense that the owners are able to capture significant rents from their deployment. Some intangible assets (such as patents, trademarks, or copyrights) enjoy protection from the intellectual property laws of different nation-states, while other assets benefit from various firm-specific isolating mechanisms (Rumelt, 1984, 1987). Such isolating mechanisms may take many forms including inter alia firm-specific technical and/or market-based capabilities, multinationality, data ownership, and after-sales service[3] (Strange, 2021). However, the efficacy of many isolating mechanisms may dissipate over time as resource and capability asymmetries erode (Denicolai et al., 2015).

In short, intangible assets are highly appropriable, non-location bound, scalable at low marginal cost, and susceptible to opaque valuations. This combination of attributes has given rise to what has been termed "intellectual monopoly capitalism" to describe lead firms' abilities of creating rents from intangible assets (Durand & Milberg, 2020; Pagano, 2014). The monopoly market structure arises out of (temporary) protection of intellectual property rights combined with scale economies driven by high fixed costs and low variable costs as well as network externalities. New Information and communication technologies (ICT)-based technologies make it possible for firms to specialize in the development of intangibles, capturing excess profits the magnitude of which depends on the degree of replicability of the intangibles involved (Teece, 2018). Recent research has confirmed the rise of so-called "superstar firms" in the US economy that rely on scalable technology and large investments in intangible assets to build productivity advantages over rivals and raise market shares (Autor et al., 2020; Crouzet & Eberly, 2019).

3 | THE "YEAST" APPROACH TO MEASURING THE RETURNS TO INTANGIBLE ASSETS

Given their attributes, the returns to intangible assets are hard to infer empirically in a direct way. In particular, when intangibles are produced and used in-house, they are often not (or incompletely) reported in the balance sheets of firms. Similarly, many intangible assets are not captured in the investment figures in national accounts statistics (Corrado et al., 2005). Chen et al. (2021) provide a simple and intuitive approach to the measurement of intangibles

income, using the so-called "yeast approach" which measures intangibles in an indirect manner based on residual income. This approach accords with intangible assets being key inputs in value creation and appropriation as discussed above. A firm derives a certain degree of monopoly power from investments in firm-specific intangible assets. As such, intangible capital is the firm-specific "yeast" that creates value from hired labor and tangible assets. The returns to this intangible yeast can be determined residually after subtracting the costs for purchased inputs. More specifically, the intangible asset returns are measured as the residual value that remains after subtracting the returns for labor (deployment of workers L at wage w) and for tangible assets (use of asset stock K at user cost rate r) from the value-added Y. In short, we measure the intangible asset returns as $Y - rK - wL$. The data on value-added, tangible asset stocks, and labor costs can be derived from published national accounts statistics, such that estimates of the unobservable value of intangibles asset returns can be made.[4]

The yeast approach has antecedents such as Karabarbounis and Neiman (2019), harking back at least to Prescott and Visscher (1980), who measure intangible asset income residually within individual industries in individual countries.[5] Chen et al. (2021) apply the same logic to GVCs to determine intangible asset returns in all industries and countries that participate in GVCs, an approach subsequently used by Jaax and Miroudot (2021).

4 | THE APPROPRIATION OF INTANGIBLE ASSET RENTS IN GVCS

A great deal of attention has been devoted, both in the press and in the academic literature, to how labor-intensive production activities have been offshored to emerging economies over the years, and how this has given rise to a fall in the labor share of GVC income and to a commensurate rise in the capital share in advanced as well as emerging economies (Karabarbounis & Neiman, 2014; Timmer et al., 2014). Far less attention, however, has been paid to how lead firms in GVCs increasingly focused their efforts on developing and managing their intangible asset base. Intangibles have rapidly increased in importance, generating profits on the basis of their high scalability and provision of (temporary) market power (Durand & Milberg, 2020).

Several authors have attempted to quantify the value of intangible assets and demonstrated their increasing importance in Europe, Japan, and the United States. US estimates (Corrado et al., 2005, 2009; Nakamura, 2001) show intangible assets accounting for ever larger proportions of the market value of US firms, with proportions up to 90% for many high-technology and pharmaceutical firms. Similar evidence has also been produced for other advanced economies in Europe and Japan (Corrado et al., 2013; Corrado et al., 2018; Fukao et al., 2009; Giorgio Marrano et al., 2009) although the data show considerable cross-national and cross-sector variations. Haskel and Westlake (2018, p. 31) report that the manufacturing sector in the advanced economies has grown more intangible-intensive over time and is now more intangible-intensive than tangible-intensive. Table 1 highlights some broad trends in the returns earned in the global production system of manufacturing goods. This includes activities in manufacturing and services industries, located in advanced as well as emerging and other economies.

Three observations follow from the data in Table 1. First, there has been a pronounced fall in the labor share of worldwide returns in GVCs, confirming prior research (Chen et al., 2021; Timmer et al., 2014). The production stages of many manufacturing GVCs are often the most intensive in unskilled labor and have increasingly been relocated to emerging economies over the past 20 years in search of lower production costs (Baldwin, 2016; Buckley et al., 2020;

TABLE 1 Global returns to factor inputs in manufacturing GVCs

Factor inputs[a]	2000	2007	2013	2019
Labor returns[b]	57.2	52.7	52.1	52.7
Tangible asset returns[c]	15.4	16.0	17.9	17.5
Intangible asset returns[d]	27.4	31.4	30.0	29.8
Total returns in GVCs[e]	100.0	100.0	100.0	100.0

Note: Own calculations updating Chen et al. (2021) based on the WIOD 2016 and ADB Multi-Regional Input–Output Tables for 2019, extended with data on tangible capital stocks and distribution margins—see the Appendix for details.
Abbreviation: GVCs, global value chains.
[a]The shares of each factor input are expressed as percentages of the total GVC returns.
[b]Labor returns include all costs of employing labor, including self-employed income.
[c]Tangible asset returns are calculated as gross returns to tangible assets based on a 4% real (net) rate of return and industry-specific depreciation rates.
[d]Intangible asset returns are calculated as a residual (gross value added minus labor and tangible asset returns).
[e]The total returns include returns earned in the upstream, production, and downstream GVC stages.

TABLE 2 Intangible asset rents in manufacturing GVCs by stage

GVC stage[a]	2000	2007	2013	2019
Upstream stage	40.9	46.4	46.9	45.2
Production stage	29.5	27.6	26.1	27.5
Downstream stage	29.6	26.0	27.0	27.3
Total intangible asset rents[b]	100.0	100.0	100.0	100.0

Note: Own calculations, see Table 1.
Abbreviation: GVCs, global value chains.
[a]See the text for details of the activities in the upstream, production, and downstream GVC stages.
[b]The rents in each stage are expressed as percentages of the total returns accruing to intangible assets in the GVCs of manufactured goods—see Table 1.

Buckley & Strange, 2015; Mudambi, 2008). This fall was very pronounced in the early 2000s during which major parts of global manufacturing industry were incorporated in GVCs, but it appears to have leveled off in the 2010s. Second, the income share captured by tangible assets (i.e., physical capital such as plant, machinery or buildings) rose steadily through much of the period as a result of technological advances and the greater capital-intensity of production. Third, and foremost, the returns captured by intangible assets (in the form of intellectual property, R&D, and firm-specific knowledge as discussed below) are much greater than by tangible assets, by a factor of 1.7, amounting to US$5.5 trillion in 2019. The total market value of final manufactured goods (for household consumption and corporate investment purposes) was US $18.4 trillion in 2019. In GVCs, intangibles matter, big time.

In Table 1, we showed the returns to labor and capital in the GVCs of manufactured goods. Subsequently, we analyze the rent appropriation by intangible assets across the different GVC stages: the production stage, the upstream stage, and the downstream stage.[6] To start off, Table 2 provides an analysis of the worldwide rents to intangible assets in each GVC stage over the past two decades.

Table 2 shows that in 2019 about one quarter of the income from intangibles in GVCs accrued in the downstream stage, another one quarter was in the production stage, and about

half in the upstream stage. A key finding is that the upstream share has been increasing in the 2000s at the expense of both the production and downstream shares. This finding fits the hypothesis of a "deepening smile curve," first formulated by Stan Shih of Acer in 1992 (Mudambi, 2008). In this vein, Durand and Milberg (2020) argued that the increased use of intangibles has led to higher returns both downstream and upstream of the production stage. Also Buckley et al. (2020) provide prima facie evidence for this hypothesis showing the increasing share of knowledge-intensive activities in GVCs. Yet an important question remains to what extent the higher returns outside production are driven by temporary market power and associated excess profits of firms or represent compensation for the higher risk profile of the intangible assets involved.[7] In an industry case study, Shin et al. (2012) found that lead firms and component suppliers in the global electronics industry earn higher gross margins and net margins compared to contract manufacturers. However, the differences were found to be minimal for return on assets (ROA) and return on equity (ROE) suggesting that returns on investment appear to be roughly similar in all stages of the GVC. The study suggests that this is because of the high costs for intangibles that need to be made in sustaining a market position in up- and downstream of production.

5 | THE SHIFTING GEOGRAPHY OF INTANGIBLE ASSET APPROPRIATION

The uses of intangible assets are not location-bound, in contrast to tangible assets and workers that are tied to a particular physical site. This is why we applied the yeast approach to GVCs, remaining agnostic so far on the location where the stages are performed. Yet, by virtue of its residual character, our approach offers a first view of where intangible rents are appropriated, based on the value-added statistics of the countries participating in the GVCs as recorded in their national accounts. Most remarkable is the continuous increase in the appropriation of intangible asset rents in China from 6% of the global total in 2000 to more than 19% in 2019 (Table 3). Concomitantly, China has been upgrading its involvement in manufacturing GVCs,

TABLE 3 Intangible asset rents in manufacturing GVCs by location of activity

Country/region[a,b]	2000	2007	2013	2019
China	6.4	11.2	17.0	19.4
USA and Canada	33.7	27.8	31.2	31.0
Japan and South Korea	15.5	9.4	6.6	7.1
Europe[c]	23.2	24.7	16.0	16.5
Other countries	21.2	26.9	29.2	26.0
Worldwide total[d]	100.0	100.0	100.0	100.0

Note: Own calculations, see Table 1.

Abbreviation: GVCs, global value chains.

[a]The rents in each country (region) are expressed as percentage shares of the total rents accruing worldwide to intangible assets in the GVCs of manufactured goods.

[b]The rents refer to activities that take place within the specified country (region) and take no account of the ownership of the intangible assets.

[c]Europe includes the 27 EU countries (per January 2020) and the United Kingdom.

[d]The rents may be generated at any stage in the manufacturing GVCs—see Table 2.

increasing its capabilities in the production and development of more complex intermediates (Kee & Tang, 2016). Chor et al. (2021) found that Chinese imports became significantly more upstream as local firms spanning more and more stages of the GVC. In line with this, we find Chinese firms performing ever more upstream activities in GVCs. Its share in global upstream rents increased from 3.2% in 2000 to 10.2% in 2019. China doubled its share in global intangible rents in the production stage (from 2.4 to 5.3% over the 2000–2019 period). It quintupled its share in the downstream stages albeit from a rather low base (from 0.7 to 4.0%). By international standards, China appears now to be particularly specialized in upstream intangibles. The Chinese development path shows that specializing in fabrication activities can be a pathway for developing countries to gradually move into more knowledge-intensive activities up- and downstream (Turkina & Van Assche, 2018). Although China and (to a lesser extent) India clearly followed this path, major barriers to catching up of other economies with advanced economies still exist (Buckley et al. 2020).

The advanced economies have lost their lead in generating intangibles' rents in manufacturing GVCs, albeit at different speed and timing. The United States and Canada dominated in 2000, generating 34% of worldwide intangible rents, losing share in the 2000s, but recovered afterwards, generating still 31% in 2019. They have lost advantage in the upstream and production stages, but have been able to retain the ability to appropriate rent in manufacturing GVCs through their strong intangible asset positions in marketing and distribution activities compared to other regions (Table 4). MNEs still have the incentive to locate intangible-intensive activities in countries with more sophisticated capital markets and more effective intellectual property rights, in particular if it involves the development of codifiable intangibles (Antràs, 2020). GVC activities in Japan/South-Korea were stronger affected by the rise of China. The share generated in Japan/South-Korea halved over the 2000–2019 period to a mere 7%. It is important to keep in mind that Tables 3 and 4 report incomes that are generated in the domestic economy. So for example, intangible rents generated by Korean firms in China are recorded under China. Like the United States, GVC activities in Japan specialized toward distribution generating almost half of the intangible rents in downstream activities. This specialization pattern is likely to be related to the size of the Japanese economy. A big domestic market offers plenty economies of scale to organize and maintain domestic retailing and wholesaling activities at home, while offshoring production activities and technologies (Gereffi, 1999). In contrast, China started out with a relatively small domestic market for higher quality manufactured goods providing initially little scale for expansion of distribution activities. The European experience stands out in yet another way. The share of Europe in global rents held

TABLE 4 Intangible asset rents in manufacturing GVCs by stage and location of activity, 2019

Country/region	Upstream stage	Production stage	Downstream stage	All stages[a]
China	52.4	27.1	20.5	100
USA and Canada	28.7	30.1	41.1	100
Japan and South Korea	26.6	30.4	43.0	100
Europe	42.7	35.7	21.6	100

Note: See Tables 1–3.

Abbreviation: GVCs, global value chains.

[a]The rents in each GVC stage are expressed as percentage shares of the total rents accruing to intangible assets in each country (region).

up in the 2000s, helped by the tightened integration of Eastern and Southern Europe within the continent. Activities in the production of durable goods such as automobiles and machinery, as well as chemicals, spread across borders within the European Union (Los et al., 2015). Subsequently GVC activities in Europe were particularly affected by declining demand for durables during the Eurozone crisis during 2010–2013. Its global share in rents plunged from 23% in 2000 to 16% in 2013 and did not recover afterwards. Compared to the other regions, Europe has specialized in final production and upstream activities, partly related to a comparatively large automobile industry with long production chains of complex components within the continent.

An open question remains as to who are the ultimate recipients of the intangible asset returns. Our approach has traced the location where the rents are generated, but is silent on the ultimate nationality of the firms that appropriate these rents. This depends upon whether activities are undertaken by independent indigenous firms, by subsidiaries of MNEs from foreign countries, or through outsourcing contracts controlled by the MNEs (Buckley & Strange, 2015). This analysis could in principle be effected by supplementing the national accounts statistics with firm-level information and foreign investment statistics but the availability of such information is currently weak (Buckley et al., 2020).

6 | THE FUTURE OF INTANGIBLE ASSET RENTS

This paper has highlighted the importance of intangible assets in the GVCs of manufactured goods and has shown how the importance of intangible assets varies across the different GVC stages. The management of GVCs and, in particular, the management of intangible assets and their rents, is a vital topic of research in global strategy. We report three main empirical findings. The first finding is that intangibles matter in GVCs: returns captured by intangible assets are much greater than by tangible assets, by a factor of 1.7 in 2019. The second finding is the rising importance of China as the location for the generation of intangible asset returns, coupled with the falling importance of Europe and Japan, and to a lesser extent the United States. The third finding is the specialization in intangible returns generation across regions, with the United States and Japan specializing in downstream activities, and China and Europe in upstream and production activities.

At the time of writing (early 2022), it is apparent that the global economy is already embracing several new realities, notably the growth of populism and economic nationalism, greater concerns about sustainable development and climate change, the deployment of new digital technologies, and changing power relationships between MNEs and their GVC partners, and between MNEs and the governments of the countries in which they operate (Ghauri et al., 2021). The fast process of globalization in the 1990s and 2000s has turned to "slowbalization" (Economist, 2019) and possibly "de-globalization." Timmer et al. (2021) report that, although the international fragmentation of production has stalled for goods, it has continued for services. Furthermore, the stock of international migrants in the world, as a share of world population, continued to grow through the 2010s, despite a backlash against immigration in some countries. Royalties and license fee receipts also continued to grow as a share of global GDP in the 2010s, increasing faster than FDI and trade in tangible goods (UNCTAD, 2020). That suggests that the overseas activities of MNEs are increasingly based on intangible assets and contracts rather than investment in physical assets. At the same time national and regional governments are vying for intangible investments, promoting trade, innovation, industrial and investment policies that attract and retain intangible capital in their economies (Van Assche, 2020).

These new realities will have important implications for the global strategies of MNEs, for the potential configuration of their GVC activities, and for rent appropriation. First, the growth of populism and economic nationalism will prompt greater restrictions on trade, not only in final manufactured products but also in intermediate goods and services (Devinney & Hartwell, 2020; Mudambi, 2018). Outward direct investment may be discouraged, while inward direct investment will be scrutinized ever more closely by host country governments. These restrictions will hinder the further offshoring of labor-intensive activities from advanced economies, and weaken competition from rivals in lower-cost locations. If so, jobs might be relocated back to the advanced economies where wages are higher (McIvor & Bals, 2021). In addition, spurred by lessons from the COVID-19 crisis, firms (and governments) may attribute greater value on geographically closer and more resilient production processes (Brakman et al., 2021; Strange, 2020). In Europe, for instance, this may imply a shift away from Asia toward Eastern Europe (Javorcik, 2020).

Second, increasingly vociferous concerns about sustainable development and climate change could put another brake on further globalization, and oblige MNEs to pay higher wages to workers wherever they are located. At the same time, advanced countries might be confronted with a new wave of outsourcing of services jobs as firms discover the new possibilities of working from home, currently imposed by the COVID-19 crisis. Brakman et al. (2021) argue that current large-scale experimentation with working from home reveals that many service-related tasks, conventionally considered as not suitable for offshoring, can actually be performed anywhere, potentially triggering a major global shift in labor demand. Dingel and Neiman (2020) predict that close to 40% of all US jobs could be done from home.

Third, the widespread deployment and adoption of new digital technologies will have several conflicting effects. For instance, the greater use of robotic systems should lead to tangible capital replacing labor in production processes, and hence an increase in the tangible asset share of GVC income. Automation and robotization of work have been on the increase across the world in recent times (Acemoglu & Restrepo, 2018). Pandemics such as COVID-19 are likely to strengthen the ongoing trend as machines are less susceptible to work interruptions due to illness and contagion fears (Seric & Winkler, 2020). Autio et al. (2021) discuss the various centrifugal and centripetal forces of digital technologies, emphasizing the important role of institutional barriers that may hamper their use in cross-border strategies. For example, the adoption of additive manufacturing processes should allow firms to customize their output more closely to customer needs. This will affect the future of large-scale production facilities and blur the boundaries between the production and distribution stages in GVCs. Meanwhile the collation and analysis of big data, together with the internet of things, should not only allow MNEs to interact more easily with consumers worldwide but also facilitate the coordination of international operations. Baldwin (2019) argues that the rise of the knowledge economy will make workers engage less with tangible capital, and more reliant on intangible assets. The increasing importance of intangible assets in the GVCs of many MNEs—manifested most clearly in the high-tech MNE giants—has created new sources of market power based on scale economies and network externalities. This increased market power allows MNEs to engage in anti-competitive behavior and profit-shifting practices, and enhances their bargaining power vis-à-vis governments both in host countries and in their home countries.

These new realities will have two main implications for rent appropriation in manufacturing GVCs in the future (Buckley, 2021). First, there is likely to be a further fall in the income share taken by low-skilled workers worldwide, while there will be new opportunities for higher-skilled workers to increase their share. Second, it is likely that activities linked to

tangible assets will become less geographically dispersed, while there will be opportunities for the further fine-slicing and global deployment of activities linked to intangible assets. This is likely to result in increases in the rents appropriated by intangible assets in GVCs.

7 | A FUTURE AGENDA FOR GLOBAL STRATEGY RESEARCH

This paper has highlighted the increasing importance of intangible assets in the creation and capture of the returns earned in the GVCs of manufactured goods worldwide. We have argued that the increasing importance of intangibles is due, in large part, to their key attributes of scalability, appropriability and non-location boundedness.

Our empirical analysis has considered the different activities (stages) carried out within these GVCs, and has taken into account the country locations of these activities and the inter-sectoral and cross-country linkages between them. This analysis provides deeper insights into the nature of the global economy that go beyond analyses of aggregate trade and FDI data. To fully understand the workings of GVCs, however, there is a need for detailed information on the governance of the individual GVC activities and, in particular, whether the various activities are owned and/or controlled by indigenous firms or by foreign MNEs (Buckley & Strange, 2015). Such data are essential in order to make a comprehensive assessment of the international distribution of the value-added. If the GVC activities in each country are exclusively controlled by indigenous firms, then the value-added will be retained within those countries. But if some of the GVC activities are owned or controlled by foreign MNEs, then a proportion of the value-added will not be retained in the countries in which it is generated but will accrue to the home countries of the MNEs (either as repatriated profits, or as management fees, transfer payments, royalties, etc). Here we note that the MNEs may control GVC activities in host countries either by direct ownership (internalization) through FDI or indirectly through outsourcing (externalization) contracts. In the latter case, the business models of *factoryless goods producers* (e.g., Apple, Dyson, Nike) are instructive as such firms do not own the facilities that manufacture their products but they nevertheless maintain control over the GVCs through the possession of scarce and valuable intangible assets (Strange, 2021). The effective management and deployment of such intangible assets is of central importance to the firms' abilities to create and maintain sustainable competitive advantages in global markets.

These observations suggest that global strategy research should delve deeper into the governance arrangements within different GVCs, and the role of intangible assets. One strand of research might focus on how lead firms develop and protect intangible assets to maintain control of both the internalized and the externalized GVCs in which they participate. This links closely with the idea of "global connectivity" as outlined in Cano-Kollmann et al. (2016) and Cano-Kollmann et al. (2018). This represents an exciting research avenue tying the analysis of GVCs with the innovation literature. A second strand might consider how those lead firms use that control to capture disproportionate shares of the rents earned within the GVCs at the expense of their GVC partners (Benito et al., 2019). A third strand might focus on how the firm boundary choices that are made by lead firms within the GVCs depend upon the key attributes of their intangible assets (Benito et al., 2019). A fourth strand might focus on where MNEs choose to register their intangible assets—bearing in mind that such assets are non-location bounded—and how the MNEs' choices about the notional location of their intangible assets can affect where they report their profits and thus the extent of their tax liabilities (Foss et al. 2019). Such location considerations might also be affected by the strength of the IP protection regimes

in different countries, though IP protection may only be relevant for certain types of intangible assets. A fifth strand might go beyond the economic impacts, and consider also the environmental, social, and governance (ESG) implications of GVCs (Montiel et al., 2021; Zhan, 2021).

These strands of research may be pursued through individual firm and GVC case studies across a range of sectors and countries. Which intangible assets are most important in which sectors? Which countries are most favored for the registration of intangible assets, and what are the resulting inter-firm payments for the use of these intangible assets? How do individual firms develop key intangible assets, and how do they promote their efficacy through the deployment of isolating mechanisms? More ambitiously—and certainly of high interest from perspective of policy-making by the governments of the countries involved—would be research based on comprehensive disaggregated data not only on the returns earned within the GVCs (as provided in this paper) but also on the governance arrangements of those GVCs. However, the collation and organization of such data would be a massive undertaking, and would require significant cooperation from the participants of all GVCs. In the meantime, progress can be made by complementing and contextualizing studies of individual firms and GVCs with comprehensive statistical data.

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ENDNOTES

[1] We use the term "rent" to emphasize the potential for intangible assets to generate supernormal profits due to their nature as key inputs in value creation and appropriation in GVCs. This is not to deny that intangible assets require upfront investment, just like tangible assets. We will return to this issue later on.

[2] We use the term intangible assets in this article but many synonymous terms are used in the literature, including inter alia intangible capital (World Intellectual Property Organization, 2017), intangible resources (Hall, 1992; Kafouros & Aliyev, 2016; Villalonga, 2004), knowledge capital (Teece, 1998), intellectual assets (Durand & Milberg, 2020; OECD, 2011), intellectual capital (Petty & Guthrie, 2000), and organization capital (Prescott & Visscher, 1980).

[3] See Gereffi (1999) for an early analysis of the importance of non-manufacturing businesses such as retailers in manufacturing GVCs.

[4] The Appendix provides additional technical details of the "yeast approach."

[5] A variant of the residual approach has also been used to gauge the amount of intangible assets at the firm level, using Tobin's q as a proxy for actual firm value and subtracting firm's assets as stated in balance sheets. See, for example, Eisfeldt and Papanikolaou (2014).

[6] In the data, the production stage refers to all activities in one of the 14 manufacturing industries that produce a final good to enter the distribution stage (wholesaling and retailing). These activities may include assembly and testing activities, but also the production of intermediate goods used for assembly within the same industry. See the Appendix for more information.

[7] To gauge the size of the supernormal returns to intangible assets, one needs to combine information on total returns with further information on the actual amounts of the investments made.

[8] We use data organized according to ISIC (rev 4). Production in a manufacturing industry consists of final and intermediate goods and might contain also intermediate services. The upstream stage includes production in services industries as well as production of intermediate goods outside the finalizing manufacturing industry. The boundary between production and upstream stages will thus depend on the level of disaggregation in the data. Ultimately, data classified by type of activity are needed to provide further insight (Buckley et al., 2020).

[9] See https://kidb.adb.org/kidb/downloads/gvc.

[10] The new system of national accounts (SNA 08) covers investment in several intangible intellectual property products, namely R&D, computer software and databases, mineral exploration and entertainment and artistic originals. In practice, many countries do not (yet) collect data according to these SNA08 rules. When possible and necessary, intangible asset investment is excluded from tangible assets investment data in our analysis.

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APPENDIX

MEASURING THE RETURNS TO INTANGIBLE ASSETS IN GLOBAL VALUE CHAINS

We model the production process of a global value chain (GVC) as consisting of different stages done in different countries using factor inputs. We follow the approach by Chen et al. (2021) to measure how much of the value of final manufactured goods ends up as returns to labor, tangible assets, and intangible assets.

Three stages are distinguished, namely upstream, production, and downstream. Production covers activities in the industry performing the finalization of the good before it is distributed to the consumer. In the data, the production stage refers to all activities in one of the 14 manufacturing industries that produce a final. These activities may include assembly and testing activities, but also the production of intermediate goods used for assembly within the same industry.[8] Downstream includes all activities in distribution to the consumer (including wholesaling and retailing). Upstream covers activities in industries that deliver inputs to the production industry. In each stage, the labor (L), tangible assets (K), and intangible assets (I) are used, such that the production function of GVC v is as follows:

$$Y_{\mathrm{v}} = f\left(\underbrace{L_{\mathrm{v}}^{\mathrm{U}}, K_{\mathrm{v}}^{\mathrm{U}}, I_{\mathrm{v}}^{\mathrm{U}}}_{\text{Upstream (U)}}; \underbrace{L_{\mathrm{v}}^{\mathrm{P}}, K_{\mathrm{v}}^{\mathrm{P}}, I_{\mathrm{v}}^{\mathrm{P}}}_{\text{Production (P)}}; \underbrace{L_{\mathrm{v}}^{\mathrm{D}}, K_{\mathrm{v}}^{\mathrm{D}}, I_{\mathrm{v}}^{\mathrm{D}}}_{\text{Downstream (D)}}\right), \tag{A1}$$

where Y_v is the value of final manufactured product v at the price paid by consumers. Following Baldwin and Robert-Nicoud (2014), we assume that production stages are perfect complements within a GVC. That is, in order to create a final product a fixed amount of each stage is required. Denote w the wage rate, r^K the rental price of tangible capital, and r^{I} the rental price of intangible capital. Prices of factor inputs may differ by stage and GVC. The cost equation is then as follows:

$$Y_v = \underbrace{\left(w_v^U L_v^U + r_v^{K,U} K_v^U + r_v^{I,U} I_v^U\right)}_{\text{Upstream}} + \underbrace{\left(w_v^P L_v^P + r_v^{K,P} K_v^P + r_v^{I,P} I_v^P\right)}_{\text{Production}} + \underbrace{\left(w_v^D L_v^D + r_v^{K,D} K_v^D + r_v^{I,D} I_v^D\right)}_{\text{Downstream}} \quad \text{(A2)}$$

In a nutshell, we obtain intangible capital returns by subtracting labor and tangible capital returns from value added in each stage.

DATA SOURCES

The value of a final product v is defined as the value-added of all activities in its GVC—anywhere in the world—that are directly and indirectly needed to produce it. The value-added in GVC activities are empirically identified on the basis of the so-called world input–output tables (WIOTs; Timmer et al., 2014). The WIOTs show how the output of a given industry in a given country is divided between final consumption and intermediate use by all other industries worldwide. We use the WIOTs, release 2016 (Timmer et al., 2015), to measure the factor incomes in GVCs for 2000–2014. We use the Asian Development Bank Multi-Regional Input–Output Tables (ADB MRIOTs) to measure the factor income in GVCs for 2014–2019.[9] In order to have a complete description of all flows in the global economy, the WIOTs also contains an input–output model for the "Rest of World," which proxies for all other countries in the world, apart from the 44 already covered in the WIOTs. The factor income in each GVC v, calculated using the WIOTs, is extrapolated using the trend in the factor income of v based on the ADB MRIOTs. In the main text we report on the factor input returns in GVCs of the goods that are finalized in the manufacturing sector of any of the 44 countries covered in the WIOTs.

Data to measure labor returns in GVCs is from the WIOD Socio-Economic Accounts (release February 2018) for 2000–2014. This requires measurement of labor compensation as a share in value added, which is extrapolated using source data that is derived from national accounts. For Australia, Japan, South Korea, Luxembourg, Mexico, Malta, and the United States we use the OECD STAN database (release December 2020). For Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Germany, Denmark, Spain, Estonia, Finland, France, Great Britain, Greece, Croatia, Hungary, Ireland, Italy, Lithuania, Latvia, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, and Sweden, we use national accounts data from Eurostat. For China, we measured the trend in labor compensation as a share in value added by industry (using the 2012 and 2017 national Input–Output Table). In case we do not have information for a given year, then we use interpolation or extrapolation while making sure that labor shares based on trends are bounded between zero and one.

The measurement of tangible capital income in GVCs requires information on the capital stock (K) and the rental price (r^K). The rental price is the real rate of return plus the depreciation rate. The real rate of return is set ex ante to 4%, which is a standard rate used in many studies. Asset depreciation rates are industry-specific geometric depreciation rates on the basis of data for Spain as calculated by Chen et al. (2021). These rates take into account differences in the composition of capital assets across industries and over time. Tangible capital stock estimates for 2000–2014 are based on the database described in detail by Chen et al. (2021).[10] The capital stocks (K) are updated using a robust approach whereby, for each year, the country-industry value-added data are updated and normalized to GDP and subsequently multiplied by country-industry capital stock to value-added ratios. The updated value-added data and the extrapolation of capital to value-added ratios are based on several sources. For Australia, Japan, and Switzerland, we use the OECD STAN database (release December 2020). For Austria,

Belgium, Bulgaria, Cyprus, the Czech Republic, Germany, Denmark, Spain, Estonia, Finland, France, Great Britain, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, and the United States, we use the EU KLEMS (release 2019) (Stehrer et al., 2019), in combination with the NAMA dataset on asset stocks by industry from Eurostat. For China, we use investment in fixed assets by industry from various editions of the China Statistical Yearbook. For South Korea, we use the OECD STAN database (release December 2020) combined with net capital stock by economic activity from Statistics Korea. If we do not have information for a given year, then we extrapolate the capital stock to value-added ratio using the trend in the aggregate ratio from PWT 10.0 (Feenstra et al., 2015).

The value-added from downstream activities is based on data for the distributive trade sector (retailing and wholesaling) and measured in terms of a "margin," that is the value of the goods sold minus the acquisition value of those goods (Ahmad, 2019). To measure value that is added in the downstream stage, we use information on the margin to sales ratio for each final manufacturing good from Chen et al. (2021). They derive a domestic margin from the difference between the price paid by the consumer and the price received by the producer, assuming that most products finalized in a country are consumed domestically. Information on the final expenditures at purchasers' and basic prices is given in national supply and use tables for most countries. Exceptions are China, Japan, and the United States for which data from retail and wholesale trade censuses are used. Purchasers' prices are adjusted for (net) taxes on products, because taxes are paid by consumers to the government and do not constitute factor input payments. Factor shares in wholesale and retailing are used to derive the factor requirements in the downstream stage.