GLOBAL VALUE CHAIN DEVELOPMENT REPORT 2021

BEYOND PRODUCTION

NOVEMBER 2021

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GLOBAL VALUE CHAIN
DEVELOPMENT REPORT 2021

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NOVEMBER 2021

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ADB recognizes "China" as the People's Republic of China and "Vietnam" as Viet Nam. This report uses ADB terminology in reference to "the People's Republic of China," "Viet Nam" and "Taipei,China."

On the cover: The picture of car assembly at the center represents production tasks along global value chains; the pictures of design and a container ship illustrate the increasingly important roles of nonproduction tasks in global value chains that are adding much more value to products manufactured and traded along these chains.

Cover design by Mike Cortes.

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Foreword

The COVID-19 pandemic has severely disrupted the world economy. Mobility restrictions, imposed by governments anxious to contain the virus, have profoundly impacted the networks of complex production-sharing known as global value chains. However, these networks were under pressure even before the pandemic. A general stagnation in the pace of globalization has persisted since the 2008–2009 global financial crisis, punctuated at times by trade disputes.

Still, global value chains have proven to be resilient. Solutions such as increased use of digital platforms emerged soon after the initial shock of the pandemic. Global value chains have played a key role in the production of personal protective equipment and vaccine components. In addition, as COVID-19 recedes, global value chains will no doubt play a major role in the recovery. This recovery must include reinvigorating a trading system that serves and improves the lives of everyone. For example, global value chains connect small-scale farmers in developing economies to multinational corporations and consumers in advanced economies. Understanding where value is created in these chains, and how it is distributed among participants, is central to ensuring that everyone gets a fair share of the gains from trade. The *Global Value Chain Development Report 2021: Beyond Production* provides research that can help stakeholders better understand these processes and develop policies for an economic environment that is being redefined by COVID-19.

This year's report, the third in a series, also breaks new ground by highlighting aspects of global value chains that go beyond the manufacturing processes typically associated with them. It shows that the value added is increasingly generated outside of manufacturing. Advanced economies are creating a growing share of value and employment in global value chains through innovation and intellectual property. At the same time, services-led growth is offering new paths to development, and the report details how developing economies can benefit from this trend.

The report is a joint undertaking of five institutions: the Asian Development Bank, the Research Institute for Global Value Chains at the University of International Business and Economics, the World Trade Organization, the Institute of Developing Economies – Japan External Trade Organization, and the China Development Research Foundation. Taking over from the World Trade Organization, the Asian Development Bank is leading this year's report, which continues to benefit from wide collaboration among global value chains researchers. Fifty-one authors, from 20 research institutions in eight countries,

contributed the 25 background papers that form the basis for this report. We look forward to expanding our collaboration to include more organizations that do research on global value chains.

We hope the *Global Value Chain Development Report 2021* will support essential work to revitalize a trading system that improves everyone's lives.

Masatsugu Asakawa
President
Asian Development Bank

Ngozi Okonjo-Iweala
Director-General
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Preface

Global value chains (GVCs) have brought about revolutionary changes in international trade, industrialization, and economic development. The GVC story is still rapidly unfolding, as vividly demonstrated by the supply chain crisis, particularly for semiconductors and other components, that broke out during the COVID-19 pandemic, causing further anxiety. But beyond what is hoped will be a short-term tremor, a radical shift in these chains is underway as more of them move beyond traditional production processes to encompass services and other intangible assets. In recognition of this, Beyond Production is the theme of the *Global Value Chain Development Report 2021*, the third report in this biennial series. The most significant feature of this "second unbundling" associated with the proliferation of GVCs in the world economy is the separation between production and nonproduction tasks. So, looking at GVCs not just in terms of manufacturing production but also from the perspective of their beyond-production components, such as intangible assets, digital platforms, and intellectual property, can deepen our understanding of the critical role of GVCs in the global economy.

GVC tasks range from preproduction (research and development, product design, and branding) to production to postproduction (marketing, distribution, and retailing). It is the firms specializing in pre- and postproduction tasks that organize, manage, and operate GVCs. In general, pre- and postproduction tasks add much more value than production tasks to a product manufactured and traded along a value chain. More importantly, the firms specializing in tasks beyond production have control over the geographic allocation of tasks. Taking the iPhone X as an example, it is Apple Inc. that organizes, operates, and expands the iPhone value chain. As a result, Apple alone captures the largest share of the iPhone X's value added: 59%.

In a value chain, intangible assets, such as brands, unique designs, patented technologies, and supply chain management know-how, rather than tangible assets are increasingly determining the ability of firms to lead GVCs and benefit from them. The concept of "trade in tasks" largely means trade between manufacturing services and the services of intangible assets. Studying the tasks beyond production can reveal the crucial role of intangibles and how multinational corporations and developed economies have been benefiting from unprecedented globalization.

The 2017 and 2019 *Global Value Chain Development Reports* focused on the value chains of manufacturing products, and this, too, has largely been the case in the economic literature on GVCs. But the GVCs of service industries have become much more developed since then and play a significant role in economic development and globalization. The impressive achievement of India's information technology industry in exporting business process management services has been largely due to its participation in the value chains of information services. And in a similarly impressive achievement, the Philippines has positioned itself as a global leader in business process outsourcing.

As both countries have so ably shown, the value chains of services sectors expand the choices for developing countries to participate in GVCs.

Profit maximization or economic efficiency is driving the development of GVCs. But the trade dispute between the United States and the People's Republic of China, runaway climate change, and COVID-19 are all showing how protectionism and geopolitical tensions, environmental risks, and pandemics can undermine the stability of GVCs and even force their reorganization geographically. Those risks require GVC studies to look beyond production processes.

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Publishing Partners

The *Global Value Chain Development Report 2021: Beyond Production* is jointly published by the Asian Development Bank (ADB), the Research Institute for Global Value Chains at the University of International Business and Economics, the World Trade Organization (WTO), the Institute of Developing Economies – Japan External Trade Organization (IDE-JETRO), and the China Development Research Foundation.

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members—49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

The Research Institute for Global Value Chains was the first research institute to focus on global value chain (GVC) research. The institute is a platform for promoting GVC research by integrating research efforts and resources of universities and other research institutions, government agencies, and firms across the world. It runs training and degree programs on GVCs, and its resources are open to all researchers.

The WTO is the only global international organization dealing with the rules of trade between nations. Its objective is to help its members use trade as a means to raise living standards, create jobs, and improve people's lives by providing a forum for its members to negotiate trade agreements and to resolve any trade problems they have with each other. The WTO helps developing countries build their trade capacity.

The Institute of Developing Economies (IDE-JETRO) is a research institution affiliated with the Japan External Trade Organization (JETRO), an incorporated administrative agency under the Ministry of Economy, Trade, and Industry of Japan. IDE-JETRO does research on the economics, politics, and societies of developing countries and regions. Through its research, IDE-JETRO contributes to knowledge and a better understanding of developing economies.

The China Development Research Foundation is a public foundation started by the Development Research Center of the State Council of the People's Republic of China (PRC). Its mission is to advance good governance and public policy to promote economic development and social progress. It organizes forums to promote policy debate, carries out social experiments to provide evidence-based policy recommendations, and does policy studies on the PRC's socioeconomic development and public governance.

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Abbreviations

ADB	Asian Development Bank
AI	artificial intelligence
AMD	Advanced Micro Devices Inc.
AMNE	Activities of Multinational Enterprises (database)
ASEAN+3	Association of Southeast Asian Nations plus Japan, the People's Republic of China, and the Republic of Korea
BPO	business process outsourcing
B2B	business-to-business
B2C	business-to-consumer
CO_2	carbon dioxide
COVID-19	coronavirus disease
EU28	European Union plus the United Kingdom
FDI	foreign direct investment
FTA	free trade agreement
GDP	gross domestic product
GHG	greenhouse gas
GVC	global value chain
HS	Harmonized System
ICT	information and communication technology
IP	intellectual property
IT	information technology
MNC	multinational corporation
MSMEs	micro, small, and medium-sized enterprises
NAFTA	North American Free Trade Agreement
OECD	Organisation for Economic Co-operation and Development
PRC	People's Republic of China
R&D	research and development
RCI	regional concentration index
RTA	regional trade agreement
TiFI	trade in factor income
TiVA	trade in value added
TRIPS	Trade-Related Aspects of Intellectual Property Rights
UN	United Nations
US	United States
WTO	World Trade Organization

Key Messages and Findings

- The global slowdown in trade integration is not uniform. While the global value chain (GVC) participation of past drivers of integration, such as the People's Republic of China (PRC), has plateaued, GVC sectors are fueling growth in other economies, including Bangladesh (textiles) and Viet Nam (electricals).

- Because GVCs are typically measured as a subset of exports, the domestic sales of multinational corporations via their local affiliates are treated as a non-GVC activity, and this "missing" activity is considerable.

- Global value chains provide a new model for exporting services of intangible assets. Factoryless manufacturers are a major group of players actively engaging in this trade.

- Conventional trade statistics do not capture exports in the services of intangibles via GVCs. These statistics therefore substantially underestimate the actual exports of developed economies and distort the trade balance between them and developing economies.

- Using a new concept—trade in factor income, which includes trade in intangible assets—as a measure, the PRC's trade surplus with the United States would be 32% lower.

- Firms in developing economies may not be able to benefit from GVC-mediated access to foreign research and development because of their low absorptive capacity and the highly specialized nature of this knowledge.

- For developing economies to create jobs, specializing in labor-intensive assembly activities along GVCs could be more beneficial than targeting sophisticated production stages.

- New entrants can upgrade along value chains by sourcing core technological modules (or acquiring the know-how to build them) from foreign multinational corporations and specializing in higher value-adding tasks, such as brand marketing.

- The rise of services GVCs offers a new path for development—akin to manufacturing GVCs—that can boost economic growth and generate well-paying jobs.

- To support integration into services GVCs, policy makers need to tackle obstacles to increasing educational attainment, since services GVCs depend more on human than physical capital.

- Compounding geopolitical, environmental, COVID-19, and cyber risks are compelling incentives to increase investment in making GVCs more resilient, especially through digitalization and automation.

- More extreme inward-oriented geopolitics fueled by protectionist populism could not only lead to further GVC decoupling but also heighten environmental and pandemic risks. Inward-oriented strategies emphasize risks from—rather than risks to—GVCs.

- Reducing meta-risks to GVCs requires outward-oriented strategies that are environmentally sustainable and market-oriented, and committed to labor protection, multilateralism, peaceful exchange, nondiscrimination, reciprocity, and transparency.

- Digital platforms are changing who participates in GVCs through increased modularization and reductions in communication costs, bringing in new players from developing economies and supporting the GVC participation of micro, small, and medium-sized enterprises.

- Digital platforms pose regulatory challenges, especially in their tendency toward consolidation. These challenges can reduce access by smaller players to the benefits of the digital economy.

Executive Summary

The theme of the *Global Value Chain Development Report 2021* is Beyond Production. Most research on global value chains (GVCs) focuses on manufacturing production; in other words, the breaking up of production processes into many discrete steps with a resulting explosion of trade in parts and components. But there are aspects of GVCs that go beyond manufacturing processes; in fact, value added and employment generation in GVCs are depending less and less on manufacturing production. This year's report features research on these aspects. For example, by highlighting the role of multinational corporations (MNCs) and, closely related to that, the role of intellectual property (IP) in setting up GVCs. Value chains are an efficient way for firms to exploit their brands, patents, and other IP. In the extreme, this leads to "factoryless" production in which firms that design and market manufactured products own none of the production process. An important part of modern GVCs consists of innovator countries exporting the services of their IP in return for manufactured goods.

Other issues that go beyond production are the role of GVCs in spurring technological innovation; the growing importance of services, both as an input into manufacturing value chains and as a component of final demand produced via their own complex value chains; and the potential for online platforms to enable more inclusive globalization by facilitating the participation of micro, small, and medium-sized enterprises (MSMEs). The report also examines the issue of risks to GVCs. The years 2018–2020 revealed some of the important risks that can threaten the normal functioning of GVCs and trade more generally. It was during this period that the Trump administration imposed a 25% tariff on about half the products that the United States (US) imports from the People's Republic of China (PRC), which disrupted major production chains. Natural hazard events in 2021, including floods in Thailand and the deep freeze in Texas, have highlighted the risks inherent in a production system that relies heavily on the just-in-time delivery of parts sourced from only a few key locations. The COVID-19 pandemic was a huge shock to world trade and GVCs. It is too early to say definitively how GVCs will evolve in response to the heightened awareness of geopolitical, environmental, and health risks, but some early evidence and analysis is emerging. So far, there has been no generalized reshoring of production back to the US or Europe, nor would that likely be effective as a response to most of the risks that have emerged. GVCs are more likely to evolve than to shut down. The rest of the summary looks at the key messages and findings in this report's six chapters.

Recent Trends in Global Value Chains

Chapter 1 updates basic statistics about trade within GVCs; that is, value added that crosses at least two borders between initiation of production and final consumption. Because GVC trade involves value added flowing from one country to another even

when the pair do not have a direct trading relationship, this can also be called indirect trading. The period from the 1990s to around the global financial crisis of 2008–2009 was the heyday of GVC expansion, dubbed the era of hyperglobalization. World trade grew especially rapidly when the PRC joined the World Trade Organization and as more developing countries shifted to open strategies, with global gross exports growing at an average 8.7% per year and indirect exports at 9.7% during 2000–2010. But both gross and indirect exports slowed dramatically in the subsequent decade, 2010–2019. Globalization did not reverse, but its advance slowed, causing *The Economist* to proclaim this the era of slowbalization. The average growth rate of gross exports slowed to 3.7% and indirect exports to 3.8%. Note that indirect exports were still expanding their share, but much more slowly than during the era of hyperglobalization.

Using input–output tables it is possible to trace the discrete steps in a production chain. From 2000 to 2010, chains lengthened for virtually all traded sectors. It was this breaking up of the production process that introduced new efficiencies and productivity gains, and made it possible for developing countries to enter manufacturing production, in particular, by finding a niche in the production chain. No longer did developing countries have to produce complete products; they could expand their comparative advantage by taking on certain tasks in the production chain. From 2010 to 2019, production length stagnated in virtually every sector: it did not shorten, but neither did it lengthen. It is possible that natural limits determine the extent to which the production process can be broken up for specific products. But it is also possible that there are countervailing forces pushing firms to shorten value chains. In the late 2010s, the world was exposed to significant geopolitical risks and environmental change, and, more recently, the COVID-19 pandemic. These events are too recent to have had much effect on 2019 GVC data, but Chapter 5 examines these risks and early evidence on how firms are responding to them, and speculates on the possible impacts of these risks on GVCs.

Although some stagnation has occurred in overall measures of GVC trade, it is important to note the considerable dynamism at the country and sector levels. Some developing countries have dramatically increased their share of GVC trade, most notably Viet Nam, which had 14.3% annual growth in indirect exports during 2010–2019. Cambodia and the Lao People's Democratic Republic, among other Asian economies, achieved similar increases, indicating that GVCs are still offering trade and production opportunities for some developing countries. It may seem surprising that the PRC has gone in the other direction: its growth of indirect exports declined from 20.0% during 2000–2010 to 4.6% in 2010–2019. But it needs to be borne in mind exactly what is being measured here. In 2010, the PRC was a major export processing center, taking in inputs from different partners and assembling them for export. A decade on and the PRC produces many more inputs—so more products are now following the pattern of traditional trade. In other words, the PRC produces the whole product for export. There may be a complex value chain within the PRC, but it is not a GVC. The country has also become the largest market for many products. Firms from the Republic of Korea used to produce electronics in the PRC for export to the US, and this would have shown up as indirect exports from the PRC in the

trade statistics. These firms nowadays sell much of their output in the PRC, so this should be recorded as an indirect export from the Republic of Korea to the PRC. The shifting statistics on GVC trade reflect these changes in the PRC's role in the world system.

One important innovation in the report is spotlighting the role of MNCs. The value added of affiliates of MNCs is recorded as domestic production in national accounts. For example, a firm from the Republic of Korea producing in the PRC has its value added included in the PRC's gross domestic product (GDP), as it should be. As emphasized in Chapter 2, the contribution of MNCs to their affiliates increasingly comes in the form of the use of IP— that is, MNCs' brand, patents, intangible know-how, and marketing networks. Those important services are generally not counted in trade statistics. Thus, often what the data show are foreign firms producing complete products in the PRC, some of which are exported. If the IP contribution of parent firms were properly counted, then this is a type of GVC trade, with the services of IP going from the parent to the affiliate, and additional value added contributed locally and then exported. From an economic point of view this is the same as if the parent were sending physical inputs, but from an accounting perspective the flow will not show up in the data.

The Organisation for Economic Co-operation and Development provides a major data service by reconstructing recent input–output tables in which the value added is divided into production from domestically owned firms and production from MNC-owned affiliates. It can be assumed that the contribution from foreign affiliates includes at least some flow from the parent. If the activities of foreign affiliates are assumed to have some intangible import content, then measures of GVC trade are roughly doubled. Unfortunately, it is not possible to extend this analysis back through time, but the exercise does reveal the extent of GVCs, which are already thought to be large—in fact, twice as large as conventional trade statistics indicate. This role of IP in value chains is the subject of Chapter 2.

Dividing production between domestic- and foreign-owned firms opens up many new research areas. Just one example: the PRC's main export is information and communication products. It turns out that similar amounts of the PRC's information technology exports come from domestic and foreign firms. Chapter 1 traces the value chains for domestic and foreign firms and finds they are strikingly similar, both having conventional "smile" shapes—that is, high value inputs early in the production process with design, finance, and high-tech inputs; low value assembly in the middle; and high-value distribution and marketing at the end. Both domestic- and foreign-owned exporters rely primarily on domestic inputs.

Trade in Intangible Assets along Global Value Chains and Intellectual Property Protection

Chapter 2 begins with the paradox that in 2018 the US's flagship manufacturer, Apple Inc., had $52 billion in sales in the PRC, but none of these products turn up in US trade

statistics; specifically, neither finished products (laptops, tablets, smart phones) nor Apple components. Apple is a prime example of a new breed of firm: the factoryless manufacturer. Factoryless manufacturers organize GVCs based on their IP, including patents, trademarks, copyrights, brand names, product designs, software, databases, and special business organization structures. IP is increasingly the prime asset owned by large international firms. An estimated 90% of the value of firms in the S&P 500 corresponds to IP, which contributes twice as much to the value of trade as does physical capital. While Apple is the best example of factoryless production, other important examples include Advanced Micro Devices Inc. (AMD), Nike Inc., and Qualcomm Inc. Factoryless firms are the extreme example of a more general phenomenon: in many important sectors, such as autos, the major firms have their own manufacturing plants around the world, but their IP is still their most important asset and the basis on which they organize GVCs.

So, how does factoryless manufacturing work? Take Apple as an example to answer this question: it contracts with manufacturing firms in the PRC to use its patents, design, and brand to produce Apple products. A significant part of this output is sold in the PRC and the rest is exported primarily to the US and Europe. From an economic point of view, the US is exporting the services of IP and importing finished products. From an accounting point of view, there are several ways for this trade to be organized. It is possible for a US firm to license patents or brands to a foreign, arms-length firm. Here, the royalty payment will show up as an export of services in US trade statistics. But most firms are reluctant to license their critical IP. Even in countries with the best IP rights protection, this protection is not perfect. And in many developing countries participating in GVCs, IP rights protection is not as strong as in advanced economies. For this reason, many firms with valuable IP prefer to keep these assets in-house and set up foreign subsidiaries. It is still possible that such a firm will charge a licensing fee to its subsidiary, but usually there are tax reasons why it is smart to charge very low fees (transfer pricing) and inflate the taxable profits of the subsidiary. Hence the total amount in trade statistics for payments for the use of IP tends to be modest, and this is a significant understatement of the actual role of IP in trade.

An additional complication comes from the tax-avoidance reasons to vest IP in subsidiaries in low-tax havens. Apple, for example, has vested its IP in overseas subsidiaries. From an accounting point of view, Apple's subsidiaries are earning profits in the PRC using IP to organize production, sales, and servicing there. Apple in the US is the ultimate owner of those profits, but there are tax advantages to booking the profits overseas and leaving them there. As of September 2021, 131 countries had agreed to a new global tax regime with a minimum corporate profit tax. This is an important reform that should halt the race to the bottom in corporate tax rates and ensure that large MNCs pay a fairer share of taxes. This tax reform, however, will not necessarily change the practices just described. The leaders of the world's 20 biggest economies have endorsed a global minimum corporate tax of 15%. Any compromise will probably leave in place the incentives to vest IP in low-tax havens because it is a low-cost maneuver—and as long as there is any tax incentive, the practice is likely to continue.

Chapter 2 explores the ways in which these practices distort bilateral trade statistics. Economists generally do not pay that much attention to bilateral imbalances, but they get a lot of attention from politicians and stakeholders who are being hurt by international trade. The US-PRC trade imbalance, in particular, has got a lot of attention. Various aspects of GVC analysis help provide a deeper understanding of the US-PRC relationship. The data most easy to tabulate swiftly is the movement of merchandise, almost all of which travels by container through major ports. Monthly merchandise trade balance data show a very large deficit in relation to the PRC from the US point of view. If the direct trade in services, such as tourism, education, and royalties on the use of IP, is added, the deficit goes down quite a bit because the US is a major net exporter of services both to the PRC and the world. Using input–output tables it is possible to shift the analysis from gross output to value added. This is important because the PRC still uses a lot of imported intermediates that are assembled for final export. Thus, some of what looks like a deficit with the PRC from the US point of view is actually a deficit with Japan or the Republic of Korea, which tend to be upstream, sending inputs to the PRC for final assembly.

An innovation in this report is introducing the concept of trade in factor income: it basically adds in what is missing from the calculation just discussed—that is, the trade in services of IP that is not directly recorded as an export of services. So, Apple's profits from the PRC, which are recorded at its overseas subsidiaries, are added to US exports to the PRC because that is the underlying economic reality, not the accounting fiction. Using the measure of trade in factor income, the US-PRC deficit is reduced by a third compared with the merchandise balance. Chapter 2 also provides insights into who is winning and losing from globalization in advanced economies. On the winning side are the big companies that own most of the IP (and their shareholders, mostly in the top 10% of income distribution) and the highly skilled technical workers who create IP benefit from exploiting IP internationally. On the losing side are semiskilled workers who find themselves competing with a vast supply of similar workers in developing countries.

The final issue taken up in Chapter 2 is IP rights protection, an issue of ever-growing importance given the expanding role of IP in GVCs and trade. While MNCs deploy their IP internationally, including in developing countries, they are naturally concerned about the protection of their IP rights. An international index shows that IP rights are generally very good in advanced economies and fairly good in most developing countries. The PRC scores modestly better than other large emerging markets, including Brazil, India, Indonesia, Mexico, Thailand, and Viet Nam. Research from the Organisation for Economic Co-operation and Development examines key factors that affect GVC participation, both for advanced and developing economies. For developing ones, the single most important factor is IP rights protection, followed by the quality and availability of infrastructure, institutional quality, and logistics. This makes sense: to operate effectively foreign investors need reasonably good infrastructure, logistics to move goods in and out, and protection of their main asset (i.e., their intangible property).

Building strong IP protection is increasingly important in the age of intangibles. Advanced economies have a strong interest in IP rights protection globally so that their firms can collect the maximum rents from their intangible assets. It also has to be recognized that the interests of developed and developing countries are somewhat different. Developing countries have an interest in implementing IP rights protection that is strong enough to attract foreign investment, including in hi-tech sectors. But much of the benefit of an open development strategy comes from advanced technologies diffusing to domestic firms. This is a natural process that goes back at least as far as US firms appropriating textile technology from Great Britain in the 18th century. Developed countries, however, own most of the IP in the world and benefit from IP rights protection that is as strong as possible. For example, advanced economies favor long patent terms for pharmaceuticals, whereas developing countries favor shorter patent terms. The COVID-19 pandemic illustrates this tension. Firms in advanced economies moved quickly to develop effective vaccines. Leading developing countries, including India and South Africa, proposed that World Trade Organization–based patent protection be waived for these vaccines. The proposal is still under discussion and no consensus has been achieved yet. This was a good start for the developing world's vaccine requirement, but not nearly enough.

Productivity Growth, Innovation, and Upgrading along Global Value Chains

Chapter 3 examines the dynamic effects that developing countries can expect from contributing to GVCs. The economic literature has long established a positive and significant causal effect of trade on aggregate productivity, which works through the channels of increased competition, expanded product markets, and improved access to production inputs. GVC trade offers more opportunities for productivity growth than trade in final goods and services. This is because by outsourcing parts of production to international suppliers, lead firms realize efficiency gains in the form of lower costs or higher quality, which increases productivity. Furthermore, when a foreign firm and a local supplier are part of the same supply chain, they need to interact and coordinate to guarantee the chain functions smoothly. That facilitates the transfer of tacit knowledge, potentially increasing domestic innovative capabilities.

Evidence from advanced and emerging economies supports the idea of domestic suppliers accessing new knowledge and resources from foreign markets and buyers, where GVC-mediated access to foreign research and development (R&D) is shown to boost innovation. Similarly, evidence shows that foreign affiliates of MNCs generate positive local spillovers, especially to their suppliers. Still, the positive effects are conditional on the absorptive capacity of local firms, which depends on human capital, own R&D investment, and broad institutional capabilities. In many developing countries, however, low absorptive capacity, large distances from the global technology frontier, and the highly specialized nature of the knowledge flowing along value chains may

prevent local firms from drawing on the knowledge and technology of lead GVC firms. Precisely because lead firms tend to work closely with their suppliers, the consequence may be that these end up being overly specialized and dependent on lead firms. Imitation remains one of the most effective channels of knowledge acquisition in developing countries, along with collective learning and learning from other non-GVC actors. MNCs also have the incentive to support their suppliers' innovation and upgrading in areas that are complementary to them, but to prevent innovation that could challenge their core competency.

For economic development to occur, productivity growth must be accompanied by sustained employment growth in modern sectors (i.e., manufacturing and, increasingly, services). While exporting through GVCs is often seen as a panacea for the weak industrialization trends in developing countries, the reality is more complex. Productivity growth is not necessarily associated with employment growth in developing countries, and the association even turns negative as economies get closer to the productivity frontier in manufacturing, possibly due to the labor-substituting effect of automation. Even in developing Asia, which has seen a massive increase in the scale of production activities along GVCs, productivity convergence and functional upgrading are slow and far from guaranteed, as shown by the diversity of outcomes across the 15 developing Asian economies examined in Chapter 3. The chapter also shows the importance of upscaling in driving income convergence and that the volume of activity matters just as much as the domestic share of the value of a product in driving income convergence.

The modularization of manufacturing—the building of complex products from smaller subsystems that can be designed independently yet function together as a whole—has reduced the production complexity of high-tech products. This allows new market entrants to catch up with established MNCs based in advanced economies and erode their market shares by sourcing core technologies from international suppliers (or acquiring the firms that own those technologies) and concentrating on noncore technology activities, such as assembly and brand development. Case studies from India and the PRC are presented as examples of the successful deployment of this strategy. While the firms in these case studies used their large domestic market to build their brands before expanding into foreign markets, the key to both success stories is that they leveraged their knowledge of the local context to create competitive advantage. The rising regionalism in GVCs means that firms from small developing countries can also take advantage of modularization and leverage their regional markets for scale. However, a free and fair global trade and investment landscape is paramount to this strategy's success.

It is worth noting that catching up in output capabilities generally means acquiring the technologies and skills relating directly to a product or service, not the ability to enhance or develop that product. The process, however, still involves new-to-the country and new-to-the-firm innovation, which are as important as frontier innovation in driving

productivity growth. The two case studies also emphasize the importance of marketing innovation in product design, packaging, placement, promotion, and pricing, as well as organizational innovation to be able to compete at the global level. In other words, the ability to develop a next-generation product is not the only way for a firm to be innovative.

The Role of Global Services Value Chains for Services-Led Development

The relationship between GVCs and development has often been discussed in the context of manufacturing or agriculture. The past few decades, however, have witnessed an unprecedented shift of employment, output, and trade shares from agriculture and manufacturing toward services industries in all regions globally—the issue taken up in Chapter 4. Services today account for more than 50% of global GDP and tend to employ more workers than manufacturing in countries at all levels of development. They play a crucial role not only for their own sector but also in the production of nonservices sectors, a process defined as the "servicification" of an economy. The upstream position of many highly traded services, with the exception of tourism, implies that the trade in services is mainly trade in intermediates and can therefore also be seen as trade in global services value chains.

Moreover, the "production" process of certain services allows for fragmentation similar to goods. This enables countries to join services GVCs just as they joined goods GVCs. Two countries where these strategies are working well are India and the Philippines. Both are now among the leading countries for offshore business services worldwide because of their low costs, human capital availability, and attractive business environments for services sectors. Here are three takeaways from their experiences. First, human capital accumulation is essential for both joining and upgrading along a value chain, especially in the context of automation, which threatens low-skill labor in many services sectors just as it does in manufacturing. India and the Philippines both have relatively large English-speaking populations with sufficient digital skills. Second, services GVCs can create a large number of well-paying jobs. Estimates indicate that indirectly the information technology industry supports about 16 million jobs in India and that workers in the industry have benefitted from average annual wage increases of 10% over the past decade. And third, developing domestic markets with strong local business networks and economic interactions are vital for sustaining a competitive edge and upgrading along value chains. This should go hand in hand with higher investment in education and R&D.

The rise of services value chains feeds into an active debate on whether servicification can replace the role of industrialization for economic development, especially in the context of export-led growth relevant for global services value chains. On the one hand, "premature deindustrialization" can be detrimental for development as, with trade and

globalization, developing economies "import" deindustrialization prematurely from advanced ones without having enjoyed the same rapid productivity growth that normally accompanies industrialization. Services-led development, relying on globalization and digitization, can become the main development path for low- and middle-income countries. Because developing countries are typically well-endowed with low-cost labor but manufacturing has become increasingly capital-intensive, these countries cannot fully exploit their comparative advantage. But this can be done with services, which require low upfront capital investment and declining trading costs due to the diffusion of information and communication technology. In general, upstream services require less capital per worker than for manufacturing inputs, but these services also require a higher level of education and skill.

The literature on services trade also reports positive effects on labor markets, although the available evidence for developing countries is ambiguous and points to better working conditions but greater employment volatility, mostly due to offshoring and reshoring decisions and to the heterogeneity of services. Nevertheless, in the future, telemigration can offer large opportunities for developing economies if services trade costs continue to decline due to digital technologies and from the expansion of fast-speed internet and the removal of policy barriers.

Trade in services has also typically been found to raise average earnings, which can help achieve the Sustainable Development Goals faster, with services being greener and more inclusive than other macro sectors. For instance, services trade can help close wage and employment gender gaps, as women have a high share of employment in services. Services GVCs can help tackle the growing polarization of incomes via job creation and labor reallocation toward cities. Indeed, cross-country evidence shows a negative correlation between income inequality and services exports. The flip side of this is that services are characterized by temporary employment, they mostly benefit the more educated, and they are more concentrated in cities leading to a larger urban–rural divide. Despite the evidence on the benefits of participating in services GVCs, most developing countries still have more foreign trade and investment restrictions on services than on manufacturing.

The policy implications for a growth model based on services GVCs to be effective and inclusive, and offer decent employment, include liberalized services sectors that can be provided efficiently and inclusively by the private sector (e.g., delicensing, privatization, foreign ownership); reducing services trade costs and barriers to increase their tradability, especially in sectors that are less susceptible to automation; expanding digital infrastructure investment; investing in the training and upskilling of workers to favor human capital accumulation; and narrowing gaps by reducing the relative costs of schooling and information asymmetries, especially in rural areas.

Rising Risks to Global Value Chains

Chapter 5 analyzes the risks that GVCs face from environmental, geopolitical, and COVID-19 sources. While each of them has created major risks for GVCs, they are quite different and require separate approaches to resilience and adaptation. A core underlying observation is that geopolitical shocks have not only become a primary concern for the future of GVCs in recent years but also entail important implications for whether and how states can handle environmental and pandemic shocks affecting GVCs. No definitive assessment of the cumulative effects of geopolitical shocks on GVCs is possible because they are still unfolding. Moreover, the effects of COVID-19 were superimposed on preexisting geopolitical tensions, conflating the two. According to standard measures of uncertainty, the uncertainty triggered by US-PRC tensions added 20% to global uncertainty since 2016, peaking during the first quarter of 2020 and declining under the Biden administration. The increase in policy uncertainty since mid-2018 might account for 1 percentage point of the decline in world trade growth. US and European imports from the PRC via complex GVCs rose significantly after 2016, but declined during 2018–2019 (prepandemic). The PRC's share in total US imports via complex GVCs has also fallen since 2018. Industry surveys suggest that about 90% of GVCs have suffered disruptions from the twin shocks of US-PRC tensions and the pandemic. A March 2020 survey finds that only 44% of firms thought US-PRC economic decoupling would be "impossible," down from 66% in October 2019. Most US respondent firms considered an escalation in trade disputes quite likely or highly likely over the next 3 years, but about 85% retained "in China for China" strategies with no plans to relocate. This is consistent with findings highlighted in Chapter 1. The PRC's role in export-oriented GVCs has declined in relative terms as more of its production is sold domestically. Firms that are in the PRC to produce for the Chinese domestic market are unlikely to relocate in response to the trade tensions, barring more extreme turns to inward-oriented geopolitics. According to surveys, these disputes and protectionism were the top macro risks for 44% of East Asian firms. The response to coping with heightened uncertainty was extremely diverse across firms, and included automation, digitalization, diversification, "just in case" capacity buffers, regionalization, near shoring, and shorter GVCs for some products.

Environmental shocks affect GVCs directly on the supply side (via disruption to people, infrastructure, transportation, and capital) and indirectly (via interrupted flows of intermediate goods and services upstream) and on the demand side, as consumers need different quantities of goods and services in response to shocks. Extreme weather events affect the trade routes, transportation, and modern infrastructure underpinning GVCs. Agriculture and tourism are susceptible to climate change, but here shocks are typically highly localized in domestic networks and temporally confined. Allowing diversified GVCs enables adjustment as shock absorbers. Because environmental risks—including disasters triggered by natural hazards—are projected to increase, the environmental risks to GVCs are likely to grow substantially.

By contrast, COVID-19 has shown how GVCs can hasten pandemic diffusion via international travel, high socioeconomic globalization, urbanization, geographic agglomeration, and population density. In this crisis, reduced production followed declines in labor-force participation because of COVID-19 containment measures, spillovers upstream and downstream (especially among economies with high GVC trade), lockdowns and border closings, rising demand for information and communication technology, and supply chain contagion and waves of reverse supply chain contagion. Other effects included contracting demand for air travel, tourism, and restaurants; rising demand for medical equipment and pharmaceuticals; and overall synergies between supply and demand shocks. Complex, lengthier GVCs with concentrated production or distribution have been the most vulnerable. GVCs, however, have been surprisingly resilient in adjusting to food, pharmaceutical, and medical equipment shortages so far in the pandemic. In general, after a 2-month or so lag, GVCs for these products have functioned well and are meeting the higher demand than before the pandemic.

Chapter 5 reports important findings on the global costs of COVID-19 lockdowns on GVCs (measured in value added), where costs depend foremost on the number of affected countries and the duration (more than strictness) of lockdowns. The spatial extent of COVID-19 is the most important driver of the global cost on GVCs. In a scenario where the PRC alone was affected, COVID-19 lockdowns would have reduced global value added by only 3.5% of GDP. Instead, the pandemic's spread to highly developed countries in Europe and to the US increased the value-added loss nearly fourfold to 12.6%. Propagation through GVCs via forward and backward linkages raises losses significantly. Importantly, low- and middle-income countries are far more vulnerable to the indirect effects of the pandemic than developed countries. Containment measures have had both substantial positive externalities (i.e., all countries benefited considerably when the PRC imposed the strictest containment measures) and negative externalities (i.e., all countries suffered from the containment measures of other countries via reduced demand). But it is the positive externalities of the containment measures that dominate.

The degree of GVC resilience and vulnerability across risks depends on the nature and magnitude of shocks, including their size, sector, and region specificity; GVC features, such as symmetric versus hub design or the presence of choke points; industry features, such as upstream versus downstream; the availability of substitutions (short or long term); and the degree of transactional stickiness. While Chapter 5 primarily examines the implications of the three macro risks *for* GVCs, it also notes GVC contributions to exacerbating each of those risks, whatever their other sources may be. All three risks *from* GVCs are on the rise, as are all three risks *to* GVCs. All three are becoming more predictable, to varying degrees, with improved understandings of their sources and mechanisms. All three could be better contained domestically and internationally if handled appropriately, especially because all three can have anthropogenic sources or mechanisms. All three risks fuel unfortunate synergies across them and all are increasingly vulnerable to cyberattacks. Firms are responding to these risks with measures to enhance resilience via diversification, transparency, mapping, digitalization,

near-shoring, and "just in case" inventories, among other things. As of early 2021, about 87% of firms were investing in enhancing resilience. Reshoring has not been a particularly widespread response so far because it comes at high cost and does not address most risks.

At the level of international relations, countries must avoid the exclusive unilateral pursuit of relative gains via GVCs and unfair trade practices. Rather, they need to reignite international collaboration that fosters reciprocity, trust, and transparency via multilateral institutions and converge on a regime that tackles rising cybersecurity risks. They need to contribute to COVID-19 Vaccines Global Access, the global vaccination initiative, to accelerate vaccine distribution. International collaboration to develop a global cost-sharing instrument ahead of the next pandemic could enable a fairer distribution of the costs of monitoring, containing, and suppressing pandemics while strengthening incentives for early action. The proliferation of extreme weather events worldwide makes clear that new technology must privilege renewable energy and decarbonization. Measures that go beyond the Paris Agreement may be required, including the elimination of global fossil fuel subsidies for both production and consumption, an agreement on a globally negotiated minimum carbon tax adjusted to gross domestic product, improved carbon emission standards, and other urgent measures toward net zero. Urgent cooperation on environmental risks may help soften the rough edges of geopolitical and pandemic-related ones, thus reinforcing mutual commitments across all three domains in a virtuous, synergistic circle.

Digital Platforms and Global Value Chains

The new digital economy is built on platforms as varied as search engines like Google and mobile phone operating systems like iOS. Chapter 6 focuses on these digital platforms, which are the basis of the digital economy itself, and have important implications for GVCs and their participants. They can increase inclusivity for MSMEs and developing economy participants by creating new means of trade and GVC participation through search and connection tools, such as e-commerce marketplaces. But they can also bring new challenges to both, including uneven access to digital infrastructure, a tendency for platform-market consolidation that reduces competition, and a host of direct and indirect costs to participate.

Digital platforms, at their core, make interactions easier between distinct users who interact via the internet, lowering the cost for user interaction and generating network effects as more participants join. The benefits of digital platforms for MSMEs go beyond identifying sales opportunities; they also allow businesses to work together through digital payment services, communication technologies, and financing.

Importantly, information communication technologies have been both the driver of digital platforms and a major factor in GVC growth in the 20th century, helping

firms around the world to reduce the barriers imposed by distance and increasing the manufacturing share of industrializing economies. Just as digital platforms can provide services that make trade and GVC participation easier, GVCs themselves provide opportunities for greater inclusivity. Whether for MSMEs or businesses in developing countries, GVCs fragment production and rely on services, as discussed in Chapter 4. This allows firms to focus on smaller, more specialized pieces of manufacturing, creating opportunities for players with more limited manufacturing capacities and MSMEs that are more likely to trade in services.

For trade, digital platforms have reshaped cross-border trade flows by reducing the importance of physical presence, lowering the costs to get into international markets, and creating new two-sided markets. Individuals can provide their virtual inputs to online tasks from marketplaces like Mechanical Turk and e-commerce marketplaces provide opportunities for MSME trade and exports from developing countries. All of these are significant changes that have led to the proposal for a new "internet driven" value chain containing both e-commerce marketplace transactions (and the data they generate) and direct business-to-business e-commerce facilitated by platforms.

Chapter 6 presents a systematic review of what digital platforms are; how they affect trade inclusivity, especially for MSMEs and developing countries; the evidence that digital platforms can facilitate GVC participation; and how this participation can be characterized. On a policy level, given the benefits of the digital platform economy and its potential for inclusivity, the chapter encourages policymakers to mitigate the digital divide through reduced access costs and increased infrastructure, to increase the availability of secure servers that permit online transactions with reduced risk, and to provide greater access to formal banking to facilitate the ease of digital transactions. It also underscores the importance of ensuring competition by preventing over-consolidation among digital platforms and making the user data that is generated within these platforms both secure and portable.

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Recent Trends in Global Value Chains

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The last few years have been challenging for globalization. While the world has benefited from the fragmented networks of production-sharing known as global value chains (GVCs), concerns are being raised over their risks. Chapter 1 of the *Global Value Chain Development Report 2019* pointed to a rise in protectionism in general and a brewing trade conflict between the United States (US) and the People's Republic of China (PRC) in particular. More obstacles have since emerged from the sudden and simultaneous closure of borders due to the COVID-19 pandemic that exposed vulnerabilities in some supply chains, rattling policymakers (Chapter 5). Despite these challenges, GVCs—for supporters and detractors alike—remain a reality that cannot be ignored. Indeed, the very vaccines crucial to ending the COVID-19 pandemic rely on multinational partnerships for the over 200 components that go into them (Irwin 2021).

This chapter sets the stage for the rest of the *Global Value Chain Development Report 2021* by examining recent trends in GVCs. Their multidimensional character requires a plurality of approaches, a fact reflected in the review of GVC frameworks by Satoshi Inomata in the *Global Value Chain Development Report 2017* (Inomata 2017). Broadly speaking, GVC research can be approached from a firm and product perspective, using micro datasets and case studies, and from an economy and industry perspective that leans more on national accounts, trade statistics, and intercountry input–output tables. This chapter, serving as a big-picture overview of recent GVC trends, mainly uses the second approach. The literature on this has flourished in recent years, rooted on a trade accounting framework first proposed by Koopman, Wang, and Wei (2014) that carefully and comprehensively decomposes exports into various value-added categories. The following sections marshal various indicators to build a coherent narrative of recent

GVC developments. The dominant theme is that of "slowbalization," a term popularized by *The Economist* (2019) to describe the general slowdown in the pace of globalization seen since around the global financial crisis of 2008–2009. This is in contrast to the era of "hyperglobalization" characterizing the 1990s and the early 2000s (Subramanian and Kessler 2013).

The following section uses a standard set of indicators to provide an overview of globalization trends. Foremost among these is the GVC participation rate, the measure that most clearly shows a slowbalized world. The chapter then discusses the role of multinational corporations (MNCs), arguably the key players of globalization, and details their activities through smile curves and network analysis. The following two sections examine the role of regionalism and whether the push to form regional trade agreements (RTAs) complements or substitutes globalization, and, moving to the national level, explore evidence that supply chains are "reshoring" and what the consequences of this might be. The chapter concludes by looking at GVCs in the postpandemic era.

From Hyperglobalization to Slowbalization

Globalization from the 1990s to 2020 had two broad phases, as noted in the literature. The first phase was a burst of integration from the 1990s to around 2008, written about by Thomas Friedman (2005) and Richard Baldwin (2016), among other authors. This has been called "hyperglobalization" by Subramanian and Kessler (2013). This period saw a steep fall in the cost of information and communication technology (ICT) and the rapid expansion of international production sharing, known as GVCs. In the second phase, trade collapsed in the wake of the global financial crisis and since then the pace of globalization has noticeably slowed (World Bank 2020), ushering in the era of slowbalization.

Antràs (2020a) notes that given the events that drove hyperglobalization—among them, the breakup of the Soviet Union and the PRC's entry into the global trading regime—a subsequent slowdown was only natural. But it is also true that a vocal opposition to globalization has emerged in recent years (Krugman 2019; Autor, Dorn, and Hanson 2013), with protectionist policies appearing in political platforms around the world (de Bolle and Zettelmeyer 2019). This suggests that more than a stagnation, globalization may be in danger of suffering a reversal.

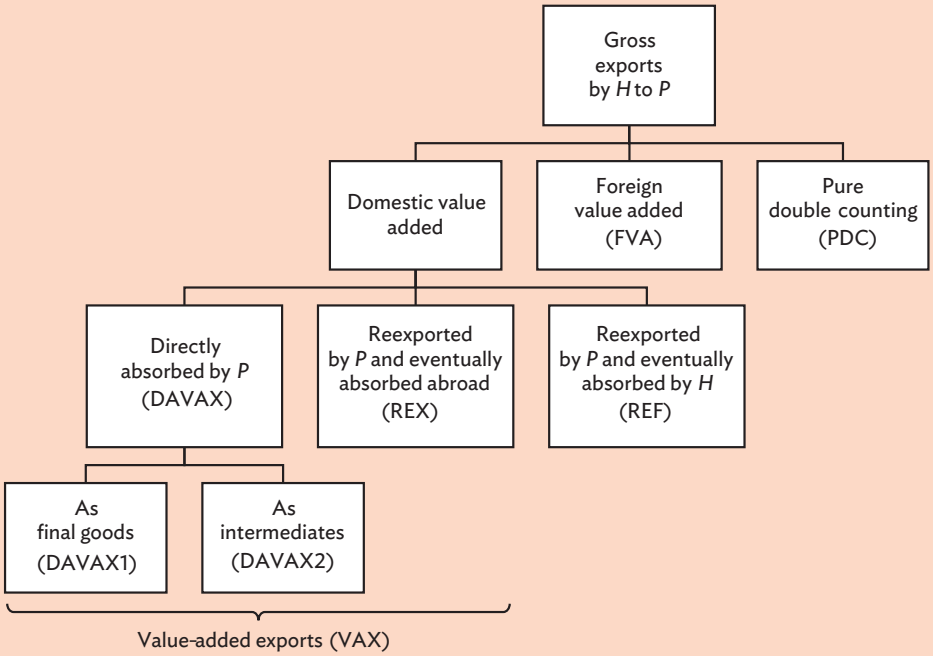
Quantifying these trends helps sharpen the picture. To do this, the trade accounting framework of Koopman, Wang, and Wei (2014)—as extended by Wang, Wei, and Zhu (2018) and Borin and Mancini (2019)—is used to decompose gross exports into meaningful value-added categories (Box 1.1). The magnitudes of some of these categories reveal the GVC participation of a particular entity. This chapter makes use of two approaches. In the trade-based approach of Borin and Mancini (2019), the GVC participation rate is measured as the share of indirect trading in gross exports. The production-based approach

of Wang et al. (2017a), meanwhile, measures the GVC participation rate as the share of the unfinished exports of domestic value added in total value added generated. Both these rates for the world are plotted in Figure 1.1 over 1995–2020.

Box 1.1: The Value-Added Trade Accounting Framework

Data in trade statistics are generally insufficient to study global value chains (GVCs). This is because reported flows are in gross terms, whereas in GVC research, it is important to also look at flows in value-added terms. Koopman, Wang, and Wei (2014) were the first to provide a methodology for comprehensively decomposing bilateral gross exports into more primitive value-added categories using information from intercountry input–output tables.

Decomposition of Home's (*H*) Gross Exports to Partner (*P*)



Sources: Authors based on Borin and Mancini (2019) and Koopman, Wang, and Wei (2014).

In the refinement by Borin and Mancini (2019), specifically their source-based approach, gross exports are divided into five main categories, as shown in the figure:

(i) Domestic value added (DVA) directly absorbed by imported (DAVAX).
(ii) DVA sent to importer then reexported to eventually be absorbed abroad (REX).
(iii) DVA sent to importer then reexported to eventually be returned to and absorbed by exporter (REF).
(iv) Foreign value added in exports (FVA).
(v) Pure double counting (PDC).

Pure double counting accounts for cases where value added crosses the same border twice or more, creating duplicate footprints in the data. The first category, DAVAX, can be further split into those absorbed as final goods (DAVAX1) and those received as intermediate goods that are then locally completed and absorbed (DAVAX2).

Of the DVA exported, a portion may be imported back home and consumed. This is called reflection (REF). The rest are value-added exports (VAX)—exports of DVA that are ultimately absorbed abroad. This can be further divided into the portion absorbed by a direct trading partner (DAVAX) and the portion that is reexported before finally being consumed (REX).

continued on next page

Box 1.1: continued

Box 1.1: The Value-Added Trade Accounting Framework

Each of these categories can be disaggregated into sectors using the following two approaches: by exporting sectors—exports are broken down by the sector that actually exports, and by origin sectors—exports are broken down by the sector from where the value added originated.

The GVC participation rate measures the extent to which an entity is participating in GVCs. Two approaches are given in the literature. The trade-based approach of Borin and Mancini (2019), following Hummels, Ishii, and Yi (2001), takes the share of indirect trade—here defined as REX + REF + FVA + PDC—in gross exports. This is the portion of exports whose underlying value added crosses two or more borders before final consumption. Meanwhile, the production-based approach of Wang et al. (2017) takes the share of unfinished exports of domestic value added—here defined as DAVAX2 + REX + REF—in total domestic value added. This is the portion of gross domestic product that goes into exports of intermediates.

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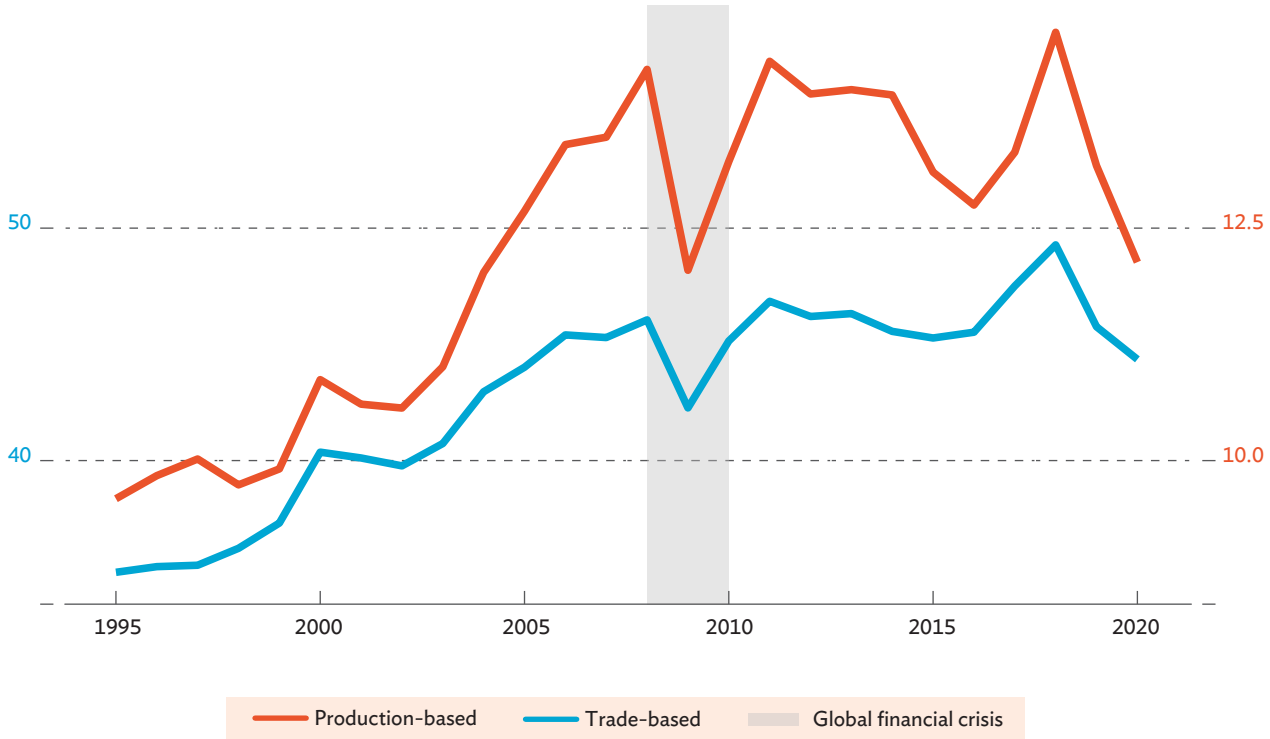
Koopman, R., Z. Wang, and S. Wei. 2014. Tracing Value-Added and Double Counting in Gross Exports. *American Economic Review*. 104 (2). pp. 459–494.

Wang, Z., S. Wei, X. Yu, and K. Zhu. 2017. Measures of Participation in Global Value Chains and Global Business Cycles. *NBER Working Paper*. No. 23222. Cambridge, MA: National Bureau of Economic Research.

Figure 1.1: Global Value Chain Participation Rates, World, 1995–2020

(%)



GVC = global value chain.

Notes: Trade-based GVC participation is based on the total GVC participation rate of A. Borin and M. Mancini. 2019. Measuring What Matters in Global Value Chains and Value-Added Trade. *Policy Research Working Paper.* No. 8804. Washington, DC: World Bank. Production-based GVC participation is based on the forward GVC participation rate of Z. Wang, S. Wei, X. Yu, and K. Zhu. 2017. Measures of Participation in Global Value Chains and Global Business Cycles. *NBER Working Paper*. No. 23222. Cambridge, MA: National Bureau of Economic Research.

Sources: 1995–2006: World Input–Output Database, 2013 Release. http://www.wiod.org/release13 (accessed 31 July 2021); 2007–2020: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Two phases of hyperglobalization and slowbalization are discernible. From 1995 to 2008, the rapid expansion in GVCs led to surges in both participation rates, with the trade-based rate rising from 35.2% to 46.1% and the production-based rate rising from 9.6% to 14.2%. After the global financial crisis, a reshoring of supply chains caused a sharp but temporary drop in both rates, which had bounced back by 2010. Since then, they have remained at roughly the same levels. And although the COVID-19 pandemic has been a drag on GVC participation, Figure 1.1 shows that participation rates have been in line with the generally anemic trend seen since 2010. As of 2020, the trade-based participation rate was 44.4% and the production-based rate 12.1%.

While participation rates have stagnated, nominal values continue to grow. Global indirect exports, the numerator of the trade-based GVC participation rate, reached a record high in 2018 of $13.6 trillion by the authors' estimates, although it declined over 2019–2020. Table 1.1 identifies the economies driving indirect trade both by magnitude and growth in 3 benchmark years: 2000, 2010, and 2019.[1]

Unsurprisingly, four of the five largest GVC exporters—France, Germany, the PRC, and the US—are also the world's largest economies. The inclusion of the Netherlands, despite its smaller size, speaks to its outsized role in GVCs. Percentages in parentheses give average compounded growth rates for 2000–2010 and 2010–2019. In line with slowbalization, four of the five economies saw growth rates significantly lower in the second period compared with the first, with the PRC experiencing the most dramatic fall—from growing 20.0% a year to just 4.6%. Consequently, even though the PRC has reliably been the world's largest exporter since 2010, it has not maintained that distinction for indirect exports. The PRC's stagnant performance is also apparent when viewed in terms of participation rates, as discussed later.

These trends may be surprising since the PRC has long been among globalization's central players—and known as the workshop of the world for decades. Three factors appear to have caused this plateau, all of which ultimately stem from the PRC's current stage of development. The first is the country's rising cost of labor. Although a cheap labor force fueled exports and drew in foreign investment during hyperglobalization, wages have since caught up with productivity, with urban wages growing 13.8% a year on average from 1998 to 2010 (Li et al. 2012). The second factor is the overall decline of trade as a share in the PRC's economy. This applies in both the forward sense, in terms of foreign buyers of the PRC's products, and the backward sense, in terms of foreign suppliers of the PRC's inputs. Both increasingly come from domestic sources (Woetzel et al. 2018; *The Economist* 2020). All this is not to say that the PRC will permanently retreat from GVCs. With strong government support for "indigenous innovation" (Liu et al. 2011; Vinig and Bossink 2015; Cheng, Meng, and Gao 2020), it may well reestablish its presence in more complex, high-value segments, such as research and development (R&D) and marketing and sales.

[1] The year 2000 is the earliest in the Asian Development Bank's Multiregional Input–Output Database. The turning point for slowbalization was around 2009, but given the anomalous nature of that year, 2010 was chosen instead. The same goes for choosing 2019 over 2020.

Table 1.1: Economies with Major Indirect Exports
($ million)

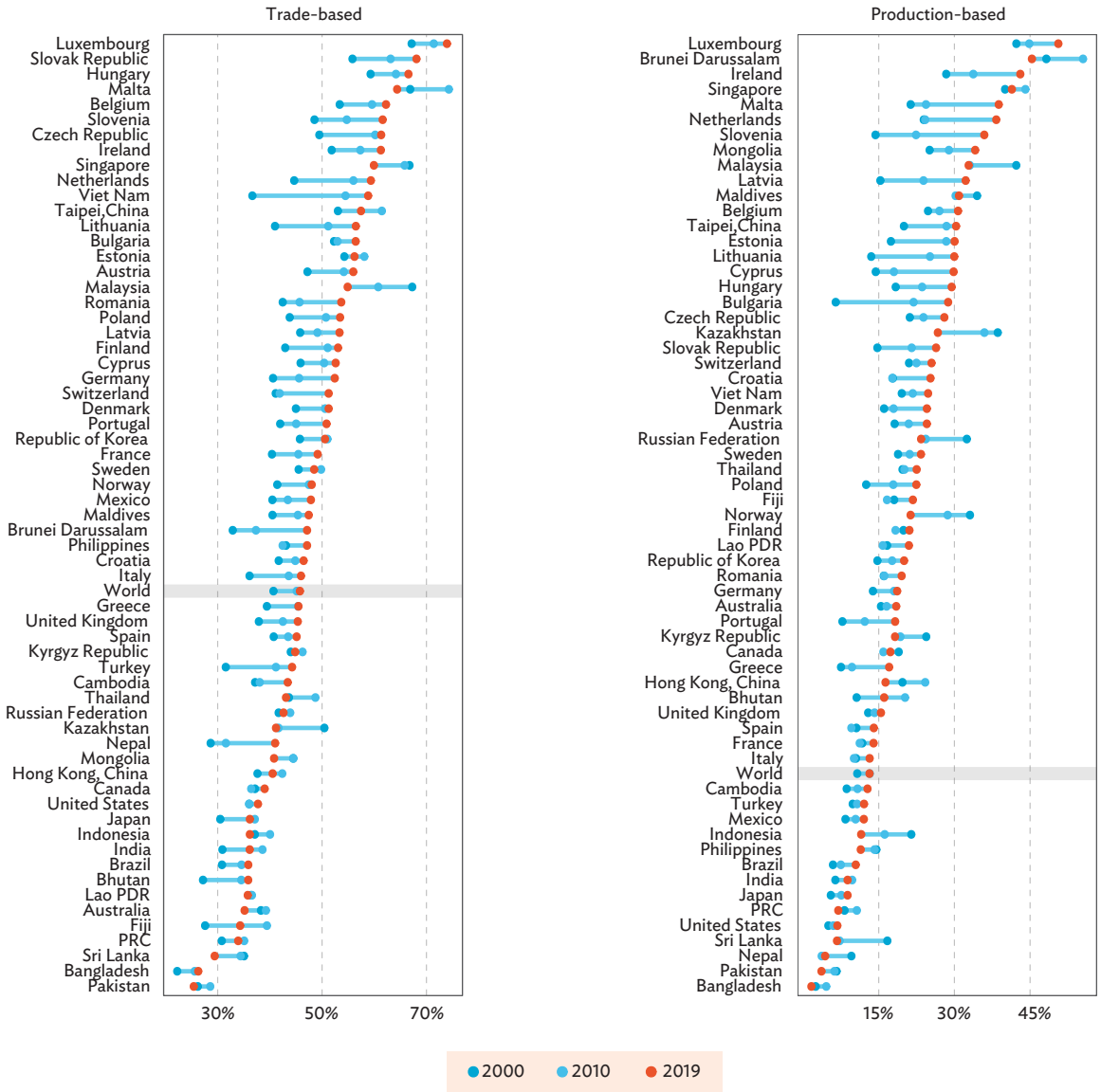
Economy	Gross Exports			Indirect Exports		
	2000	2010	2019	2000	2010	2019
World	**7,418,146**	**17,638,600**	**24,594,288**	**3,018,079**	**7,963,467**	**11,254,582**
		(8.7%)	(3.7%)		(9.7%)	(3.8%)
Top 5 by Magnitude, 2019						
Germany	585,655	1,385,309	1,810,593	237,832	631,683	949,316
		(8.6%)	(3.0%)		(9.8%)	(4.5%)
United States	926,628	1,552,490	2,514,751	333,968	559,297	948,578
		(5.2%)	(5.4%)		(5.2%)	(5.9%)
PRC	262,018	1,697,752	2,664,103	80,676	595,559	903,902
		(18.7%)	(5.0%)		(20.0%)	(4.6%)
Netherlands	199,698	481,024	755,817	89,180	269,426	448,621
		(8.8%)	(5.0%)		(11.1%)	(5.7%)
France	356,767	649,302	862,767	144,159	295,172	424,097
		(6.0%)	(3.2%)		(7.2%)	(4.0%)
Top 5 by Growth, 2010–2019						
Cambodia	1,258	4,041	16,549	468	1,538	7,186
		(11.7%)	(15.7%)		(11.9%)	(17.1%)
Lao PDR	452	1,548	6,985	164	566	2,498
		(12.3%)	(16.7%)		(12.4%)	(16.5%)
Viet Nam	17,155	83,474	279,720	6,287	45,482	164,563
		(15.8%)	(13.4%)		(19.8%)	(14.3%)
Nepal	984	1,067	2,666	282	337	1,093
		(0.8%)	(10.2%)		(1.8%)	(13.1%)
Mongolia	441	2,955	8,413	196	1,315	3,433
		(19.0%)	(11.6%)		(19.0%)	(10.7%)

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Notes:
1. Magnitudes are in millions of current dollars.
2. Numbers in parentheses are compounded average growth rates for 2000–2010 and 2010–2019.
3. Estimates of indirect exports are based on the source-based decomposition methodology of A. Borin and M. Mancini. 2019. Measuring What Matters in Global Value Chains and Value-Added Trade. *Policy Research Working Paper*. No. 8804. Washington, DC: World Bank.
Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Table 1.1 identifies economies with the fastest growing indirect exports, with the top five all achieving yearly double-digit growth from 2000 to 2019. All five are developing Asian economies adjacent to the PRC: Cambodia, the Lao People's Democratic Republic, Mongolia, Nepal, and Viet Nam. The largest by far is Viet Nam, whose indirect exports of over $160 billion in 2019 were 4.3 times larger than that of the Philippines, an economy of roughly the same size and level of development. Indeed, Viet Nam has long been a rising star in GVCs, having become a leading alternative to the PRC for labor-intensive manufacturing (Herr, Schweissheim, and Vu 2016; Hanson 2021; Abiad et al. 2018).

Figure 1.2 charts the two GVC participation rates for each economy in 2000, 2010, and 2019. Immediately noticeable is that for both ratios almost all economies saw participation expand from 2000 (dark blue dots) to 2019 (red dots). This is even true when taking just the 2010–2019 slowbalization period, although here the picture is mixed.

Figure 1.2: Measures of Global Value Chain Participation, 2000, 2010, 2019



GVC = global value chain, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Notes: The trade-based GVC participation rate is based on the total GVC participation rate of A. Borin and M. Mancini. 2019. Measuring What Matters in Global Value Chains and Value-Added Trade. *Policy Research Working Paper*. No. 8804. Washington, DC: World Bank. The production-based GVC participation rate is based on the forward GVC participation rate of Z. Wang, S. Wei, X. Yu, and K. Zhu. 2017. Measures of Participation in Global Value Chains and Global Business Cycles. *NBER Working Paper*. No. 23222. Cambridge, MA: National Bureau of Economic Research.

Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Highlighting the difference between participation and raw magnitudes is the fact that the PRC and the US, although among the top GVC players, have participation rates that are significantly below the world average. The PRC, in particular, is seeing declining rates: from 35.1% in 2010 to 33.9% in 2019 for the trade-based GVC participation rate and from 10.7% in 2010 to 7.0% in 2019 for the production-based GVC participation rate. European players, however, have been growing more integrated in cross-border supply chains. The trade-based participation rate for Germany, the world's largest indirect trader as of 2019, expanded from 45.6% in 2010 to 52.4% in 2019, although its production-based rate expanded more modestly, from 18.0% to 18.7%.

Cases where the two rates show contrasting pictures illustrate the nuances between what they are measuring. For example, although Indonesia's trade-based participation rate declined modestly over 2000–2019, its production-based participation rate plummeted from 21.5% to 11.5% in the same period. This implies a growing domestic economy and a relatively stagnant GVC sector (ADB 2019). Brunei Darussalam had among the highest participation rates in 2019 measured by the production-based participation rate (2nd out of 62 economies in Figure 1.2), but only middling participation measured by the trade-based participation rate (33rd out of 62). This is because trade is such a huge portion of Brunei Darussalam's economy, which is concentrated in oil, even if much of it is not in GVCs.

A curious case is Bangladesh, which, in spite of stellar 10.5% annual growth in indirect exports over 2010–2019, remains a laggard in GVC participation, appearing near or at the bottom for both rates. One explanation is that its GVC trade is highly concentrated in a particular sector: textiles and garments (Mercer-Blackman, Foronda, and Mariasingham 2017).[2] As Table 1.2 shows, this sector accounts for 79.7% of Bangladesh's gross exports and 7.5% of its gross domestic product (GDP), the highest and second highest, respectively, out of the 62 economies in Figure 1.2. For textiles and garments, Bangladesh's participation is actually above the world average, beating Pakistan and Sri Lanka. This is because of a development strategy that wisely makes use of Bangladesh's abundant pool of cheap, low-skilled labor that allowed it to achieve an average real GDP growth rate of 7.4% over 2015–2019 and to be among the few economies to grow in 2020.[3] It must be said, however, that Bangladesh's textile and garments industry remains confined to relatively low-value-added segments like cutting and sewing, and its cost advantage may have been gained at the expense of labor welfare (Anner 2019; Barrett, Baumann-Pauly, and Gu 2018).

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2 The "textiles and textile products" sector comprises C13–C14 in the International Standard Industrial Classification, revision 4 (ISIC 4).

3 International Monetary Fund. World Economic Outlook Database. https://www.imf.org/en/Publications/WEO/weo-database/2021/April/download-entire-database (accessed 31 July 2021). However, Bangladesh's 2020 growth partly stems from having a fiscal year that ends in June, thus "splitting" the impact of COVID-19 over 2019/2020 and 2020/2021.

Table 1.2: Global Value Chain Participation for Selected Economies and Sectors, 2019
(%)

Economy	Share of Exports	Trade-Based Participation Rate	Share of Gross Domestic Product	Production-Based Participation Rate
Textiles and Textile Products				
Bangladesh	79.7	26.5	7.5	2.1
Pakistan	54.7	21.1	3.4	11.4
Cambodia	52.8	44.8	12.0	3.0
Sri Lanka	31.3	18.9	5.1	3.1
Turkey	17.5	39.5	3.7	25.1
World	**3.1**	**35.0**	**0.7**	**17.0**
Electricals and Optical Equipment				
Taipei,China	52.8	60.3	15.8	78.1
Malaysia	33.8	70.2	5.2	78.6
Philippines	31.5	67.7	2.4	55.9
People's Republic of China	29.7	39.7	3.8	16.4
Republic of Korea	28.3	53.4	8.9	58.0
World	**12.2**	**51.3**	**2.2**	**34.7**

GVC = global value chain.

Notes: The trade-based GVC participation rate is based on the total GVC participation rate of A. Borin and M. Mancini. 2019. Measuring What Matters in Global Value Chains and Value-Added Trade. *Policy Research Working Paper.* No. 8804. Washington, DC: World Bank. The production-based GVC participation rate is based on the forward GVC participation rate of Z. Wang, S. Wei, X. Yu, and K. Zhu. 2017. Measures of Participation in Global Value Chains and Global Business Cycles. *NBER Working Paper*. No. 23222. Cambridge, MA: National Bureau of Economic Research.

Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Table 1.2 also looks at another GVC-oriented industry, electrical and optical equipment, along with the industry's export-leading economies.[4] For Malaysia, the Republic of Korea, and Taipei,China, electricals dominate not only their exports but also GDP. GVC participation rates are high for both, cementing their status as major participants in the world electricals value chain. This contrasts starkly with an economy like Mexico. While electricals comprise a sizable portion of Mexico's exports (24%) of which much are in GVCs (77%), the value that the sector generates domestically is largely not oriented toward GVCs.

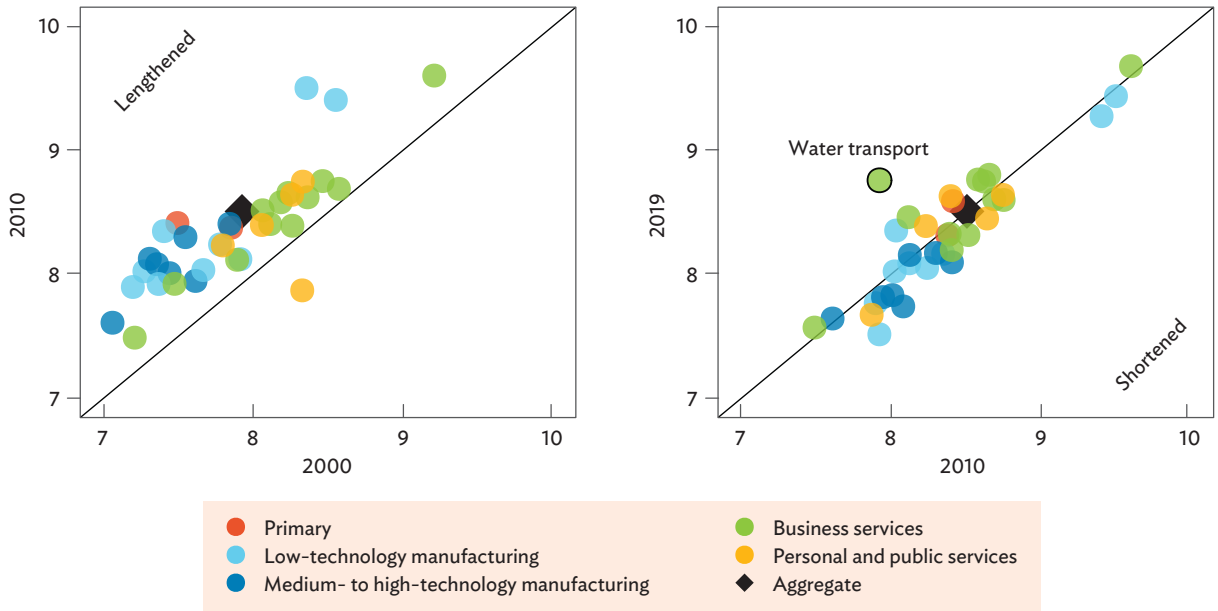
A benefit of GVCs is the opportunity they give for specialization not just in products but also in tasks. Rather than simply exporting cars or computers, economies can now find niches in particular stages of the car and computer value chain, from R&D to the production of raw materials, and to assembly and then marketing. As noted earlier, Bangladesh specializes in the downstream end of the textile and garments value chain, producing ready-made garments for over 1,000 retailers (Anas 2020). Thus, Bangladesh does not need to acquire the skills of, say, Japanese and Swedish designers to participate

4 The "electrical and optical equipment" sector comprises C26–C27, C3313–C3315, and C3319 in ISIC 4.

in the value chains of Uniqlo Co. Ltd. and Hennes & Mauritz AB. But this should only be a first stage of development. Over time, Bangladesh should be able to move along the value chain toward more value-adding tasks.

Value chains with more stages lend themselves easier to task specialization (Box 1.2). Using the methodology of Wang et al. (2017b) and Antràs and Chor (2018), the average number of stages in the GVC component of a given sector is estimated for 2000, 2010, and 2019. The results are plotted in Figure 1.3. A general lengthening of GVCs occurred across sectors from 2000 to 2010. On average, the number of stages separating primary inputs and final consumption in GVCs globally was 7.9 in 2000 and 8.5 in 2010. Stagnation followed, consistent with slowbalization, with stages remaining at about 8.5 from 2010 to 2019. Interestingly, the only sector that achieved a significant lengthening was water transport, whose GVC stages went from 7.9 in 2010 to 8.8 in 2019.[5]

Figure 1.3: Global Value Chain Production Lengths by Sector, World, 2000, 2010, 2019



Notes: Global value chain production lengths are the sum of backward and forward lengths, computed following the methodology of Z. Wang, S. Wei, X. Yu, and K. Zhu. 2017. Characterizing Global Value Chains: Production Length and Upstreamness. *NBER Working Paper*. No. 23261. Cambridge, MA: National Bureau of Economic Research.

Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Comparing GVC lengths from the forward and backward perspectives positions an economy along the value chain. If the forward length is longer than the backward length, then an economy is said to be relatively upstream, and vice versa, as the figure in Box 1.2 shows. This can be visualized in a scatterplot following Escaith and Inomata (2013), with backward lengths on the horizontal axis and forward lengths on the vertical axis. The 45-degree line divides observations between upstream and downstream economies.

5 The "water transport" sector comprises H50 in ISIC 4.

Box 1.2: Positioning Economies in Global Value Chains

With the rise of global value chains (GVCs), patterns of specialization have expanded to cover not only products but also tasks. Indeed, gross trade statistics may lead to the conclusion that an economy has a product specialization when in fact it has a *functional* specialization.

A case in point is developing countries with major electronics exports, such as the Philippines. These economies do not specialize in electronics per se, but in a particular segment in the electronics value chain (Timmer, Miroudot, and de Vries 2019).

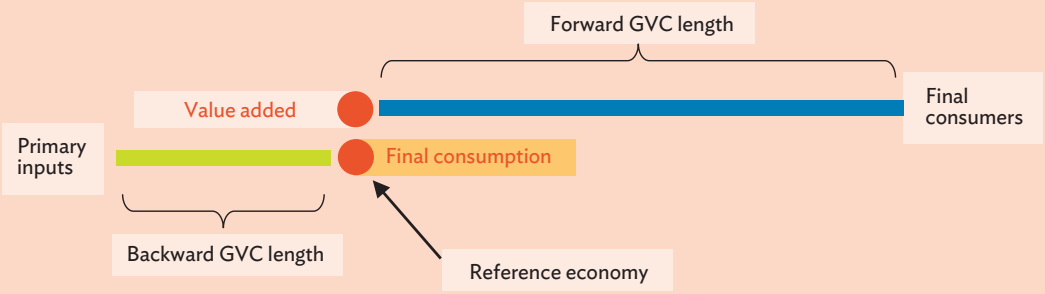
To observe functional specialization, some method for positioning a particular economy along GVCs is needed. This assumes that GVCs are essentially sequential in nature, which, while not universally true (Baldwin and Venables 2013), is a convenient assumption to make. Antràs and Chor (2018) review various ways of characterizing an economy's GVC position. The simplest is to take the share of final demand in an economy's total output, termed F/GO, on the reasoning that the larger this ratio is, the closer the economy is to final consumers. That is, it is positioned relatively downstream in GVCs. Alternatively, the share of value added in an economy's total purchases, termed *VA/GO*, measures how close the economy is to primary inputs. More upstream economies have higher *VA/GO* ratios.

The ease of computing *F/GO* and *VA/GO* are matched by their bluntness. A limitation is that they do not account for heterogeneity among intermediate use and purchases. For example, two economies that both sell 40% of their output to final consumers may still end up differing in downstreamness depending on who they sell the remaining 60% to.

A more sophisticated approach, proposed in Antràs and Chor (2013), uses input–output techniques to compute a weighted average of the stages separating an economy and final consumers at one end and primary inputs at the other end, resulting in upstreamness (*U*) and downstreamness (*D*) indices. An economy with an upstreamness index of 2.5, for example, has output that is on average 2.5 stages away from final consumers. Having a high *U* and a low *D* indicates a relatively upstream economy, while the opposite indicates a relatively downstream economy. Having both a high *U* and a high *D* suggests that an economy is positioned deep within long and complex value chains.

Wang et al. (2017) refine this further to extract the GVC segment of a production chain. That is, stages captured in U and D that take place in domestic and traditional trade value chains are excluded. In the figure, since the forward GVC length is noticeably longer than the backward GVC length, this economy is said to be positioned relatively upstream in GVCs.

Global Value Chain Position of an Economy



GVC = global value chain.

Source: Authors.

All measures discussed here are computed at the sector level. To aggregate at the national level, two approaches are possible. The first is to aggregate the base intercountry input–output tables and apply the formula from there. The second is to take a weighted average of the sector-level measures, the weights being each sector's share in total value added. The authors use the latter approach.

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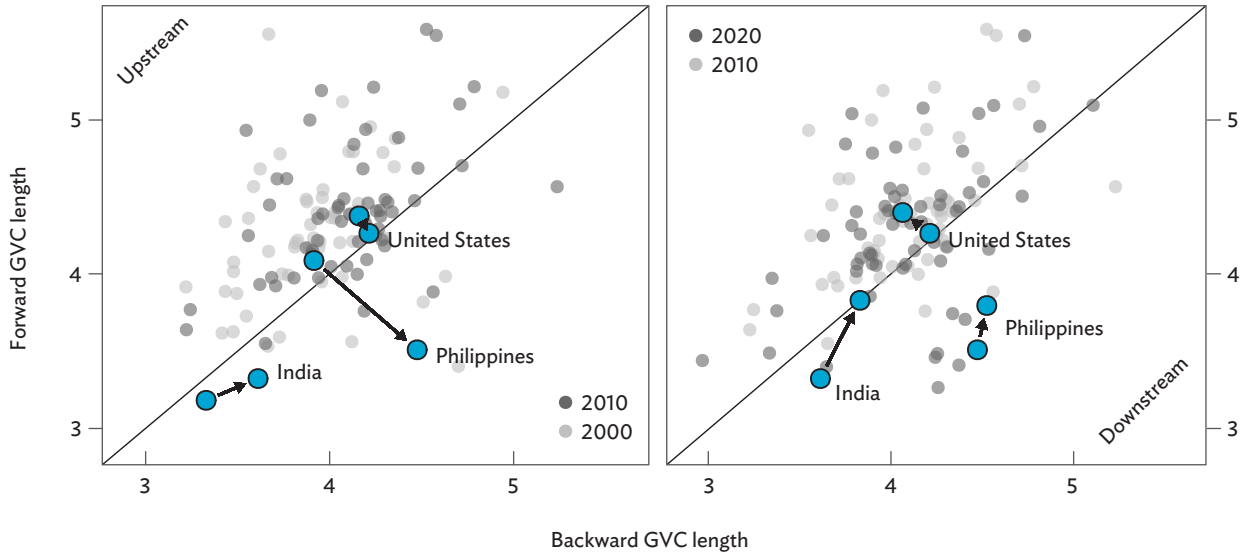
Wang, Z., S. Wei, X. Yu, and K. Zhu. 2017. Characterizing Global Value Chains: Production Length and Upstreamness. *NBER Working Paper*. No. 23261. Cambridge, MA: National Bureau of Economic Research.

Figure 1.4 constructs such a plot for the "other business activities" sector in the Multiregional Input–Output Database of the Asian Development Bank (ADB). This is a residual category capturing various business-related services in management, law, and information technology, among other areas. Crucially, it contains business process outsourcing (BPO), a sector that several developing countries have started to specialize in—and one which shows the viability of a services-led approach to economic growth. BPO involves a variety of customer-facing or back-office services provided to MNCs. Its most well-known specialists include India and the Philippines, whose skilled workforce, competitively priced labor, and command of English have made them favored destinations for BPO investment (Mitra 2013; Baja, 2011).

Figure 1.4: Global Value Chain Production Length for Other Business Activities, 2000, 2010, 2020



GVC = global value chain.
Notes:
1. GVC production lengths are computed based on the methodology of Z. Wang, S. Wei, X. Yu, and K. Zhu. 2017. Characterizing Global Value Chains: Production Length and Upstreamness. *NBER Working Paper*. No. 23261. Cambridge, MA: National Bureau of Economic Research.
2. "Other business activities" refer to the "renting of machinery & equipment and other business activities" sector in the Asian Development Bank's Multiregional Input–Output Database. This covers J582, J62–J63, M69–M74, N77–N78, and N80–N82 in the International Standard Industrial Classification revision 4.
Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Chapter 4 explores software services in India and BPO in the Philippines in greater detail. Here, some broader observations of their positioning in GVCs are made. Figure 1.4 shows that both countries tend to exhibit shorter forward lengths than the US, the top GVC participant in "other business activities." But although India remained relatively downstream from 2000 to 2010, the Philippines made a marked shift from being relatively upstream to being relatively downstream. This coincided with and was probably caused by the development of its BPO sector. In contrast, most other points in the figure indicate that their business-related services tended to enter in the upstream stages of the value chain.

India shifted to a more middle position from 2010 to 2020, similar to the US though with shorter overall lengths. The Philippines maintained its relative downstreamness, indicating a continued heavy reliance on foreign inputs that keeps it stuck in low value-adding segments of the value chain. Indeed, half of the 1.3 million people employed in the country's BPO sector are classified as low-skilled (Lopez 2020). This possibly points to the limitations of a services-led approach to development, especially when it does not spill over to other more productive industries (Liu et al. 2019).

In summary, the slowbalization era is evident in globally stagnant GVC participation rates and shortening value-chain lengths. The drivers of GVCs in the hyperglobalization era—the PRC and the US, among others—have seen marked declines in the growth of their GVC trade. But several smaller players from the developing world are emerging: Bangladesh in textiles and garments, the Philippines in business services, and Viet Nam in electricals, to name a few. Thus, slowbalization is by no means a universal phenomenon.

The Role of Multinational Corporations

Measuring GVCs in terms of exports, as the previous section does, misses a crucial aspect of GVCs: the role of the firm. Fragmented production is not undertaken by economies or economy sectors but by firms.[6] This point is significant for at least three reasons. First, it highlights the concentrated nature of the participation of firms in GVCs. Globally, firms that both import and export (an indication of a GVC firm) comprise 15% of all firms, but they capture 80% of total trade (World Bank 2020). Second, as Antràs (2020a) argues, GVCs are fundamentally relational. Rather than a global market of impersonal buyers and sellers, production networks are built up by firms that engage in repeated interactions, making them "sticky." And third, MNCs course a significant amount of their sales through local affiliates established through foreign direct investment (FDI). When these are recorded as domestic activities in host economies, GVCs tend to be underestimated.

This section focuses on the third issue. Wang et al. (2021), in an extension of their earlier framework, propose a decomposition of economic activity that distinguishes the activities of MNCs. They do this using the Organisation for Economic Co-operation and Development's Analytical Activities of Multinational Enterprises (AMNE) database, which disaggregates each cell in the intercountry input–output table into domestic- and foreign-owned firms. They classify GVC activities into three types: (i) trade-related GVCs, involving trade in intermediates by domestic firms; (ii) FDI-related GVCs,

6 An economy sector refers to a unique entity in the Asian Development Bank's Multiregional Input–Output Database defined by a sector and the economy it belongs to. Thus, the electricals sector in Viet Nam is an economy sector. Because the database has information on 63 economies (including the rest of the world), each divided into 35 sectors, there are 63 × 35 = 2,205 economy sectors in the database.

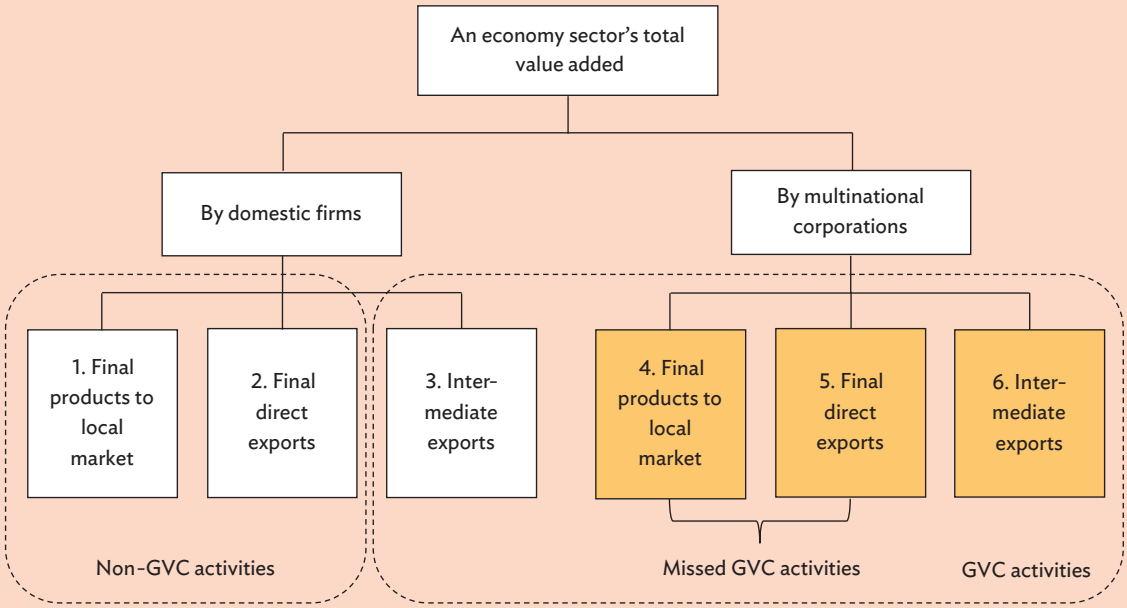
involving the sales of local the affiliates of MNCs; and (iii) trade- and FDI-related GVCs, involving all other trade in intermediates. It is the FDI-related GVCs that are missed in standard decompositions (Box 1.3).

Box 1.3: Accounting for Foreign Direct Investment in Global Value Chains

Frameworks for measuring global value chain (GVC) activities using intercountry input–output tables underestimate because they fail to capture the role of multinational corporations (MNCs) and their foreign affiliates. This is particularly evident in cases where local affiliates of multinational corporations participate in GVCs in a different way compared with purely local firms.

The figure illustrates an accounting framework proposed by Wang et al. (2021) that quantifies the varying degrees of GVC participation by economy sectors, while accounting for the role of affiliates of foreign MNCs in value-added generation.

Accounting Framework Identifying Multinational Corporations



GVC = global value chain.
Note: Value-added components highlighted in yellow refer to GVC activities related to foreign affiliates.
Source: Wang et al. (2021).

This incorporates the value added from MNCs not captured in previous frameworks, including the value added of firms that are ultimately absorbed as final products in local markets, and the value added of MNCs absorbed by third economies as exports of final goods. In earlier frameworks, these two are classified as pure domestic production and traditional trade, respectively, though arguably they may be more properly classified as GVCs.

This framework is operationalized using the Organisation for Economic Co-operation and Development's Analytical Activities of Multinational Enterprises (AMNE) database (Cadestin et al. 2018). Although standard intercountry input–output tables do not provide information on whether firms are domestic- or foreign-owned, the AMNE database breaks down the sectors according to the shares of domestic- or foreign-owned firms, as shown in the following figure.

continued on next page

Box 1.3: continued

Box 1.3: Accounting for Foreign Direct Investment in Global Value Chains

Structure of the Organisation for Economic Co-operation and Development's Analytical Activities of Multinational Enterprises Database

			Intermediate Use							Final Demand				Total Output
			1		2		...	60						
			d	f	d	f	...	d	f	1	2	...	60	
Intermediate inputs	1	d												
		f												
	2	d												
		f												
	⋮	⋮												
	60	d												
		f												
Value added														
Total input														

d = domestic-owned, f = foreign-owned.
Source: Organisation for Economic Co-operation and Development. Activities of Multinational Enterprises Database. https://www.oecd.org/sti/ind/analytical-amne-database.htm (accessed 31 July 2021).

A foreign-affiliate firm is considered foreign-owned when it has at least 50% of foreign ownership. In contrast, domestic-owned firms comprise domestic MNCs and domestic firms that do not have investments abroad. The AMNE database covers 59 economies and an aggregate for the "rest of the world" category. It is divided into 34 sectors based on the International Standard Industrial Classification revision 4 from 2005 to 2016.

References

Cadestin, C., K. de Backer, I. Desnoyers-James, S. Miroudot, D. Rigo, and M. Ye. 2018. Multinational Enterprises and Global Value Chains: The OECD Analytical AMNE Database. *OECD Trade Policy Papers*. No. 211. Paris: Organisation for Economic Co-operation and Development.

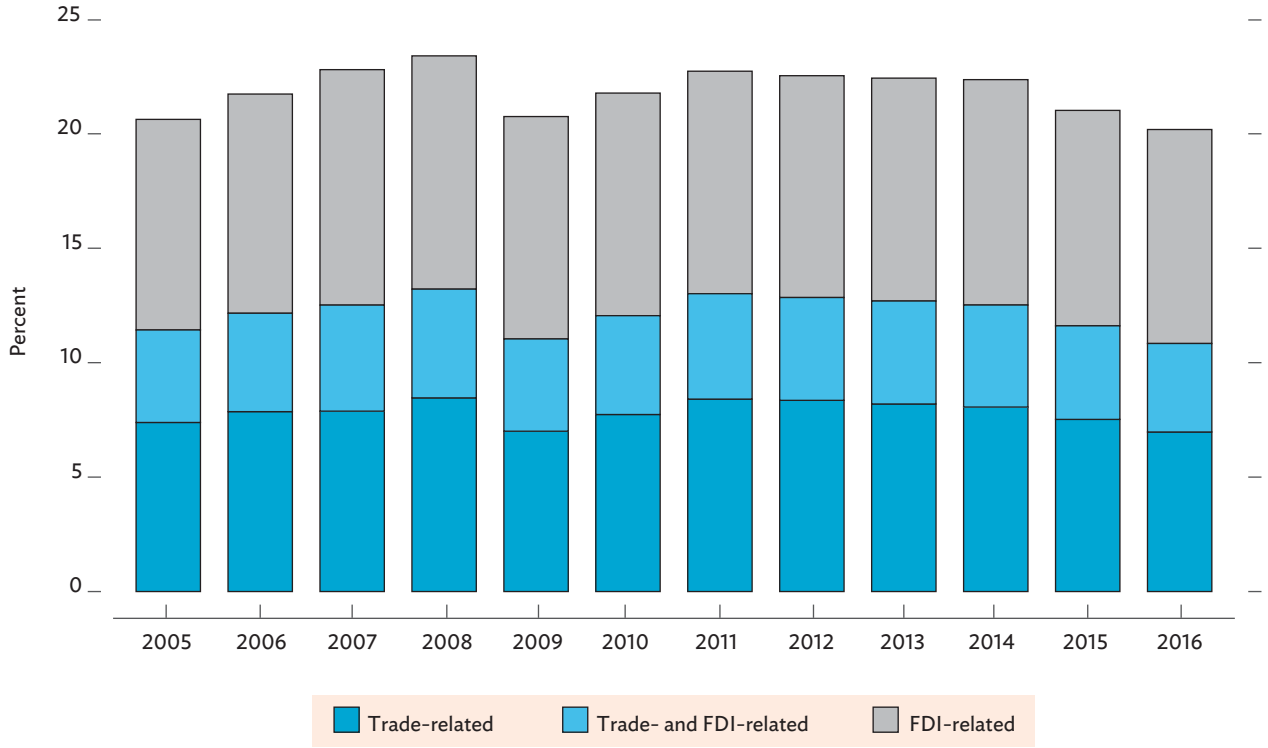
Wang, Z., S. J. Wei, X. Yu, and K. Zhu. 2021. Tracing Value Added in the Presence of Multinational Firms: With an Application to High Tech Sectors. Unpublished.

Figure 1.5 shows FDI-related GVCs accounted for 9.3% of global GDP in 2016. This was comparable to the combined shares of types (i) and (iii) for a total GVC participation rate of 20.2%. Thus, without distinguishing foreign-owned firms, the estimated rate is more than halved. This mismeasurement naturally varies depending on the prevalence of MNCs in an economy. In the small, highly open economy of Hong Kong, China, for example, FDI-related GVCs were 40.8% of GDP in 2016 compared with a total GVC participation rate of 54.3%, meaning over three-fourths of GVCs are missed if foreign ownership is not distinguished.

The results of the framework of Wang et al. (2021) are further explored using two analytical tools: the smile curve and network analysis. Because these were discussed extensively in the 2017 and 2019 *Global Value Chain Development Reports*, this analysis mostly focuses on their extension to incorporate MNCs. Smile curve analysis plots the value-added contribution of different entities in an industry across its stages of production,

arranged left to right from the most upstream to the most downstream participants. It is hypothesized that fitting a line through the observations will give an inverted U-shape—in other words, a smile curve (Figure 1.6). This is because the extreme ends of a value chain tend to involve more intangible, knowledge-intensive activities—R&D, design, and brand-building in the upstream stages and after-sales services and marketing in the downstream stages. Those in between involve more labor-intensive activities, such as manufacturing and assembly. This helps to shed light on the "paradoxical pair of concerns" that deal with the distribution of value-added gains between developed and developing economies (Baldwin, Ito, and Sato 2014). That is, advanced economies tend to concentrate in production stages that generate high value added, while developing economies tend to participate in low-end and tangible production activities, and this pattern prompts a concern that the latter could be stuck at the bottom portion of the smile curve.

Figure 1.5: Global Value Chain Participation with Multinational Corporations, World, 2005–2016

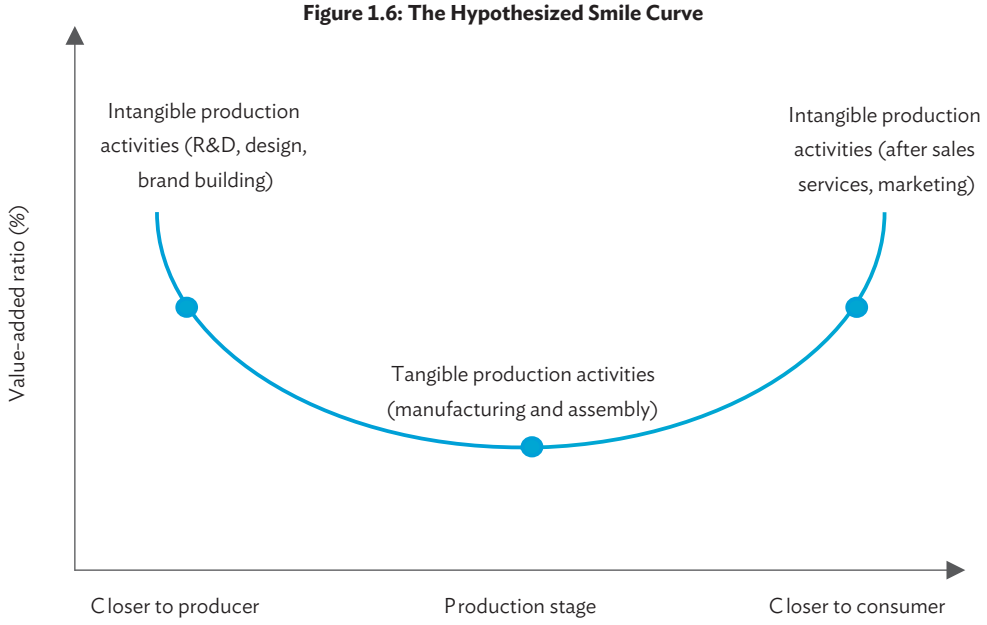


FDI = foreign direct investment.
Note: Decomposition follows the methodology of Wang et al. (2021).
Sources: Organisation for Economic Co-operation and Development. Analytical Activities of Multinational Enterprises Database. https://www.oecd.org/sti/ind/analytical-amne-database.htm (accessed 31 July 2021); Z. Wang, S. J. Wei, X. Yu, and K. Zhu. 2021. Tracing Value-Added in the Presence of Multinational Firms: With an Application to High Tech Sectors. Unpublished.

Several studies attempt to identify and measure smile curves. One set of studies use intercountry input–output tables to calculate the two ingredients in plotting smile curves: value-added gains of economy sectors in GVCs (i.e., the trade in value added), and the production stage in which the economy sector mainly operates, as measured

by the average propagation length (Ito and Vézina 2016; Meng, Ye, and Wei 2020). A shortcoming of this approach is that MNCs cannot explicitly be identified. Another set of studies use firm-level data, applying "teardown" analysis to track the value added of individual components to source firms and their economy of origin (Xing 2020 and Chapter 2). The limitation of this approach is that its findings may not be representative of the entire production network since it only focuses on the supply chain of a particular firm producing a particular product. The existence of a smile curve using data that takes into account the role of foreign-owned firms in GVCs had not been probed until Meng and Ye (forthcoming) filled this gap by using the AMNE database to examine the existence of a smile curve in the ICT industry. In particular, PRC and US exports for 2016 are considered, differentiated by domestic firms and MNCs. The four panels of Figure 1.7 show the results.

Figure 1.6: The Hypothesized Smile Curve

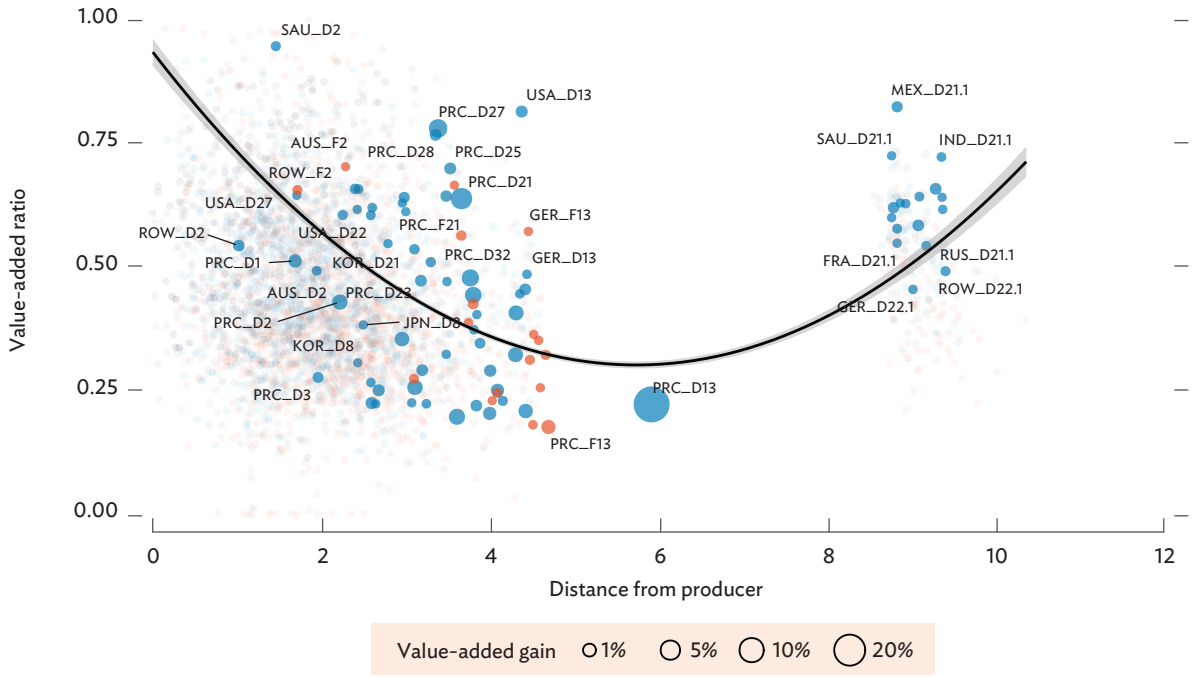


R&D = research and development.
Source: Authors.

Panel a shows the value chain for the exports of the PRC's domestic ICT firms appears as a smile curve. These firms are in the middle-bottom of the curve since they mainly export assembly products that are labor-intensive and are highly dependent on intermediate inputs. Despite being generally at the low value-added production stage, these firms also have the largest value-added gains. Other PRC domestic firms, such as wholesale and retail services and transportation services, also participate, mainly at the upstream end of this value chain since they provide the intermediate inputs that are directly or indirectly used by the PRC's domestic ICT firms.

Figure 1.7: Information and Communication Technology Export-Related Value Chain, 2016

a. PRC Domestic Firms



b. PRC-Based Multinational Firms

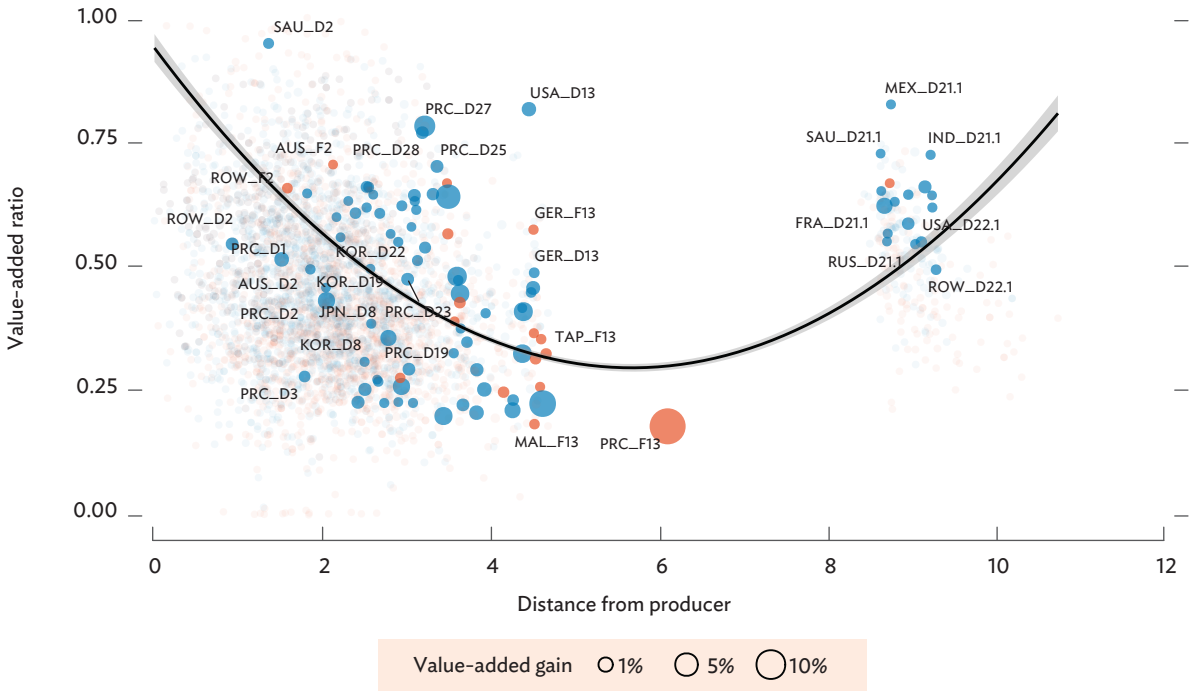


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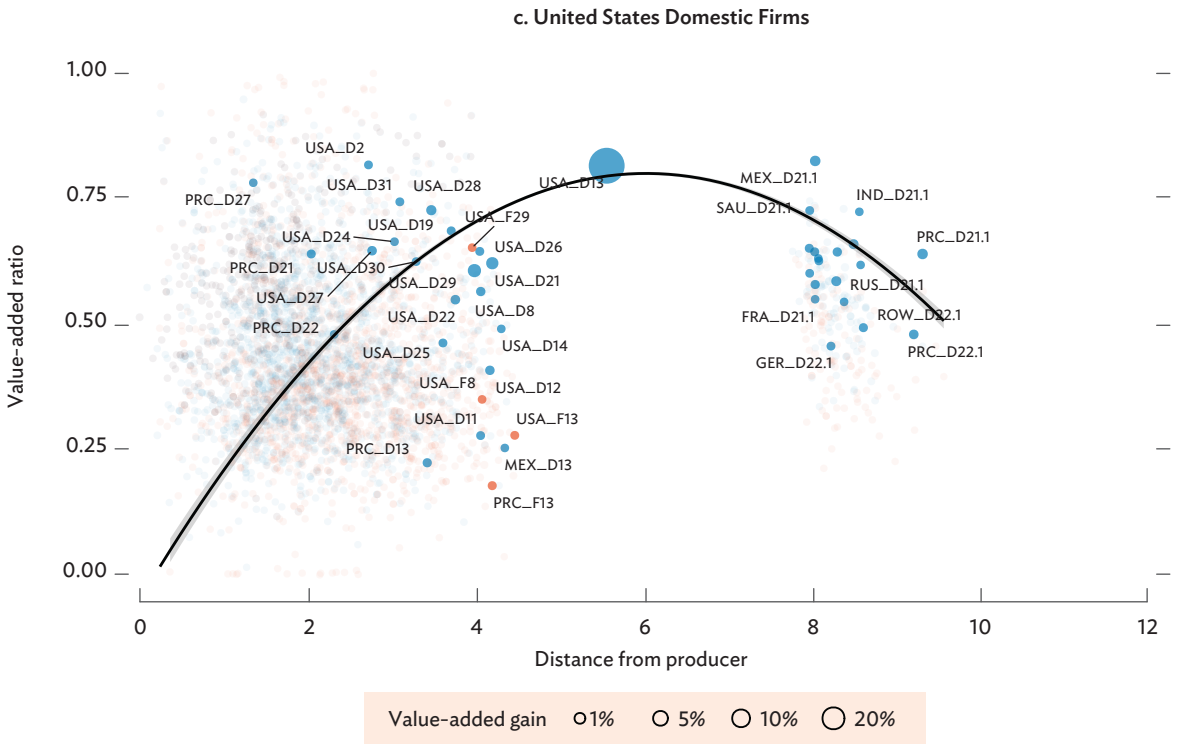
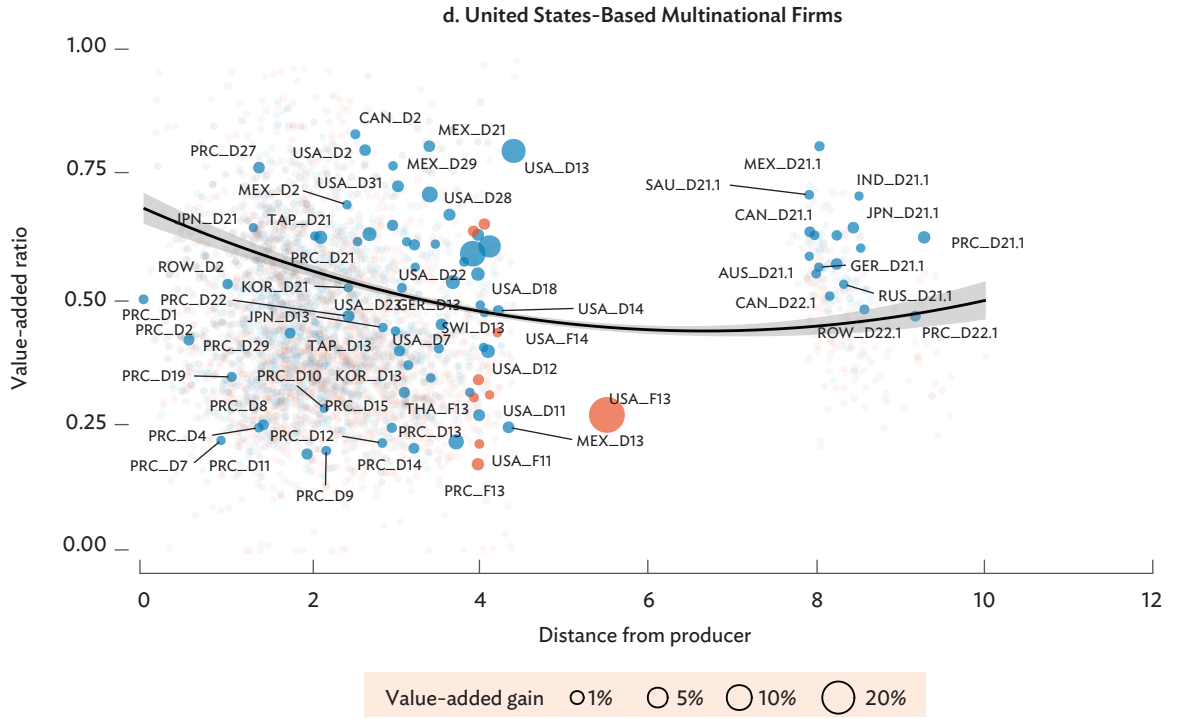
Figure 1.7: continued





AUS = Australia, BRA = Brazil, CAN = Canada, CHL = Chile, D = domestic-owned, F = foreign-owned, FIN = Finland, FRA = France, GER = Germany, HKG = Hong Kong, China, IND = India, IRE = Ireland, ITA = Italy, JPN = Japan, KOR = Republic of Korea, MAL = Malaysia, MEX = Mexico, PHI = Philippines, PRC = People's Republic of China, ROW = rest of world, RUS = Russian Federation, SAU = Saudi Arabia, SIN = Singapore, SPA = Spain, SWI = Switzerland, TAP = Taipei,China, THA = Thailand, TUR = Turkey, UKG = United Kingdom, USA = United States.

Note: Numbers in the point labels indicate sectors.

Sources: B. Meng and M. Ye. Forthcoming. Smile Curves in Global Value Chains: Foreign- vs. Domestic-owned Firms; the U.S. vs. China. *Structural Change and Economic Dynamics*; Organisation for Economic Co-operation and Development. Analytical Activities of Multinational Enterprises Database. https://www.oecd.org/sti/ind/analytical-amne-database.htm (accessed 31 July 2021).

Strong cross-border intra-linkages can be seen between the PRC's domestic ICT firms and the US, as well as those of other economies in East Asia. Interindustrial linkages can also be seen between the PRC's domestic ICT firms and domestic non-ICT firms and other economies. MNCs, as of 2016, were involved in the value chains of the exports of domestic ICT firms, but this was not as substantial as the contribution by the PRC's domestic ICT firms. At the downstream sections of this value chain, the wholesale and retail trade and transportation services sectors in Japan, Mexico, the US, and some parts of Europe have also benefited from large value added since the PRC's domestic ICT products are mainly exported to these economies.

PRC-based multinational ICT firms are also at the middle-bottom of the value chain, as panel b shows. But the value-added share is relatively smaller, and the position relatively lower compared with the PRC's domestic ICT firms. This is because most PRC-based multinational ICT firms are in the processing trade, which requires greater intermediate imports and is more labor intensive.

Panel c shows the value chains for the exports of US domestic ICT firms do not have a smile curve, but rather an inverted U-shape. This is mainly because US domestic ICT firms have higher value-added shares relative to firms at either ends of this value chain. US domestic ICT firms employ a high-skilled, high-wage workforce and use sophisticated, high-rent capital inputs.

Panel d shows the value chains for the exports of US-based multinational ICT firms have a smile curve. The results are similar to that of PRC-based multinational ICT firms, but the smile curve is flatter, suggesting the value-added ratio across stages of production does not show a large variation. The production of exports by US-based multinational ICT firms also requires large amounts of intermediate inputs, which are sourced out from both domestic and foreign firms at the upstream of the value chain.

Meng and Ye (forthcoming) show some remarkable structural changes in the participation of economy sectors in GVCs by comparing smile curves in 2005 and 2016. For the PRC, the industrial upgrading of domestic manufacturing firms and the increasing role of domestic services in the country's ICT value chain resulted in more PRC domestic manufacturing and services firms being involved in the upstream portion of the chain for exports by the PRC's domestic ICT firms. Significant structural changes also resulted in the replacement of foreign firms as providers of intermediate inputs to PRC-based multinational ICT firms. Rapid technological upgrading in the PRC even enabled domestic manufacturing and services firms to position themselves in the upstream of the value chain for exports by US-based MNCs. Significant technological upgrading in the US also resulted in the transition of US domestic ICT firms to the production of very high value-added products with less reliance on both domestic and foreign intermediate inputs.

Another way the role of MNCs can be explored is through their visualization in network charts. Building on the methodology in Xiao et al. (2020) and using the AMNE database,

Gao, Meng, and Ye (2020) use networks to characterize the patterns of various GVCs distinctly comprised of domestic firms on the one hand and MNCs on the other.[7] Networks are examined for these types of ownership (domestic and foreign) from two perspectives (supply and demand) across two sector groups (manufacturing and services) and for 2 years (2005 and 2016).

In these networks, nodes represent the most central (or significantly connected) economy sectors and are sized according to the share of their total value-added exports (in the supply perspective) or value-added imports (in the demand perspective) to the world total. The connections between nodes represent the direct bilateral flows of value added, whether through exports (in the supply perspective) or imports (in the demand perspective) from source to destination. The nodes are weighted according to the shares of bilateral flows to the economy's total exports or imports, again from the perspective under consideration.

To streamline the networks and derive useful insights, the connections visualized in the network charts are limited to those that constitute the largest (or top 1) bilateral flows of value-added exports for the supply perspective and imports for the demand perspective, as well as all other flows with shares larger than 25%. Because of the nature of GVCs, where value added is ultimately absorbed by a third economy, the connections in the networks do not represent direct links between producing and consuming economy sectors, but instead give a notion of the extent and pattern of interdependence among economies as they are linked by trade in parts and components.

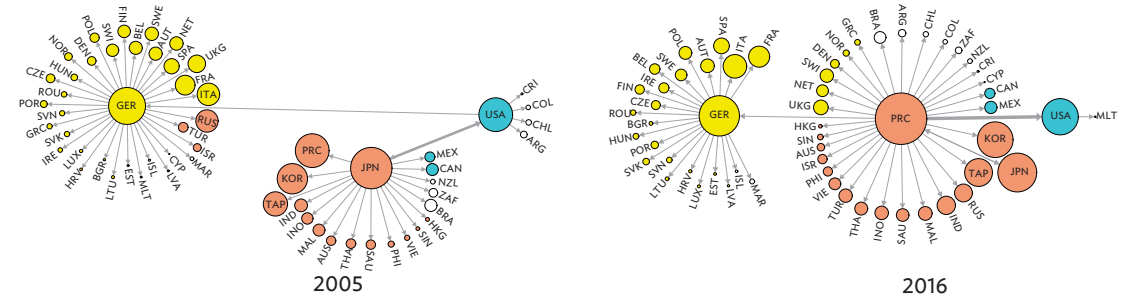
The supply perspective focuses on the role of economies as exporters of value added in manufacturing and services. Economies represented by the largest nodes have the largest shares of value-added exports to the world total and are thus considered supply centers in the value chain network. In 2016, both domestic and multinational manufacturing firms in Germany and the PRC were global supply centers, as shown in panels a and b of Figure 1.8. This is starkly different from the pattern in 2005, where Germany, Japan, and the US were each regional supply centers in the domestic value chain network, and where Germany was the global supply center in a monocentric multinational value chain network.

The increasing centrality of the PRC's position in both domestic and multinational manufacturing networks is notable. Comparing the 2005 and 2016 networks of domestic firms, the PRC has essentially replaced Japan as Asia's supply center and the US as North and South America's. The PRC has also exceeded Germany's value-added share in global manufacturing. In the networks of MNCs, the monocentricity of the structure in 2005 was broken by the emergence of the PRC as a global supply center by 2016 with significant links to primarily economies in East Asia and North and South America. In the same multinational networks, the US remained a relatively independent periphery throughout the period. However, it mainly received supply through Germany in 2005 and through the PRC in 2016.

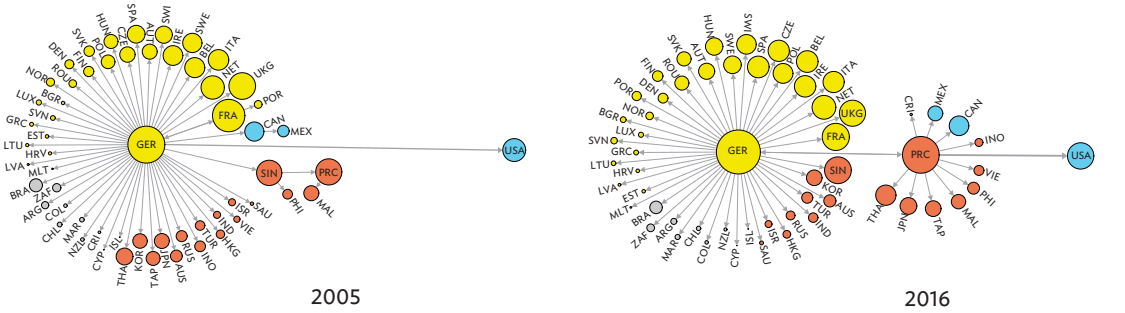
[7] GVCs here are so-called complex GVCs—that is, those that involve the crossing of at least two borders.

Figure 1.8: Complex Global Value Chain Networks, Supply Perspective, 2005 and 2016

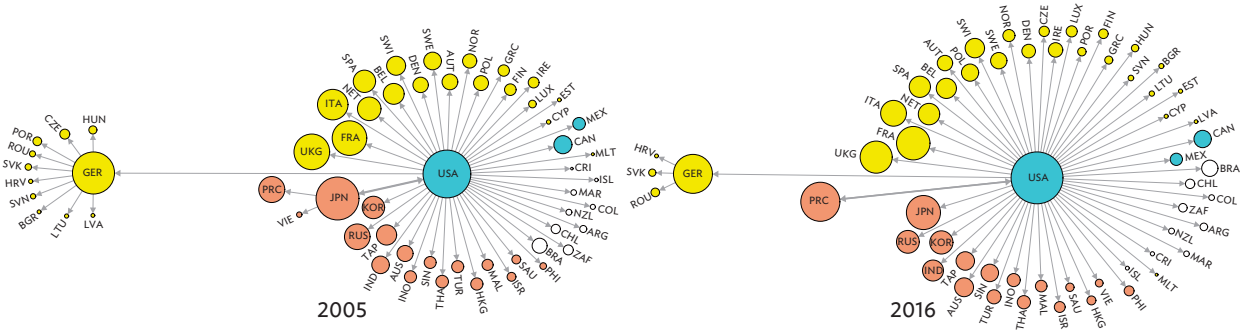
a. Domestic Manufacturing Firms



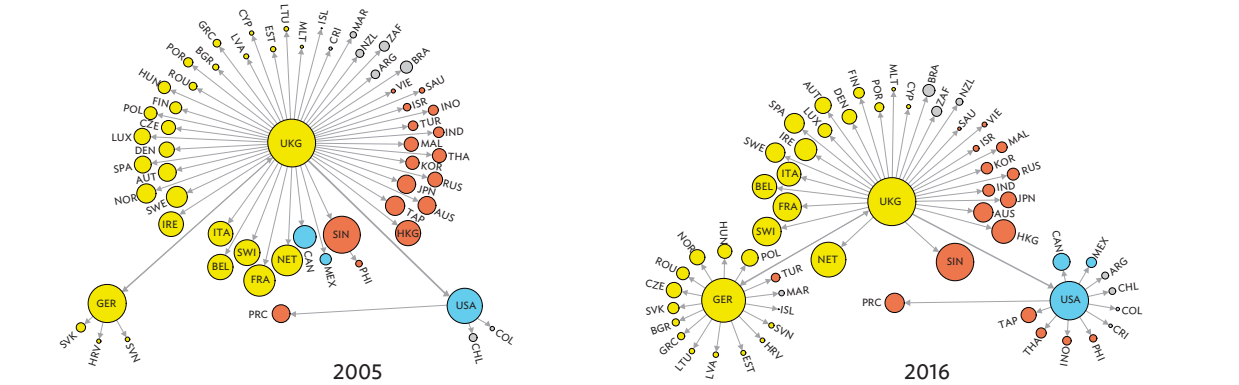
b. Multinational Manufacturing Firms



c. Domestic Services Firms



d. Multinational Services Firms



Sources: Y. Gao, B. Meng, G. Suder, and J. Ye. 2021. Who Dominates Global Value Chains? Multinationals vs Domestic Firms. *IDE Discussion Paper.* No. 825. Chiba, Japan: Institute of Developing Economies – Japan External Trade Organization; Organisation for Economic Co-operation and Development. Analytical Activities of Multinational Enterprises Database. https://www.oecd.org/sti/ind/analytical-amne-database.htm (accessed 31 July 2021).

In contrast to the regionally clustered networks of domestic manufacturing firms, the corresponding networks in services have become increasingly centered around the US, as seen in panels c and d of Figure 1.9. In 2005, Germany was a small regional center with value-added formation primarily sourced from the US, then distributed to countries in eastern European. In the same year, the PRC was not directly linked to any supply center, but it was indirectly getting value added from the US via Japan. By 2016, the PRC had been able to establish a significant connection to the US, both as a destination and source of its value added.

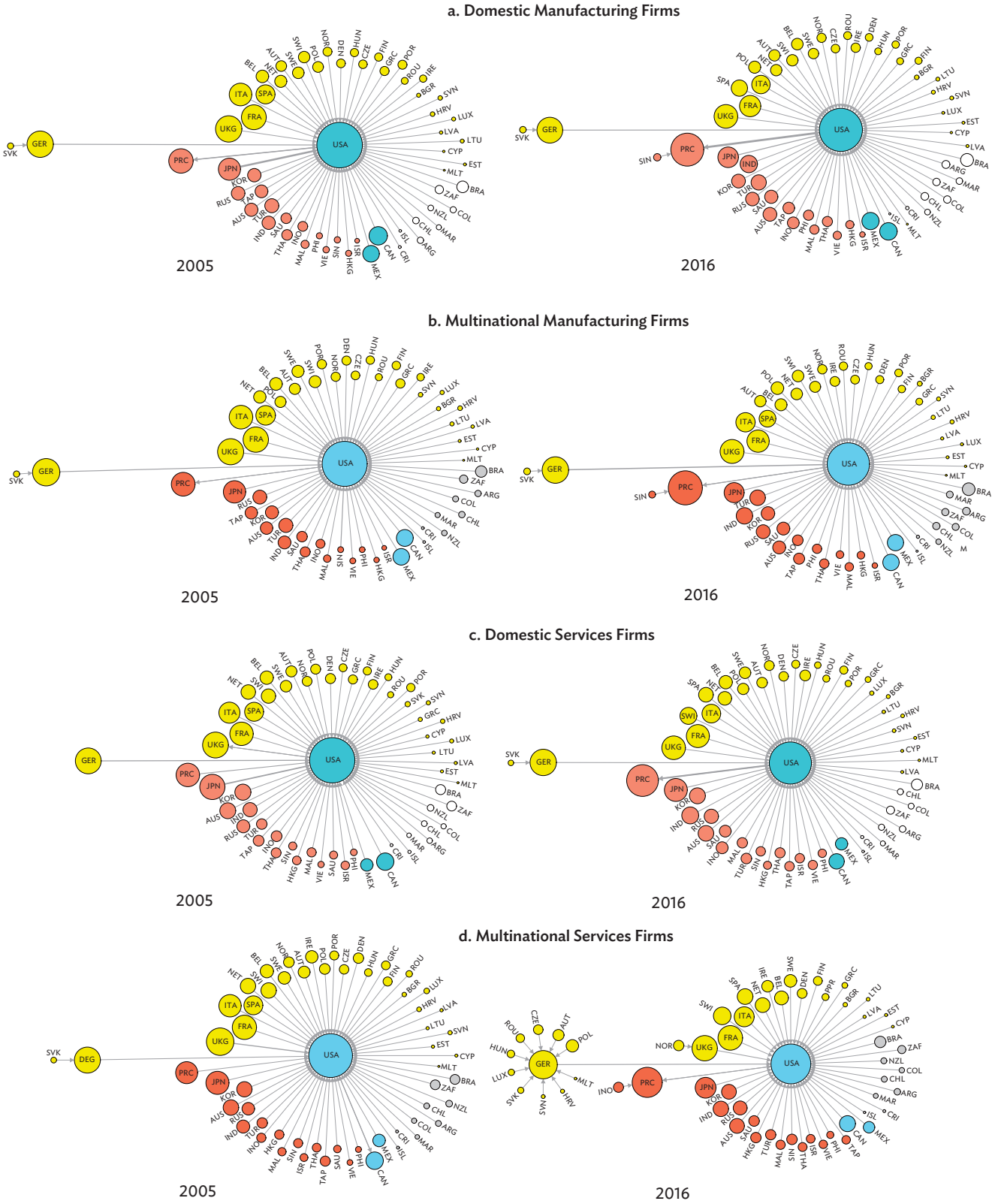
The networks of multinational services firms have become more polycentric. In 2005, the United Kingdom was the largest supply center of multinational value formation in services, with nearly all economies sourcing value added from it, either directly or indirectly. Strongly connected to the United Kingdom were the smaller supply centers of Germany and the US, which had, by 2016, become central in their respective regions. The PRC was peripheral in these networks and only linked to the US, which was its main source of value added.

The demand perspective, shown in Figure 1.9, focuses on the role of economies as importers of value added in manufacturing and services, comparing the situation in 2005 with 2016. Economies represented by the largest nodes have the largest shares of value-added imports to the world total and are therefore considered demand centers in the value-chain network. From the demand perspective, the US has consistently been the global demand center of GVC networks, whether domestic or multinational, or in manufacturing or services. In the networks of manufacturing firms, value-added formation from all economies, regardless of region, were directed to the US in both periods. Value-added formation from the US was directed to domestic firms in the United Kingdom in 2005 and the PRC in 2016—and to MNCs in the PRC in both years. Unlike the manufacturing networks from the supply perspective, these demand-side networks were strongly monocentric, with the role of the PRC and Germany being relatively limited.

The general observation for both domestic and multinational networks for services are the same as for the manufacturing sector—that is, the US was the global demand center toward which value-added formation from all economies was destined, either directly or indirectly. Similarly, the PRC was the only economy that received value added from the US. A slight difference exists in the multinational network of services firms in 2016: more value added passed onto the US via third economies, most notably Germany and the PRC.

Further distinguishing the sources of value-added formation in networks by ownership, whether domestic or foreign, provides different insights compared with those produced from analyzing economy sectors. The networks of domestic manufacturing firms from the supply perspective, for example, show stronger regionalization than networks of MNCs in the same sector. The opposite is true for networks of the services sector from the supply perspective. Here, domestic services firms are more internationally linked than services MNCs. Some small differences exist in the domestic and multinational networks from the demand perspective—the bigger role of German MNCs in the services sector for example.

Figure 1.9: Complex Global Value Chain Networks, Demand Perspective, 2005 and 2016

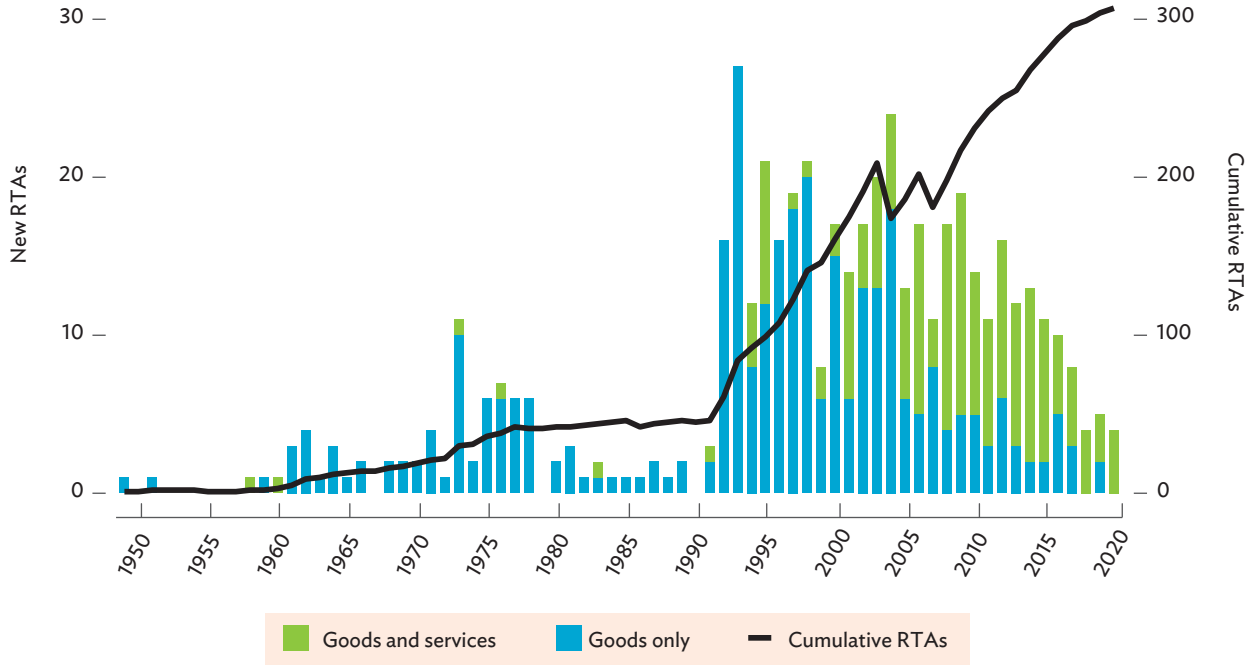


Sources: Y. Gao, B. Meng, G. Suder, and J. Ye. 2021. Who Dominates Global Value Chains? Multinationals vs Domestic Firms. *IDE Discussion Paper*. No. 825. Chiba, Japan: Institute of Developing Economies – Japan External Trade Organization; Organisation for Economic Co-operation and Development. Analytical Activities of Multinational Enterprises Database. https://www.oecd.org/sti/ind/analytical-amne-database.htm (accessed 31 July 2021).

The Turn Toward Regionalism

One trend that has survived slowbalization is the continued formation of new regional trade agreements (RTAs), as shown in Figure 1.10. Based on World Trade Organization data, over 300 RTAs were in force in 2020. The largest RTA is the yet-to-be-ratified Regional Comprehensive Economic Partnership involving 15 economies in Asia and the Pacific (Heijmans and Nguyen 2020). While new RTAs have slowed in recent years, they are still higher than before 1990, the turning point for a sharp rise in these agreements. Moreover, a boost to further RTAs is expected in 2021 as post-Brexit United Kingdom seeks its own trade deals.

Figure 1.10: Regional Trade Agreements, 1949–2020



RTA = regional trade agreement.
Notes: An RTA includes at least two economies. Cumulative RTAs are net of retired RTAs, but new RTAs are not. Accessions—economies joining existing RTAs—are excluded.
Source: World Trade Organization. Regional Trade Agreements Database. https://rtais.wto.org/UI/PublicMaintainRTAHome.aspx (accessed 31 July 2021).

An inherent tension between globalism and regionalism has always existed. Globalism operates under the most-favored-nation system that ensures that tariff cuts and other trade concessions are nondiscriminatory. Regionalism seeks to promote trade within a restricted group (Frankel 1997). Membership is generally within close geographic proximity, as in the Regional Comprehensive Economic Partnership, the European Single Market, and the North American Free Trade Agreement. Increasingly, however, membership can also be transcontinental, as in the Comprehensive and Progressive

Agreement for Trans-Pacific Partnership.[8] This section examines the growth of regionalism in recent years, its effects on trade, and its characteristics.

The historical survey in WTO (2011a) lists three waves of regionalism since the Second World War. The first and second, starting in the 1950s and 1980s, were set in motion by Western Europe when it formed the European Economic Community in 1957 and deepened into the European Single Market in 1993. The second wave led to the wider proliferation of RTAs seen in Figure 1.10, a consequence of several factors, including the reversal of the US position against regionalism, import substitution being abandoned by much of the developing world, and the bringing together of Eastern and Western Europe at the end of the Cold War (Frankel 1997). A record 27 RTAs came into force in 1993, all but four of them involved a form of European east–west integration. The world is in its third wave of regionalism, one marked by the growing presence of services in negotiated terms.

Scholars continue to debate whether RTAs encourage multilateralism or undermine it. Skeptics like Bhagwati (2008) argue that RTAs are more trade-diverting than trade-creating, leading to a general reduction in the gains from trade. Optimists note that the first two waves of regionalism gave way to successful multilateral initiatives, with the second in particular culminating in the establishment of the World Trade Organization in 1994. Empirical evidence suggests that although RTAs divert trade, they may also result in lower tariffs on nonmembers since trade with them has become less important. Estevadeordal, Freund, and Ornelas (2008) find this to be the case for Latin American free trade areas (FTAs) over 1990–2001, although a follow-up study by Crivelli (2016) clarifies this only applied to high-tariff economies. In a broader dataset covering the world over 1989–2011, Saggi, Stoyanov, and Yildiz (2018) find that even economies outside FTAs are induced to lower tariffs on FTA members, again because their trade became less important.

Limão (2016) notes that RTAs have proliferated even though tariffs faced by World Trade Organization members under most-favored-nation arrangements have fallen. This is puzzling since it seemingly reduces the potential benefits of an RTA. The decision to join either regional or multilateral initiatives must therefore extend beyond a simple desire for lower tariffs—and, indeed, RTAs in the third wave increasingly cover nontariff issues, such as services, capital flows, intellectual property, and labor and environmental standards (WTO 2011a). One important motivation cited in Limão (2016) is that RTAs provide a form of insurance, which is useful in the event of a global breakdown in trade openness.

Table 1.3 tabulates the regional composition of RTAs. Asia and the Pacific (comprising East Asia, Southeast Asia, Oceania, and the Pacific islands) is the most prolific; its economies having 42 RTAs among themselves and dozens more with all other regions.

8 This has led some, such as Limão (2016), to favor the term "preferential trading agreements" over RTAs. This chapter uses the RTA terminology of the World Trade Organization.

This stems from Asia and the Pacific having numerous trade-oriented economies, from large ones, such as Japan and the PRC, to the smaller emerging economies of Southeast Asia. The three large economies of North America, however, have just one intra-regional RTA, though they have 28 with neighboring South America. Europe, the original forerunner of regional integration, has 31 intra-regional agreements.

Table 1.3: Inter- and Intra-Regional Trade Agreements, 2020

Regions	Asia and the Pacific	South Asia	Central Asia	Middle East and North Africa	Sub-Saharan Africa	Europe	North America	South America
Asia and the Pacific	**42**							
South Asia	12	**7**						
Central Asia	7	2	**15**					
Middle East and North Africa	3	3	9	**2**				
Sub-Saharan Africa	1	1	2	42	**6**			
Europe	13	1	29	19	7	**31**		
North America	8	2	1	10	1	6	**1**	
South America	26	4	2	4	2	9	28	**26**

Notes:
1. Data as of 31 December 2020.
2. Regional trade agreements involving more than two regions are counted for each region pair. Because of this, the figures do not sum to total agreements.
3. Turkey and the Russian Federation are grouped in Central Asia. South America includes Central America and the Caribbean. Asia and the Pacific includes East Asia, Southeast Asia, Oceania, and the Pacific islands.

Source: World Trade Organization. Regional Trade Agreements Database. https://rtais.wto.org/UI/PublicMaintainRTAHome.aspx (accessed 31 July 2021).

It must be noted that a degree of arbitrariness creeps in when defining geographic regions. This chapter classifies Turkey under Central Asia, but if it were counted under Europe, that region would have 38 intra-regional RTAs rather than 31. Similarly, while it appears that the most integrated regional pair is Central Asia–Europe, counting both the Russian Federation and Turkey under Europe instead of Central Asia decreases the pair's interregional RTAs from 29 to 20. More drastically, the interregional RTAs between North America and South America are halved from 28 to 14 if Mexico is counted under South America instead of North America. With these considerations in mind, the most robustly integrated regional pair is Asia and the Pacific–South America, which shares 26 interregional RTAs.

Although this analysis considers regional integration in terms of breadth, it can also be approached in terms of depth. Frankel (1997) proposes five types of RTAs. With increasing levels of integration, these are preferential trade agreements, free trade areas, customs unions, common markets, and economic unions. Box 1.4 defines the five types, although it bears noting that arrangements with the same label can vary significantly in practice. One free trade area may be more "free" than another. A more quantitative measure for the depth of integration is needed.

Box 1.4: Taxonomy of Regional Trade Agreements

Limão (2016) defines a regional trade agreement (RTA) as an "international treaty with restrictive membership and including any articles that (i) apply only to its members and (ii) aim to secure or increase their respective market access." Scholars call RTAs by different names. Limão (2016) uses "preferential trade agreement," while Baier, Bergstrand, and Clance (2018), among others, use "economic integration agreements."

RTAs can be classified according to how deeply they integrate the economies of their members. Frankel (1997) proposes five levels:

(i) **Preferential trade agreement**. Tariffs are partially lowered for members. This may be reciprocal or nonreciprocal. Nonreciprocal arrangements are generally in the form of developed economies granting concessions to developing ones.
(ii) **Free trade area**. A reciprocal agreement where all tariffs and nontariff import restrictions are eliminated among members.
(iii) **Customs union**. This is a free trade area where members apply a common external tariff and adopt a common set of trade barriers to nonmembers.
(iv) **Common market**. The free movement of the factors of production (labor and capital) are allowed, apart from goods and services.
(v) **Economic union**. The highest stage of integration involving the free movement of goods, labor, and capital, plus a harmonized set of fiscal and monetary policies.

The World Trade Organization's RTA database records the formation (and dissolution) of nonreciprocal preferential trade agreements, free trade areas, customs unions, and common markets, although it does not necessarily use these classifications.

Jeffrey Bergstrand and Scott Baier have constructed a more comprehensive database that codes each RTA into the five types (https://sites.nd.edu/jeffrey-bergstrand). The coverage, however, is only until 2012.

References

Baier, S. L., J. H. Bergstrand, and M. W. Clance. 2018. Heterogeneous Effects of Economic Integration Agreements. *Journal of Development Economics*. 135 (C). pp. 587–608.
Frankel, J. A. 1997. *Regional Trading Blocs in the World Economic System.* Washington, DC: Peterson Institute for International Economics.
Limão, N. 2016. Preferential Trade Agreements. *NBER Working Paper*. No. 22138. Cambridge, MA: National Bureau of Economic Research.

One possible measure would be to calculate the extent a region trades with itself relative to its share in global trade. This is in the same spirit as the index of regional concentration proposed in Frankel (1997), only instead of gross exports, this chapter uses flows of value added. An index closer to 1 means trading patterns within a region more or less replicate global trends. In this case, it would be as if a random selection of economies had been grouped together. An index higher than 1 implies greater integration, with trade more concentrated among the region's members (Box 1.5).

The regional concentration index (RCI) is computed for four well-defined RTAs whose members are (largely) included in ADB's Multiregional Input–Output Database. These are the Association of Southeast Asian Nations plus Japan, the PRC, and the Republic of Korea (ASEAN+3), the Eurasian Economic Union, the European Union plus the United Kingdom (EU28), and the North American Free Trade Agreement (NAFTA). Their indices for 2000 and 2007–2020 are plotted in Figure 1.11.

Three interesting insights emerge. First, the most integrated bloc is generally NAFTA, trading among itself at about 1.5 times the rate that it trades with the world. It is even more integrated than the EU28, whose union is older and institutionally tighter. However, this does not necessarily imply that NAFTA is self-sufficient as it still requires external suppliers to meet its demand.

Box 1.5: Regional Concentration Index

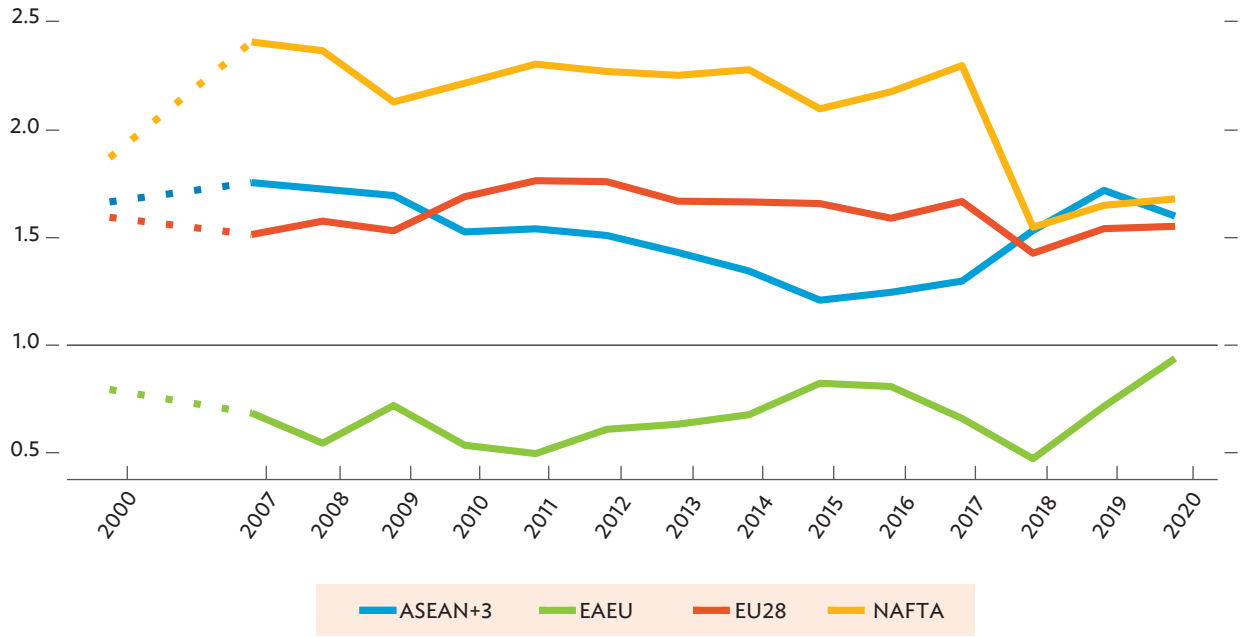
Regional integration is commonly measured by the share of a region's total trade occurring within that region. Frankel (1997) criticizes this as being misleading since regions with more members necessarily capture more of each other's trade, thus overstating integration. Frankel (1997) instead proposes a calibrated index that takes the ratio of intra-regional trade to the share of that region in world trade. This is called the regional concentration index. An index closer to 1 means value is flowing into a region at about the same rate as it is outside the region. The higher the index is over 1, the more a region disproportionately relies on producers and consumers within itself, and thus is more integrated.

A value-added-adjusted version of this index is possible. Rather than using gross exports, it uses flows of value added estimated from an intercountry input–output table. Under this approach, a $100 flow from economy A to economy B means that $100 worth of value added generated solely in A was sent to and absorbed solely in B.

References

Frankel, J. A. 1997. *Regional Trading Blocs in the World Economic System.* Washington, DC: Peterson Institute for International Economics.

Figure 1.11: Index of Regional Concentration for Selected Regional Trade Agreements, 2000, 2007–2020



ASEAN = Association of Southeast Asian Nations, EAEU = Eurasian Economic Union, EU = European Union, NAFTA = North American Free Trade Agreement.

Notes: The index of regional concentration is the share of intra-regional value-added trade relative to a region's global share in value-added trade. ASEAN+3 is ASEAN plus Japan, the People's Republic of China, and the Republic of Korea. EU28 is the EU plus the United Kingdom. Because of data constraints, ASEAN+3 does not include Myanmar and the EAEU does not include Armenia and Belarus.

Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Second, although ASEAN+3's RCI has always remained above 1, it spent much of the slowbalization years becoming less integrated. Because several of its members pursued export-led growth, they naturally turned to the high-income markets of the US and Europe rather than maintaining a regional focus. The bloc, however, began regaining its integration by 2017, around the time of the trade conflict between the US and the PRC.

And third, the Eurasian Economic Union's RCI has consistently remained below 1, meaning its members trade more with economies outside the RTA than those within it. This is partly because it only came into being in 2015, but the larger reason is that over a third of its value-added exports are in oil, which cannot of course all be absorbed within the bloc.

Table 1.4 lists indices for sectors at the heart of GVCs. The integration of NAFTA countries is even more pronounced when looking specifically at metals, electricals, and textiles. Indeed, among the more important industries benefiting from NAFTA are automobiles and steel (Wasson, Wingrove, and Martin 2019). The decline in ASEAN+3 integration is steepest in the miscellaneous business activities sector as services-oriented economies like the Philippines take advantage of the BPO boom that caters largely to firms in industrialized economies. In contrast, the EU28's indices for this sector have remained high due probably to the large degree of labor mobility among its members. While indices for the Eurasian Economic Union appear high, especially in the textiles sector, these mostly stem from a low share in world exports (the denominator in the RCI formula) and thus may overstate the level of integration. The importance of these sectors in the bloc's exports still pale in comparison with oil, which has a very low RCI.

The case of the Eurasian Economic Union raises an important point about RTAs: some blocs face a natural limit to their integration. If member economies are not sufficiently diversified, the need to trade outside the bloc exerts a centripetal force on the bloc's trading patterns. One way to visualize this more explicitly is through a skyline chart (WTO 2011b). This shows the share of a bloc's demand satisfied by its own output and the share satisfied by imports from outside the bloc, disaggregated by sectors whose relative importance to the bloc is also visualized (Box 1.6).

Figure 1.12 shows skyline charts for the four RTAs, with 2019 chosen since 2020 was anomalous. Each skyline chart consists of 35 "towers," representing the 35-sector disaggregation of ADB's Multiregional Input–Output Database. Their widths reflect the share of each sector in the RTA's output; their heights measure output induced by demand both within and outside the RTA, expressed as a share of domestic demand. A portion of each tower is shaded red to indicate the reduction in output due to imports. The RTA is said to be self-sufficient in a sector if the tower's blue portion exceeds the 100% line, meaning its own output is enough to satisfy its induced domestic demand.

Panel a shows ASEAN+3, as expected, has a strong export orientation in its manufacturing sectors, particularly textiles and electricals. While it has substantial exports in wholesale trade, it is generally just self-sufficient in services sectors. It is in the primary sectors where the bloc has to rely on external suppliers, particularly in mining and quarrying. Panel b shows that nearly the exact opposite is the case for the Eurasian Economic Union, with its hefty exports in oil—which are part of the mining and quarrying sector in ADB's Multiregional Input–Output Database on which Figure 1.2 is based—but a general reliance on imports for its manufacturing sectors. Transport equipment, in particular, is both highly demanded, but largely supplied by economies outside the union. Other

sectors with substantial exports—coal, refined petroleum, and inland transport (i.e., oil pipelines)[9]—are likely tied to the Eurasian Economic Union's oil industries, further emphasizing the lack of diversification in this bloc.

Table 1.4: Index of Regional Concentration for Regional Trade Agreements and Sectors, 2000, 2010, 2019

Region	2000	2010	2019
Basic Metals and Fabricated Metal			
ASEAN+3	1.75	1.56	1.71
EAEU	0.78	0.49	0.63
EU28	1.62	1.71	1.59
NAFTA	3.25	3.88	2.55
Electrical and Optical Equipment			
ASEAN+3	0.79	0.88	1.10
EAEU	9.72	8.27	19.28
EU28	2.10	2.32	2.91
NAFTA	1.51	2.57	1.53
Textiles and Textile Products			
ASEAN+3	0.92	0.62	0.80
EAEU	60.00	45.18	66.03
EU28	1.50	2.15	2.30
NAFTA	4.90	7.28	7.71
Renting of Machinery and Equipment and Other Business Activities			
ASEAN+3	3.01	2.21	2.20
EAEU	4.46	1.59	3.15
EU28	1.22	1.15	0.98
NAFTA	1.08	1.17	0.94

ASEAN = Association of Southeast Asian Nations, EAEU = Eurasian Economic Union, EU = European Union, NAFTA = North American Free Trade Agreement.
Notes:
1. The regional concentration index is the share of intra-regional value-added flows relative to a region's global share in value-added flows. Indices greater than 1 are colored blue.
2. ASEAN+3 is ASEAN plus Japan, the People's Republic of China, and the Republic of Korea. EU28 is the EU plus the United Kingdom. Because of data constraints, ASEAN+3 does not include Myanmar and the EAEU does not include Armenia and Belarus.

Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

The EU28 relies on its members to satisfy almost all its demand, except, notably, for the mining and quarrying and electricals sectors (panel c). This is in spite of the high level of integration observed in the EU28's metal, electrical, and textile sectors as measured by the RCI. NAFTA remains heavily dependent on external suppliers for most of its manufacturing demand (panel d). The EU28 and NAFTA show that a high level of integration need not

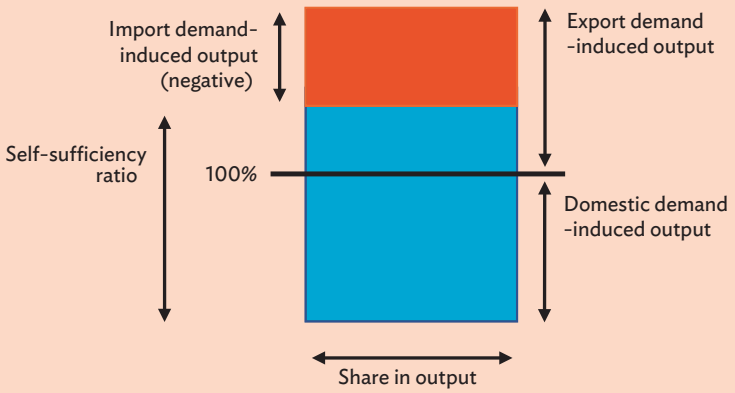
[9] The "coke, refined petroleum and nuclear fuel" sector comprises of C19 in ISIC 4. The "inland transport" sector comprises of H49 in ISIC 4.

imply regional self-sufficiency. Put another way, a bloc that does a lot of business with itself may still be open for business for nonmembers. A larger output share in services is found within NAFTA than all other RTAs, while ASEAN+3 dominates the manufacturing sector.

Box 1.6: Constructing a Regional Skyline Chart

A skyline chart visualizes the industrial structure of an economy and the extent to which it relies on imports (METI 2011; WTO 2011). Each sector is represented by a "tower," as in the figure. The width of the tower measures the share of a sector in the economy's output. The height of the tower measures output induced by demand for that sector, computed using data from an input–output table.

A Tower in a Skyline Chart



Source: Authors based on WTO (2011).

Output induced by domestic demand is normalized at 100%, with anything above corresponding to output induced by export demand. Part of the tower is shaded red to indicate the reduction in output induced by imports, which, being negative, starts from the top of the tower and extends downward.

If the blue region of the tower is above the 100% line, then the sector it represents is said to be self-sufficient. That is, its own output is enough to satisfy its induced domestic demand. If it is below the 100% line, domestic output is insufficient and the economy has had to import the shortfall in supply. The actual height of the blue region is called the sector's self-sufficiency ratio.

The skyline chart can be constructed at the regional level. In this case, the underlying input–output table is aggregated at the regional level, meaning imports and exports refer to flows going in and out of the region while flows between economies within the region are treated as "domestic" flows. Self-sufficiency then refers to the ability of the region to supply its induced demand without having to import from outside the region.

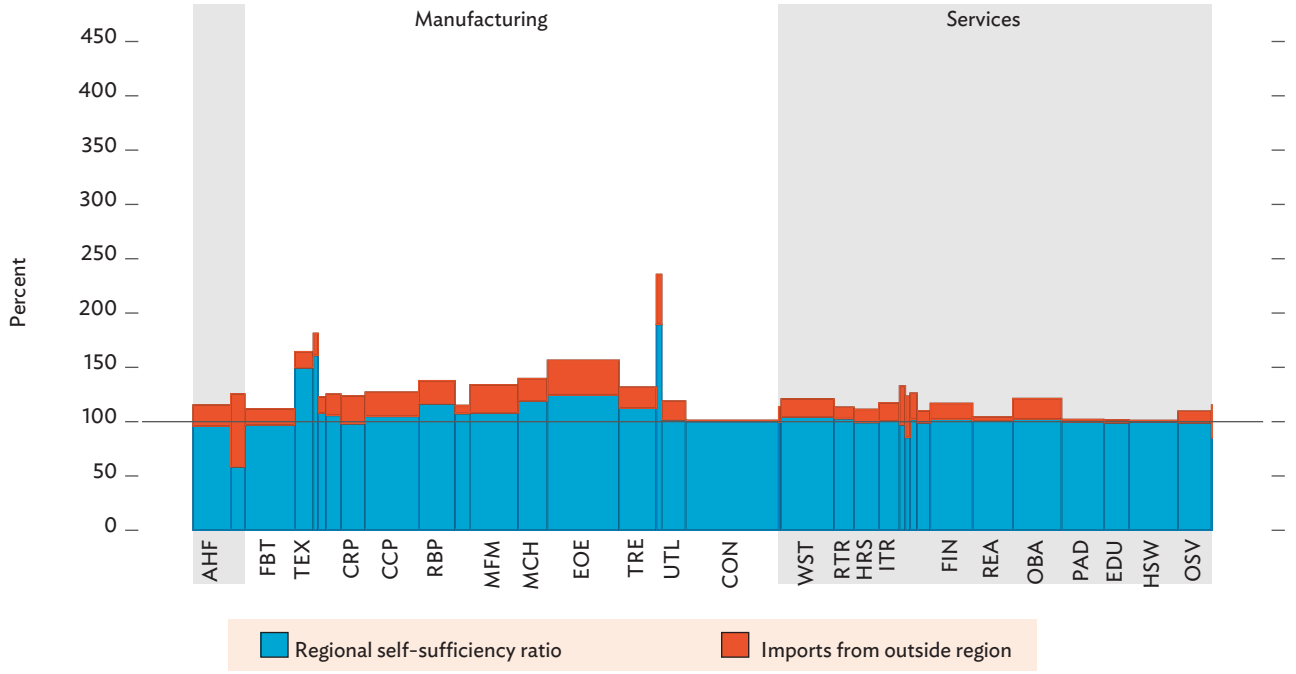
References

METI (Japan Ministry of Economy, Trade and Industry). 2011. White Paper on International Economy and Trade, Supplementary Notes. https://www.meti.go.jp/english/report/data/gWT2011fe.html.
WTO (World Trade Organization). 2011. *Trade Patterns and Global Value Chains in East Asia: From Trade in Goods to Trade in Tasks.* Geneva.

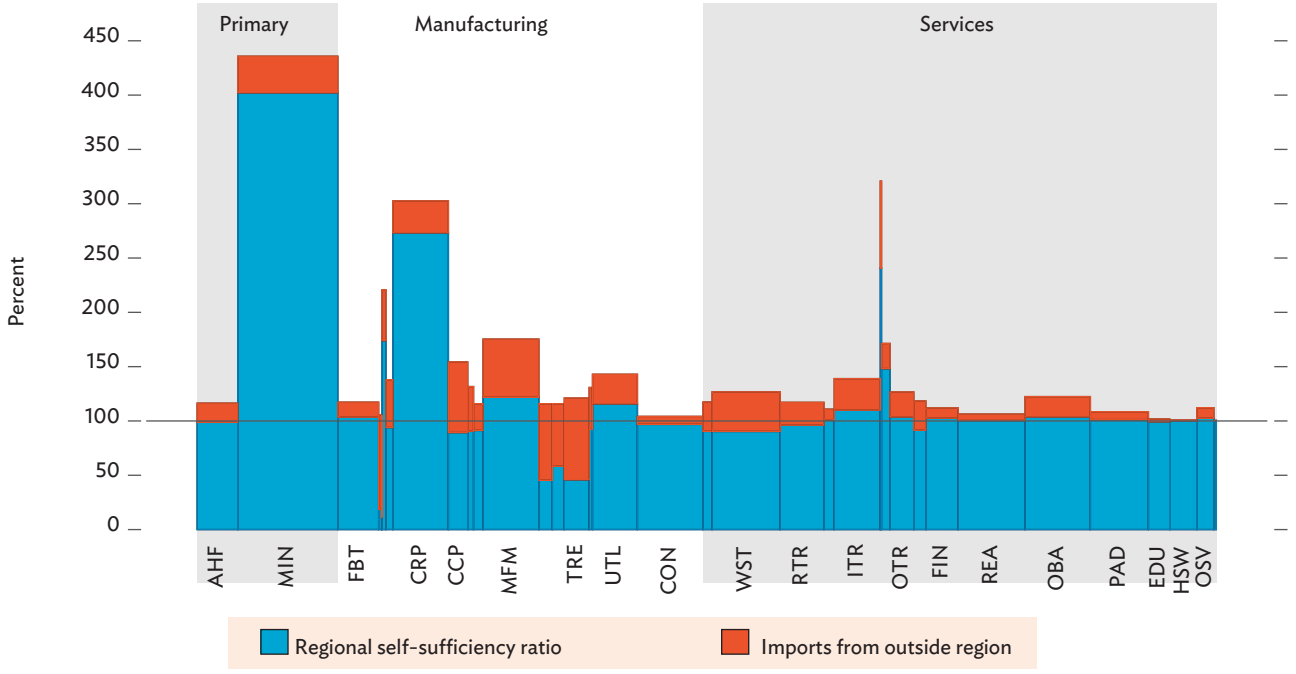
All this presents a complex picture of regionalism. The most prolific region in signing RTAs is Asia and the Pacific. But in the case of ASEAN+3, an emphasis on export-led development has meant the regional concentration of the bloc's trading patterns has been declining during the slowbalization era. Moreover, some RTAs, including the Eurasian Economic Union, are not "deep," with members trading less with each other than they do with nonmembers. But even blocs that are highly integrated may still find it necessary to engage in external trade—NAFTA being a good example. Regionalism, then, need not be the antithesis of globalism.

Figure 1.12: Skyline Charts by Bloc, 2019

a. ASEAN+3



b. Eurasian Economic Union



continued on next page

Figure 1.12: continued

AHF = agriculture, hunting, forestry, and fishing, ASEAN = Association Southeast Asian Nations, ATR = air transport, CCP = chemicals and chemical products, CON = construction, CRP = coke, refined petroleum, and nuclear fuel, EDU = education, EOE = electrical and optical equipment, EU = European Union, FBT = food, beverages, and tobacco, FIN = financial intermediation, HRS = hotels and restaurants, HSW = health and social work, ITR = inland transport, LTH = leather, leather products, and footwear, MCH = machinery, not elsewhere classified, MFG = manufacturing, not elsewhere classified, and recycling, MFM = basic metals and fabricated metal, MIN = mining and quarrying, MTV = sale and repair of motor vehicles and motorcycles, retail sale of fuel, OBA = renting of machinery and equipment and other business activities, ONM = other nonmetallic mineral, OSV = other community, social, and personal services, OTR = other supporting transport activities, PAD = public administration and defense, and compulsory social security, PHE = private households with employed persons, PPP = pulp, paper, printing, and publishing, RBP = rubber and plastics, REA = real estate activities, RTR = retail trade and repair, except of motor vehicles and motorcycles, TEL = post and telecommunications, TEX = textiles and textile products, TRE = transport equipment, UTL = electricity, gas, and water supply, WDC = wood and products of wood and cork, WST = wholesale trade, except of motor vehicles and motorcycles, WTR = water transport.

Note: To avoid overlapping text, some sector labels have been suppressed.

Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Domestic Agglomeration

In a highly integrated global economy, linkages of domestic sectors to global trade have significant implications. Koopman, Wang, and Wei (2008) argue that developing a measure of the domestic content of exports is important for assessing how an economy might be affected by currency appreciations and for gauging the effects of this on trade on wages. Redefining domestic linkages to domestic value added, Banga (2014) argues that maximizing gains from participating in GVCs relies on the ability of domestic sectors to gain value added from these activities. From a policy standpoint, measuring domestic linkages is essential for measuring gains from GVC activities.

Recent studies find that domestic linkages add another layer of complexity to GVCs. Domestic activities are indirectly associated with GVC activities through the production of intermediate goods that are later exported or by using inputs from vertically integrated sectors (Mercer-Blackman, Foronda, and Mariasingham 2017; Tang, Wang, and Wang 2020). Because very few firms directly engage in trade, however, current measures of GVC participation do not capture the contribution of domestic sectors to global trade activities (Bernard et al. 2007). This implies that current indicators underestimate the contribution of domestic sectors in GVC activities.

Another strand highlights the role of domestic linkages in the decline in global trade. Slowbalization highlights how economies are trying to reshore activities once located elsewhere (*The Economist* 2019; Titievskaia et al. 2020). The rise of protectionism and trade conflicts characterize this period. In the context of the COVID-19 pandemic, reshoring rises in importance as a risk management tool. A highly integrated global economy implies that different economies are vulnerable to supply chain risks, which can offset the benefits of fragmenting production processes based on cost-related factors (Giuseppina and Michele 2018). This creates incentives to relocate activities that were once offshored back to the domestic economy.

These incentives provide a rationale for developing a measure of domestic linkages. Several attempts have been made to construct this measure. Jones (2011) and Bartelme and Gorodnichenko (2015) measure domestic linkages by estimating the output multiplier associated with intermediate goods from domestic sectors. Tang, Wang, and Wang (2020) construct a firm-level measure of domestic linkages by estimating the indirect domestic value added of non-exporting firms in the PRC, with the overall goal of defining the contribution of state-owned enterprises to trade. Perhaps the most prominent measure is the Kearney reshoring index, which captures the amount of imported inputs in manufacturing by calculating the year-on-year change in the manufacturing import ratio. This index has been used to characterize reshoring in the US (Kearney 2021).

This section offers an alternative measure by adopting the concept of agglomeration to global trade. This relies on the decision of different firms to “locate” activities domestically. The agglomeration indices look at how much value added is sourced

from and/or absorbed in domestic economy sectors given the production of final goods in other sectors. This improves on existing indices for two reasons. First, it is not limited to capturing activities associated with reshoring. Second, the use of value added accruing to domestic sectors provides a better sense of how much goes to domestic sectors, in contrast to indices based on output multipliers. Box 1.7 explains how the index is constructed.

Box 1.7: Calculating the Agglomeration Index

Let $\mathbf{v}$ be the vector of value-added coefficients and $\mathbf{y}^d$ the vector of domestic final goods sales. And let $\mathbf{A}^d$ be the matrix of domestic technical coefficients and $\mathbf{B}^d \equiv (\mathbf{I}-\mathbf{A}^d)^{-1}$. Then

$$V^D = \hat{\mathbf{v}}\mathbf{B}^d\mathbf{y}^d$$

is the vector of value added generated in each economy sector that ends up as final goods absorbed domestically, while

$$Y^D = \mathbf{v}\mathbf{B}^d\hat{\mathbf{y}}^d$$

is the vector of each economy sector's final goods absorbed domestically whose value added also originated domestically. A hat on top of a vector, as in $\hat{\mathbf{x}}$, denotes its diagonalized version.

Let $\mathbf{va}$ be the vector of value added generated by each economy sector. The forward agglomeration index for economy sector (*s*, *i*) is given by

$$AGG^F_{s,i} = \frac{V^D_{(s,i)}/va_{(s,i)}}{\sum_r V^D_{(r,i)}/va_{(r,i)}}.$$

The numerator is the share of value added generated in (*s*, *i*) that ends up as final goods absorbed domestically in the total value added generated in (*s*, *i*). The denominator is the same share for sector *i* averaged for all economies in the world. Thus, the forward agglomeration index is the ratio of (*s*, *i*)'s V^D share against the world average.

Likewise, let $\mathbf{y}$ be the vector of final good sales by each economy sector. The backward agglomeration index for economy sector (*s*, *i*) is given by

$$AGG^B_{s,i} = \frac{Y^D_{(s,i)}/y_{(s,i)}}{\sum_r Y^D_{(r,i)}/y_{(r,i)}}.$$

This is the ratio of (*s*, *i*)'s Y^D share in final goods sales against the world average.

Being ratios, agglomeration in either perspective is said to be high if the index is greater than 1; conversely if it is less than 1. An economy sector may be profiled by whether it has high or low forward and backward agglomeration. The four possible types are shown in the "agglomeration map" in the figure.

Agglomeration Map

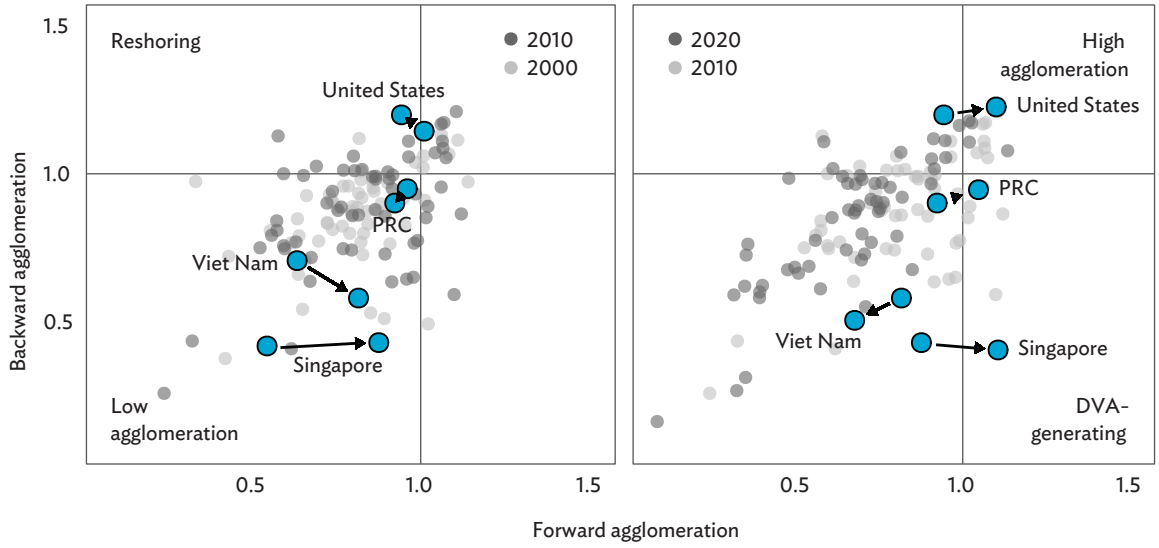
Reshoring economies $AGG^F < 1, AGG^B > 1$	High agglomeration $AGG^F > 1, AGG^B > 1$
Low agglomeration $AGG^F < 1, AGG^B < 1$	DVA generating economies $AGG^F > 1, AGG^B < 1$

DVA = domestic value added.
Source: Authors.

A high backward agglomeration signals that domestic value added embodied in final goods and services consumed domestically is high. Intuitively, this implies that domestic production for domestic consumption is higher than the world average. A high forward agglomeration indicates that domestic sectors absorb a significant portion of value added generated by an economy sector. This means that value added that goes to domestic production is higher than the world average. The classification presented in the agglomeration map combines these two effects to determine the form of domestic linkages taking place in an economy sector.

Figure 1.13 shows forward and backward agglomeration indices for all economies in ADB's Multiregional Input–Output Database for 2000, 2010, and 2020. In 2000, only three were classified as reshoring economies: Australia, Nepal, and Pakistan. While the first two shifted to high agglomeration by 2010, another 10 moved into reshoring, bringing the number in that category to 11. These included the US, which shifted to reshoring from high agglomeration. Most other high-agglomeration economies remained so, including Bangladesh, Brazil, India, and Japan. Among major GVC players, the PRC registered modest declines in both agglomeration indices, while Singapore and Viet Nam boosted their forward agglomeration significantly.

Figure 1.13: Agglomeration Across Economies, 2000, 2010, 2020



DVA = domestic value added, PRC = People's Republic of China.
Sources: Asian Development Bank. Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

From 2010 to 2020, many reshoring economies shifted to low agglomeration. Indonesia and the US were notable exceptions, as they shifted to high agglomeration. The PRC left the low agglomeration category to become domestic value-added generating, indicating higher domestic content in domestic consumption of final goods. Singapore continued its forward agglomeration, while Viet Nam moved toward lower agglomeration on both perspectives.

These developments highlight the changing and complex nature of domestic linkages in different sectors. Economies moving toward the reshoring class provide support to slowbalization, as activities once located elsewhere become concentrated back to the domestic economy. The increases in forward agglomeration in some economies signal the ability of domestic sectors to absorb value added from GVCs, which increase incentives to participate. These two forces indicate that strong domestic linkages do not necessarily imply a decline in overall trade.

Conclusions

This chapter provided a broad view of recent developments in GVCs by combining indicators from the literature with ones developed by the authors of this chapter. Although economic nationalism, the COVID-19 pandemic, and other headwinds reinforce the narrative of slowbalization, a comprehensive and systematic look shows that the picture is more mixed. Even though major players have taken an anti-globalization turn, emerging economies, particularly Bangladesh and Viet Nam, continue to push global integration forward. New accounting frameworks and a novel dataset from the Organisation for Economic Co-operation and Development have shown that MNCs and their affiliates contribute a significant amount of GVC activity that has hitherto been hidden. The turn toward regionalism has generally not dampened the appetite for inter-bloc trade; indeed, some blocs, including NAFTA and the Eurasian Economic Union, simply cannot rely on their members for the totality of their demand. And a new set of domestic agglomeration indices show that reshoring has not become any more pervasive than before. The indicators examined in this chapter point to a globalization that is not uniformly slowing—and in many aspects it has grown in complex and interesting ways.

The COVID-19 pandemic, for which data at the input–output level is still preliminary, will add another layer of complexity to the slowbalization era. Measures taken to combat COVID-19 have sharply exposed vulnerabilities in many supply chains. At the same time, the rapid adoption of digital technologies has made supply chains smarter and more efficient, providing new opportunities for GVC expansion. What happens in the coming years, as Antràs (2020b) emphasizes, will depend on the policies that governments adopt in the postpandemic era. Will these vulnerabilities embolden nationalist sentiments and lead to the reshoring of supply chains? Or will the crucial role played by globalized networks of production in goods as varied as semiconductors and vaccines compel governments to ensure their continued functioning? One can only speculate.

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2

Trade in Intangible Assets along Global Value Chains and Intellectual Property Protection

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Trade is becoming increasingly intangible, but current trade statistics do not capture the international trade in the services of intangible assets through global value chains (GVCs). The increasing importance of intangibles in international trade has made intellectual property (IP) protection an even greater area of concern. Intangible assets include patents, trademarks, copyrights, brand names, product designs, software, databases, and certain types of business organization structures (Cummins 2005).

International trade along GVCs constitutes a new international division of labor, where lead firms specialize in high value-added tasks, such as research and development (R&D), product design, branding, marketing, and retailing, while non-lead firms are in charge of transforming raw materials, manufacturing parts and components, and assembling and testing final products. Value chain–based modern trade has not only amplified the flow of trade in intermediates but also created a new means of exporting intangible assets, expanded the scope of traditional exchanges of final goods or primary products between nations to include trade in services of intangible assets, and significantly strengthened the role of intangibles in international trade.

This new means of exporting services of intangibles greatly differs from conventional trade in intangible assets, where owners of these assets charge licensing fees or royalties through licensing agreements on a variety of IP, including software, patented technologies, trademarks, and designs. Some intangible assets, such as logistics management skills and organization structures, cannot be codified; in fact, they cannot be sold or licensed. For instance, factoryless manufacturers, such as the Japanese

clothing group Fast Retailing Co. Ltd., British home appliances company Dyson Ltd., and Apple Inc., do not license their IP to third parties. Instead, they use their IP to organize and manage their value chains and outsource all fabrication activities to contract manufacturers. They gain returns on their IP by selling tangible products that are assembled or made by contract manufacturers mostly in the developing world. Multinational corporations (MNCs) prefer to keep their IP in-house because IP protection has limitations even in countries with the best institutions. In fact, this is a major rationale for direct investment—to deploy IP internationally without allowing it to leave the firm. Combining IP with foreign direct investment (FDI) is another way to export services of intangible assets to global customers. Direct investment by Toyota Motor Corp., Mercedes-Benz AG, and General Motors Company are typical examples of these export activities (Fu and Ghauri 2020).

In terms of value added, IP and other intangibles add on average twice as much value as tangible capital to products manufactured and traded along value chains. One-third of the value of products bought come from intangibles, such as technology and branding, and about one-sixth is return on physical capital, which is mostly owned by firms in the developing world. That leaves half of the value added coming from labor (WIPO 2017). These shares are averages; for some hi-tech products and popular brands, the share of IP in value added is much higher. For example, in the iPhone X, Apple's intangible assets embedded in the phone, including the iOS operating system, the design, the Apple logo, and marketing, account for almost 59% of the iPhone's retail price of $1,000 (Xing 2020a). Similarly, Nike Inc. captured an average of 43.8% of the value added of its products sold in the global market with its strong brand, aggressive marketing activities, and innovative designs (Nike 2018).

Despite the importance of intangible assets and their significant contribution to value-chain trade, GVC analysis is focused primarily on tasks related to the manufacture of tangible intermediates and the assembly of parts into final products. Less attention is being paid to the specialized contributions of lead firms, which add value to final products with intangible assets. The popular trade in value added (TiVA) database of the Organisation for Economic Co-operation and Development (OECD) does not include trade in intangibles via GVCs by factoryless manufacturers. The TiVA database, constructed with current trade statistics, simply uses international input–output tables to decompose officially reported gross trade value according to country of origin. Because of this it only covers value added at manufacturing stages, which are just a part of GVCs. Even some studies on servicification within GVCs—Heuser and Mattoo (2017), for example—examine only services, such as finance, logistics, and transportation, embedded at the fabrication and assembly stages of the production process (i.e., services necessary for the production of physical components and final products).

Exports of services of intangibles via GVCs challenge the consistency and applicability of the system for trade statistics to measure the contribution of intangible assets to international trade and national income. Trade statistics are calculated based on the value

of goods crossing national borders: if goods are shipped across a country's border and declared to customs, the shipment is recorded as an export from that country (i.e., the physical crossing of a national border is a necessary criterion for including the value of goods in trade statistics). A case in point: the compilation of the International Trade in Goods Statistics in the European Union depends primarily on customs records, which basically mirror the physical movement of goods across borders (UNECE 2015). Crossing borders, however, is no longer necessary for factoryless manufacturers to export their products to international markets, because all their products are assembled or made by foreign contract manufacturers and shipped to international markets from the country of manufacture.

In the current system, customs officers in home countries cannot trace the international trade activities of factoryless MNCs. Factoryless goods makers also retain the ownership of their products assembled by contract manufacturers before the products are sold to final users (Bayard, Byrne, and Smith 2015). When contract manufacturers ship those products to foreign downstream firms for intermediate or final users in international markets, they only declare the cost of manufacturing to customs. Because of this the value added of intangible assets embedded in those goods is not recorded in the trade statistics of any country even if the goods cross national borders. For example, Foxconn Technology Co. Ltd., a major assembler for Apple, only declares the production cost of iPhones to customs in the People's Republic of China (PRC) when it ships them to the United States (US). Exports in services of the intangibles embedded in tangible products manufactured via the outsourcing activities of MNCs are largely missing in conventional trade statistics (Xing 2020b).

International trade has long been a critical engine of economic growth. The factoryless phenomenon emerged as a result of the aggressive outsourcing activities of MNCs, and it is playing an increasingly important role in the globalized economy (Feenstra and Hanson 1996). Failing to recognize the impacts of factoryless manufacturers on international trade not only leads to a misunderstanding of the trajectory of today's unprecedented globalization but also, more importantly, understates the contribution of value-chain trade to the growth of the world economy. Factoryless manufacturers, such as Apple and Nike, are lead firms of GVCs. The sales of their products in the global market are part of value-chain trade, but those sales either do not cross national borders (as in the case of Nike shoes made in Viet Nam and sold there) or they cross a border only once (e.g., iPhones exported from the PRC to the US). So, strictly defining GVC trade as intermediate exports that cross a border twice (World Bank 2020) undoubtedly underestimates the importance of GVCs in the promotion of trade, industrialization, and economic growth.

Moreover, in the age of GVCs, firms from developing countries primarily specialize in the fabrication of tangible goods. But MNCs in industrialized countries are increasingly specializing in the development of intangible assets. The case of the iPhone (Xing 2020a) and the smile curve of information and communication technology

(Meng, Ye, and Wei 2020; Meng and Ye forthcoming) intuitively show this international division of labor along value chains. The gains of industrialized countries from globalization depend less on physical goods and more on intangible assets. It is estimated that intangible assets account for 27% of income in the manufacture of GVCs in OECD countries (Alsamawi et al. 2020). Developed countries also own most patents and international trademarks. The European Union, Japan, and the US together accounted for 82.5% of patents registered at the three major patent offices in those regions in 2013. The OECD indicator of international intensity of trademarks relative to gross domestic product (GDP) finds that no developing country was in the top 20 from 2010 to 2012 (Durand and Milberg 2018).

The discussion so far clearly shows that failing to count trade in intangibles along GVCs understates the degree to which developed countries benefit from unprecedented globalization. More importantly, it distorts the trade balance between industrialized and developing countries. The evolution of international trade from the classic cloth-for-wine trade to trade in tasks requires a fundamental reform of the method of compilation of trade statistics. For measuring trade activities in the age of GVCs, it is imperative to include the trade in services of intangible assets embedded in physical products. Doing this would give economists and policymakers a more accurate understanding of the role of MNCs in the global economy, enabling them to more accurately assess both the benefits of globalization for developed countries and trade balances between developed and developing countries. It is true that MNCs tend to transfer IP ownership to their foreign affiliates for tax purposes. In these cases, the earnings derived by affiliates from IP are recorded as part of foreign investment income in current accounts, not as exports of IP-related services (Jenniges et al. 2018). But this kind of IP arrangement could render the income of intangible assets invisible in a country's GDP (de Haan and Haynes 2018).

This chapter differs on this point from Alsamawi et al. (2020), Cummins (2005), and Chen, Los, and Timmer (2018), who argue that national account statistics are missing out on a sizable set of intangible assets. This chapter, however, does not intend to challenge the accuracy of national accounts or discuss whether factoryless manufacturers, such as Apple and Nike, should be classified as distributors or manufacturers. Rather, it emphasizes the important role of factoryless manufacturers in 21st century international trade, which is dominated by GVCs. It argues that, for a more accurate understanding of the benefits of value chain–based trade in the age of GVCs, the concept of exports should be expanded from tangible products to include the intangibles embedded in physical products.

Within GVCs, intangible assets determine the roles performed by MNCs and the income they receive. Intangible assets have grown to become a major source of national income for advanced economies, but at the same time their capacity to make physical goods has gradually diminished. IP protection is no longer simply a matter of encouraging innovation; it is more importantly about protecting new sources of income for countries. To coordinate fragmented production processes and maintain the smooth operation of

value chains, GVC lead firms should engage in intensive information exchanges with other firms involved in their value chains. They may have to share technological parameters, product standards, designs, and other information with their suppliers and contract manufacturers to do this. Those information flows entail a risk of appropriation by potential competitors. Because of this IP protection is more critical for value-chain trade than for traditional trade in finished products, where reverse engineering is necessary for imitation (Durand and Milberg 2018). But the advancement of technologies, such as 3D printers, has made the replication of sophisticated technological products increasingly easy and cheap. The quality of a country's institutions for IP protection could therefore determine whether the country could be integrated with GVCs or not.

This chapter focuses on three important issues related to trade in intangibles. First, it addresses the failure of trade statistics to record trade in intangibles via GVCs. Its analysis of official data on imports by Japan and the PRC from the US of laptop computers and mobile phones shows that Apple's sales in the two countries are completely missing from the official trade statistics. The missing export phenomenon is also observed in Nike's sales in the PRC. Examining the case of the iPhone X trade illustrates why conventional trade statistics fail to capture trade in intangibles. It shows that in PRC-US trade, four US factoryless goods producers, Apple, Nike, Advanced Micro Devices Inc. (AMD), and Qualcomm Inc., have derived enormous income from selling to customers in the PRC the services of their intangible assets embedded in tangible goods assembled or produced by their foreign contract manufacturers. Counting that income as a US export to the PRC would substantially increase the figure for US exports in services to the PRC and reduce the calculated trade imbalance between the two countries.

Second, to measure the contribution of all US foreign affiliates to international trade, this chapter introduces a new concept—trade in factor income, or TiFI. This is used to reestimate bilateral trade between the US and the PRC. Using TiFI not only eliminates the double counting issue of conventional trade statistics but also expands the scope of trade from tangible goods to include intangible assets. This approach constitutes a further improvement in the measurement of trade with international input–output tables. The chapter closes with an argument for the importance of IP protection for securing the welfare of developed countries and for expanding the participation of developing countries in GVCs.

Does Apple Export Its Products to Overseas Markets? A Case Study in the Trade of Intangibles

This question may sound strange. In fact, Apple is the world's largest maker of information and communication technology. iPhones, iPads, and iMacs are trendy and globally popular electronic gadgets. In 2018, Apple's sales totaled $153.5 billion in overseas markets, one of the highest figures among US companies (Apple 2018). But despite being a major exporter, trade statistics give a completely different picture of

Apple's role in US exports. In terms of conventional trade statistics, Apple is not seen as a large US exporter. Boeing Co., with $71.0 billion in overseas sales in 2018, less than half of Apple's foreign sales, has long been regarded as the largest US exporter. In fact, Apple does not even appear in the list of the top 100 US exporters compiled by the *Journal of Commerce*.

The passion of Chinese consumers for Apple products turned the PRC into Apple's largest overseas market, with PRC sales of $51.9 billion in 2018 (Apple 2018). But going by official data on PRC imports and exports as a reference, Apple did not export a dollar's worth of goods to the PRC. According to the United Nations (UN) Comtrade Database, a repository of official international trade statistics provided by UN members, the PRC, in 2018, imported $2.6 million from the US in laptop computers, tablets, and other portable data processors, as defined in Harmonized System (HS) 847130. The PRC also imported $1.5 million from the US in mobile phones, as defined in HS851712. In total, the PRC imported $4.1 million from the US in laptop computers, mobile phones, and similar products included in the two HS categories. The definitions of the two categories imply that all Apple products fall into the two groups.

Comparing Apple's sales in the PRC with the official trade statistics presents a puzzle: does Apple actually export its products to that country? Apple's $51.9 billion in sales to the PRC in 2018 is more than 12,000 times larger than the PRC's reported total imports in laptop computers and mobiles from the US in 2018. The disparity between the official trade data and Apple's sales figure is too large to be explained by statistical errors or by Apple's extraordinarily high gross margins. The sales figure includes the income Apple derived from its intangible assets and services, which might exaggerate the disparity. But the gap remains huge even if the cost of producing the goods sold by Apple was used as a basis for the comparison. The production cost of the Apple products sold in the PRC in 2018 was an estimated $32.1 billion, almost 8,000 times the PRC's imports from the US in laptop computers and mobile phones that year. Table 2.1 shows the PRC's imports from the US in laptop computers and mobile phones from 2015 to 2018, and compares them with Apple's annual sales in the PRC, along with the corresponding manufacturing costs. The disparities are significant and prevail for all years. Given all that, the only possible explanation for the disparity is that the official trade statistics do not recognize even one dollar of Apple sales in the PRC as a US export. It is evident that current trade statistics are not capable of recording the flows of value-chain trade and, as a result, a substantial share of exports by US factoryless manufacturers is "missing" from official trade statistics.

Apple's foreign sales are not just missing from the trade statistics tracking bilateral trade between the PRC and the US: they are also missing from the statistics for all US trading partners. A similar phenomenon can be readily observed for Apple's sales in the bilateral trade between Japan and the US. UN Comtrade data show that in 2018 Japan imported $8.7 million from the US in laptop computers and mobile phones, as defined by HS847130 and HS851712. Apple reported, however, that it had $21.7 billion

in sales in Japan, equivalent to 2,500 times reported Japanese imports (Apple 2018). The total manufacturing cost of those Apple products is estimated at $13.4 billion, more than 1,500 times reported Japanese imports. Table 2.2 shows the value of Japanese imports from the US in laptop computers and mobile phones from 2015 to 2018, and compares those figures with Apple's annual sales in the country, along with the corresponding manufacturing costs. A dramatic disparity is immediately visible between reported Japanese imports, Apple's sales, and the manufacturing cost of Apple products during the period. This case adds support to the argument that conventional trade statistics fail to measure trade in intangibles via GVCs.

Table 2.1: People's Republic of China Laptop and Mobile Phone Imports from the United States, and Apple Sales to the People's Republic of China, 2015–2018

Year	A[a] PRC imports from the US in laptops and mobile phones ($ million)	B Apple sales in the PRC ($ billion)	C Manufacturing cost of Apple products sold in the PRC ($ billion)	B/A ('000)	C/A ('000)
2015	1.67	58.72	35.17	35.2	21.1
2016	3.60	48.49	29.53	13.5	8.2
2017	2.98	44.76	27.53	15.0	9.2
2018	4.05	51.94	32.05	12.8	7.9

PRC = People's Republic of China, US = United States.
[a] The sum of the PRC's imports from the US in Harmonized System 847130 and 851712.
Source: Y. Xing. 2021. Factoryless Manufacturers and International Trade in the Age of Global Value Chains. *GRIPS Working Paper*. DP 21-02. Tokyo: National Graduate Institute for Policy Studies.

Table 2.2: Japan Laptop and Mobile Phone Imports from the United States, and Apple Sales to Japan, 2015–2018

Year	A[a] Japanese imports from the US in laptops and mobile phones ($ million)	B Apple sales in Japan ($ billion)	C Manufacturing cost of Apple products sold in Japan ($ billion)	B/A ('000)	C/A ('000)
2015	7.30	15.71	9.41	2.2	1.3
2016	8.61	16.93	10.31	2.0	1.2
2017	8.24	17.73	10.91	2.2	1.3
2018	8.69	21.73	13.41	2.5	1.5

US = United States.
[a] The sum of Japan's imports from the US in Harmonized System 847130 and 851712.
Source: Y. Xing. 2021. Factoryless Manufacturers and International Trade in the Age of Global Value Chains. *GRIPS Working Paper*. DP 21-02. Tokyo: National Graduate Institute for Policy Studies.

The missing export phenomenon is also present in trade in labor intensive goods, such as apparel and footwear. According to the UN Comtrade Database, the PRC, in 2018, imported $209.3 million in apparel and footwear from the US, as defined by HS62 and HS64. Comparing this figure with Nike sales in the PRC raises the parallel question: does Nike export its products to the PRC? This is after all Nike's largest overseas market. In 2018, Nike sold $5.1 billion in athletic apparel and footwear to consumers in the

PRC, almost 25 times the PRC's apparel and footwear imports from the US that year, as reported by official trade statistics. It is estimated that the total manufacturing cost of those Nike products is about $2.9 billion, roughly 14 times the value of the PRC's imports reported by the official trade statistics (Xing 2021). The HS62 and HS64 definitions imply that Nike products should be classified into the two categories by trade statistics if they were shipped to the PRC from the US. Table 2.3 shows the PRC's apparel and footwear imports from the US during 2015–2018, along with Nike's sales in the PRC and the corresponding manufacturing costs. The huge gap between the PRC's import figures and Nike's sales figures is visible over all 4 years. Nike is the largest seller of athletic footwear and apparel in the world. Nike's statement that "virtually all Nike products are manufactured by independent contractors. Nearly all footwear and apparel products are produced outside the United States" (Nike 2018) explains why, according to conventional trade statistics, Nike's sales in the PRC add nothing to US exports to the PRC.

Table 2.3: People's Republic of China Apparel and Footwear Imports from the United States, and Nike's Sales to the People's Republic of China, 2015–2018

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

PRC = People's Republic of China, US = United States.
Sources: Y. Xing. 2021. Factoryless Manufacturers and International Trade in the Age of Global Value Chains. *GRIPS Working Paper*. DP 21-02. Tokyo: National Graduate Institute for Policy Studies.

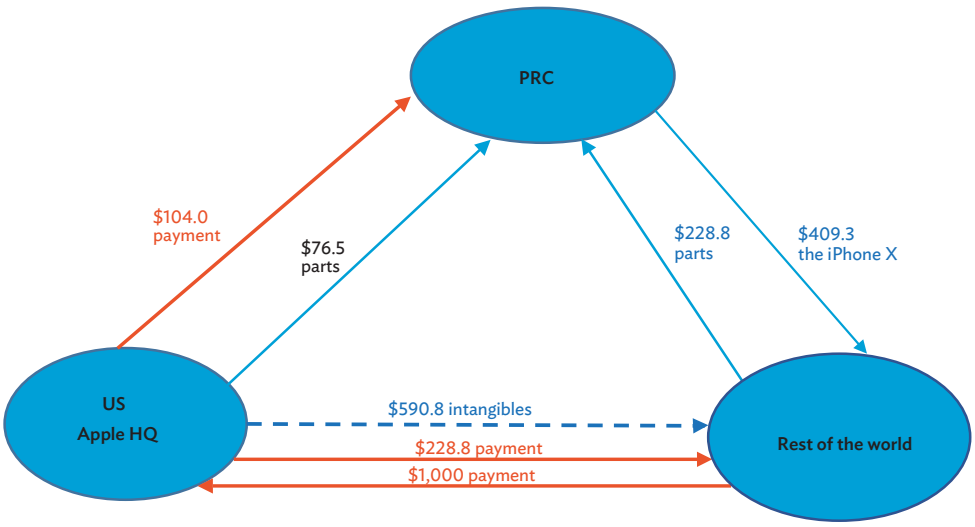
Exporting without Crossing Home Borders: The Case of the iPhone X

Two major reasons explain the inconsistency between the picture depicted by trade statistics and the reality that Apple exports billions of dollars in consumer goods yearly to foreign destinations. First, almost all Apple products sold in overseas markets are assembled in and shipped from factories outside the US, (i.e., they do not cross US borders to enter international markets). As a result, they are not regarded as US exports by the customs of any country. For example, all Apple products sold in the PRC are shipped directly from the company's contract manufacturers Foxconn, Luxshare Precision Industry Co. Ltd., Pegatron Corp., and Wistron Corp., which are all in the PRC. Second, even if Apple products were counted as exports of the manufacturing countries—for example, the iPhones exported from the PRC to Japan—the value added associated with Apple's intangible assets and services would not be counted as part of these exports. This is explained by Apple's contract manufacturers having no

ownership of these products; they are only responsible for the assembly of ready-to-use Apple products. The contract manufacturers only declare the manufacturing costs of the assembled Apple products to customs when they ship them abroad. Hence, the value added of Apple's intangible assets embedded in all its products is not recorded by customs in any country, a clear-cut case of a vanished US export.

The export of an iPhone X can be used for an intuitive explanation of the inability of conventional trade statistics to trace trade in intangibles via GVCs. Assume the iPhone X is sold in the rest of the world, not in the PRC or the US. Figure 2.1 shows trade and income flows between the PRC, the US, and the rest of the world for the manufacture and sale of the iPhone X, which retails at $1,000. A teardown analysis reveals the production cost (the cost of all parts and assembly service) totals $409.3 to which Apple adds $590.8 in intangible assets: the iOS operating system, the brand, product design, and marketing and retail networks (Xing 2020a). To make an iPhone, Foxconn in the PRC imports $76.5 worth of parts and components from the US and $228.8 from the rest of the world. As a result, the sale of a $1,000 iPhone X represents a total export volume of $714.6 for the world economy—$305.3 in parts exported to the PRC plus the $409.3 iPhone X exported by the PRC. It must be emphasized that trade statistics report only the $76.5 in parts shipped directly from the US to the PRC as a US export, about one-tenth of the total export value generated by the sale of a $1,000 iPhone X abroad. Clearly, the trade statistics greatly underestimate the actual US export value of an iPhone sale.

Figure 2.1: Mismatch between iPhone X Trade and Income



HQ = headquarters, PRC = People's Republic of China, US = United States.
Note: Blue lines indicate flows of goods associated with the production and export of the iPhone X; red lines denote corresponding flows of income.
Source: Y. Xing. 2020. How the iPhone Widens the US Trade Deficit with China: The Case of the iPhone X. *Frontiers of Economics in China*. 15 (4). pp. 642–658.

Figure 2.2 shows the income flows, denoted by the red lines, do not match the trade flows. More specifically, (i) the PRC received only $104.0 for the assembly service and parts made in the country, despite the reported $409.3 export; (ii) trade statistics show the PRC imported $305.3 in parts from the US and the rest of the world for assembly of the iPhone X, but there is no corresponding income flowing from the PRC to those regions, because Apple paid its suppliers in the US and the rest of the world directly; and (iii) as a result of selling the iPhone X in the rest of the world, the US received $1,000 in income from abroad, but there is no trade flow corresponding to the $1,000 received. This analysis of iPhone trade clearly shows that conventional trade statistics only capture the value of physical goods crossing borders, and cannot trace exports in services of intangible assets embedded in physical goods. Those statistics fail to reflect the "exports" of the services of the intangible assets embedded in tangible goods.

Trade in Intangibles between the People's Republic of China and the United States

US Census Bureau data show the US had a $420 billion trade deficit in commodity trade with the PRC in 2018, accounting for almost half of the total US trade deficit in goods. That persistent and rising trade deficit trigged an ongoing trade war between the two countries. Besides macroeconomic factors, such as differences in savings rates, the inconsistency between current trade statistics and value chain–based modern trade is one of the major factors for the apparently huge trade imbalance between the two. A few studies (e.g., Xing and Deter 2010; Koopman, Wang, and Wei 2014; Xing 2020a) show the foreign value added in US figures on PRC exports greatly exaggerates both the PRC's exports and its trade surplus with the US. While foreign value added inflates the PRC's bilateral trade surplus, the emergence of factoryless goods producers has resulted in US exports to the PRC being underestimated. By outsourcing all fabrication tasks to foreign contract manufacturers, many US firms have adopted a new business model for marketing their products in the PRC. Instead of selling made-in-US goods, they sell products with US brands, designs, and technologies that are made or assembled in the PRC or third countries.

Every year, US factoryless manufacturers sell billions of dollars of tangible products, such as iPhones, Nike shoes, AMD central processing units, and Qualcomm chipsets, in the PRC and earn billions in income from that market as a return on their intangible assets and services. In 2018, Apple's net sales in the PRC totaled $51.9 billion; Qualcomm's $15.1 billion, Nike's $5.1 billion, and AMD's $2.5 billion. The total PRC revenue of the four companies was $74.6 billion. The extraordinarily high gross profit margins—43.8% for Nike's products and 55.0% for Qualcomm's—show the US companies captured a significantly large share of the value added of the products sold in the PRC. What Chinese customers actually buy from those factoryless manufacturers are the services of their intangible assets embedded in tangible goods assembled and produced by foreign contractors. These activities, however, are not treated as US exports to the

PRC because conventional trade statistics are designed for the classic cloth-for-wine trade, not value chain–based modern trade. Compared with exports of agricultural products and airplanes, exports in services of intangible assets via GVCs create both jobs and income for the US economy—and hence they should be considered as a new type of export in the age of GVCs.

Table 2.4 shows the estimated income earned by Apple, Nike, AMD, and Qualcomm on their intangible assets through the sale of tangible goods in the PRC. It is worth emphasizing that the estimated income includes neither the value added by their contract manufacturers, such as TSMC, nor that by local service staff in the PRC.[1]

Table 2.4: Income by Apple, Nike, Advanced Micro Devices, Qualcomm from Intangibles in the People's Republic of China, 2018
($ billion)

Company	Apple	Nike	AMD	Qualcomm	Total
Sales in PRC	51.9	5.1	2.5	15.1	74.6
Income on intangibles	18.3	1.4	0.8	7.4	27.9

AMD = Advanced Micro Devices Inc., PRC = People's Republic of China.
Source: Y. Xing. 2021. Factoryless Manufacturers and International Trade in the Age of Global Value Chains. *GRIPS Working Paper*. DP 21-02. Tokyo: National Graduate Institute for Policy Studies.

As Table 2.4 shows, of Apple's total $51.9 billion sales in the PRC, the company earned $18.3 billion, which represents the payment for its intangible assets, such as the Apple brand, iOS operating system, product design, marketing activities. In terms of bilateral payments, the $18.3 billion is part of the payment made by Chinese consumers for the services of Apple's intangible assets. Nike derived an estimated $1.4 billion from the PRC as a return on its brand, design, and marketing activities. Of Qualcomm's $15.1 billion PRC sales, $7.5 billion can be attributed to the value added by its intangible assets. In all, the four factoryless manufacturers earned a total of $27.9 billion by selling the services of their intangible assets to Chinese customers. The international division of labor along value chains, as illustrated by the iPhone (Xing and Detert 2010; Xing 2020a) and the smile curve (Meng and Ye forthcoming), suggests that MNCs from developed countries generally specialize in the tasks of creating intangible assets, while firms from developing countries perform the tasks of material fabrication and product manufacturing. "Trade in tasks" refers to the international use of services of intangible assets in the manufacture of tangible products. Hence, from the perspective of value-chain trade, the $27.9 billion constitutes 2018 exports to the PRC by the four US companies.

US Census Bureau data show the US exported $57.1 billion in services to the PRC in 2018. If the income derived by the four US companies from the PRC was classified as US exports to the PRC in services, its service exports to the PRC would increase by 48.9% to $85.0 billion, and its overall trade balance (goods and services) with the PRC would shrink by 7.3% to $352.1 billion (Table 2.5).

[1] See Xing (2021) for details of the methodology used in this estimation.

Table 2.5: United States Factoryless Manufacturers and Their Trade with the People's Republic of China
($ billion)

US Services Exports to PRC			US Trade Deficit with PRC[a]		
Official	Adjusted for factoryless manufacturers	Change	Official	Adjusted for factoryless manufacturers	Change
57.1	85.0	48.9%	(380.0)	(352.1)	7.3%

( ) = negative, PRC = People's Republic of China, US = United States.
[a] Includes trade in goods and services.
Source: Y. Xing. 2021. Factoryless Manufacturers and International Trade in the Age of Global Value Chains. *GRIPS Working Paper*. DP 21-02. Tokyo: National Graduate Institute for Policy Studies.

Clearly, adding the services exports of intangibles by the four US factoryless manufacturers would substantially increase the volume of US exports to the PRC and reduce the trade deficit. This is not a simple statistical trick for artificially narrowing the trade imbalance between the two countries: it is the adjustment necessary to make trade statistics appropriate for GVC trade. In a nutshell, recognizing the income derived by US factoryless manufacturers from their intangibles as part of US exports should narrow the trade gap and significantly mitigate the bilateral trade imbalance. The logic for this adjustment in the current reporting practice is straightforward. When Chinese consumers and firms buy their products, such as iPhones, Nike shoes, Qualcomm chipsets, and AMD central processing units, they pay not only for the production costs of these products, but, more importantly, also for the value added of intangible assets embedded in the physical goods. Ignoring the income of US factoryless manufacturers from their PRC sales not only greatly understates the benefits of the US trading with the PRC but also surely distorts calculations of the bilateral trade balance.

Trade in Factor Income between the People's Republic of China and the United States

An important objective of exports is to derive income from foreign markets. Exporting products directly to foreign countries, building factories abroad, and outsourcing production to foreign contract manufacturers are different business models, but they have the same objective: making profit. The four US companies discussed in the previous section are only a small part of the overall picture of US multinational companies exporting services of intangibles via GVCs. As mentioned earlier, FDI combined with IP is a popular means of earning returns on intangible assets in the global market. For example, an estimated 90% of the market value of the S&P 500—the 500 largest firms on the US stock market, most of which are involved in international trade—came from intangible assets in 2020 (Ocean Tomo 2020).

The proliferation of GVCs has blurred the difference between direct investment and international trade. The complexity and sophistication of GVCs due to the increasing inter- and intra-firm trade in intermediate goods and services, which may cross national borders multiple times, has also made it difficult to determine "who creates what for

whom?" and "who gets factor income and from where?" For example, a large number of US brand goods (e.g., Tesla Inc.'s PRC-made Model 3 vehicles) are produced by US firms invested in the PRC and sold in that market via FDI channels. Those sales are treated as domestic transactions in the PRC. In conventional international trade statistics, none are regarded as a US export to the PRC. Profits associated with those sales are also counted as part of the PRC's GDP. From the viewpoint of factor income, however, the return on both tangible and intangible capital embodied in those sales undoubtedly belongs to US-owned firms. If those products are sold on the Japanese market, conventional trade statistics will treat them as PRC exports to Japan—none will be regarded as US exports to Japan. Clearly, current trade statistics are defined by territory (country borders) rather than the ownership of factor income, which causes a "what you see (domestic sales or trade flows) is not what you get (income)" problem in mapping GVCs.

To overcome this, a new measure of trade—trade in factor income (TiFI), proposed by Meng et al. (2021), should be considered. TiFI is based on a new intercountry input–output model that considers firm ownership information and FDI channels. It takes advantage of both teardown-type case studies (e.g., Xing 2020a) with explicit consideration of the investments of MNCs and trade activities around the world and the intercountry input–output model based on the trade in value added (TiVA) measure for removing all double counting (Koopman, Wang, and Wei 2014; WTO 2017; OECD 2019). TiFI defines the US-owned factor income induced by the PRC's final demand as US exports to the PRC. It can also be seen as a kind of "beyond border" trade measure that extends the concept of commercial presence used in measuring trade in services to include goods (WTO 1994). Using TiFI can therefore significantly improve the understanding of the nature and distribution pattern of factor income along complex GVCs.

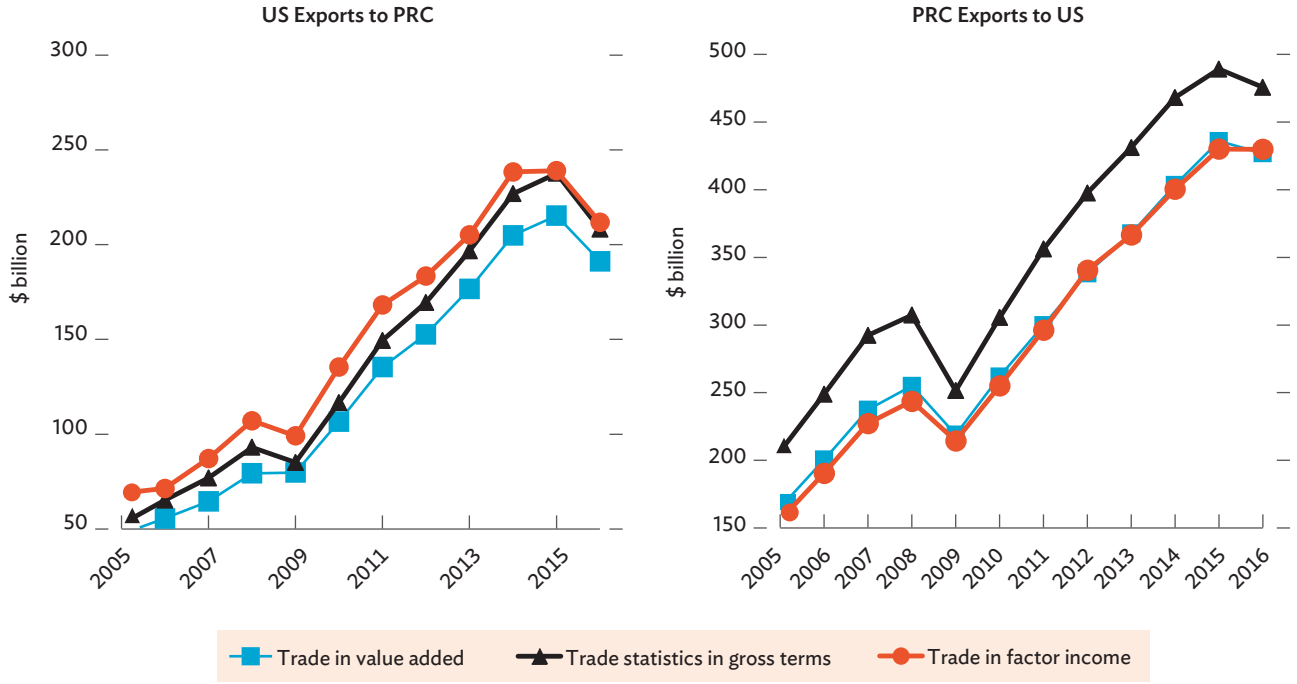
In the context of PRC-US trade, TiFI defines US exports to the PRC as the income belonging to US-owned factors and induced by the PRC's final demand. US-owned factor income includes the return on the tangible and intangible assets of US-owned firms within and outside the US via FDI channels, US domestic labor compensation, and net US government taxes. The PRC's exports to the US are PRC-owned factor income induced by US final demand. PRC-owned factor income includes the same three elements as US-factor income.

With these newly defined concepts of exports, the trade balance between the US and the PRC can be reestimated. [2] Figure 2.2 shows three different measures of the bilateral trade between the two countries from 2005 to 2016: (i) gross trade flows; (ii) TiVA and TiFI based on the OECD's Activities of Multinational Enterprises database, including intercountry input–output tables split according to firm ownership (Cadestin et al. 2018); and (iii) this chapter's estimation of sectoral and bilateral FDI data (Meng et al.

[2] The treatment of factor income, especially the return to capital associated with trade, is different from the concept of national income in the national accounting system. For example, the return to the capital gain of US-owned firms in the PRC is, by definition, part of the PRC's GDP. Most of that capital gain may be added to the PRC's gross national income, but capital gains are generally owned and controlled by US-owned firms. TiFI emphasizes the owner who essentially controls the firm rather than the firm's location.

2021). US exports to the PRC in TiFI terms are on average 20.3% (ranging from 49.4% in 2005 to 10.7% in 2016) higher than in TiVA and 8.2% (ranging from 31.8% in 2005 to 0.6% in 2016) higher than in traditional gross terms. PRC exports to the US in TiFI terms are on average 1.6% (ranging from 5.1% in 2005 to 0.7% in 2016) lower than in TiVA and 16.0% (ranging from 24.2% in 2005 to 9.6% in 2016) lower than in traditional gross terms.

Figure 2.2: Bilateral Trade between the People's Republic of China and the United States by Three Different Measures, 2005–2016

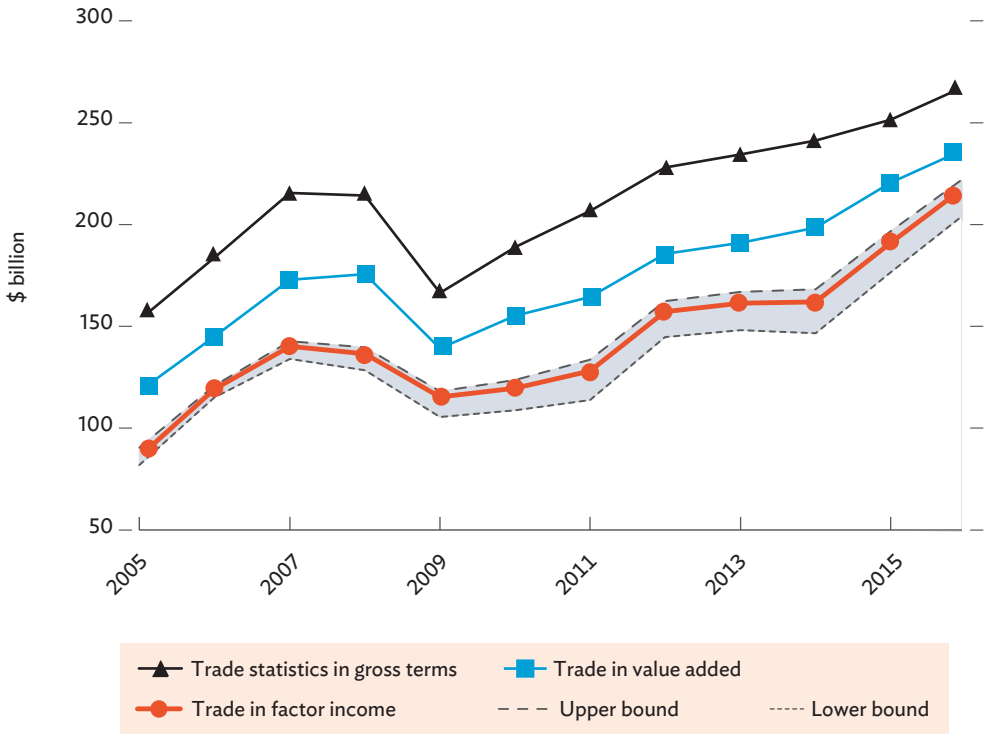


PRC = People's Republic of China, US = United States.
Source: B. Meng, Y. Gao, J. Ye, M. Zhang, and Y. Xing 2021. Trade in Factor Income and the US-China Trade Balance. *IDE Discussion Paper*. No. 819. Chiba, Japan: Institute of Developing Economies – Japan External Trade Organization.

Using the estimates in Figure 2.2, the PRC-US trade balance can be calculated in terms of TiFI and compared with calculations of the trade balance using other measures. Figure 2.3 shows the PRC's trade surplus with the US, measured using TiFI, is about 68.0% of that measured by gross trade volumes on average from 2005 to 2016. Compared with the trade surplus computed with TiVA, which supposedly removes the distortion associated with foreign value added, the bilateral trade balance measured by TiFI was 17.4 % smaller on average during the period.[3]

[3] Besides the TiFI measure, some approaches also attempt to investigate the US-PRC trade balance in income terms. For example, Li et al. (2018) show the PRC's trade surplus with the US in national income terms was 61% smaller in gross terms and 22% smaller in value-added terms in 2012. Bohn, Brakman, and Dietzenbacher (2021) show the US trade deficit with the PRC in income terms was 82% of that in value-added terms in 2014. The approach of Li et al. (2018), however, is based on a single national income–output model without explicit consideration of double counting of intermediates via GVCs, although they separate each sector in the PRC input–output tables used by domestic and foreign-invested companies. The approach of Bohn, Brakman, and Dietzenbacher (2021) is based on a world input–output model, but they do not explicitly consider the difference of production functions (technologies) between domestic- and foreign-owned firms within the same sector of the input–output system.

Figure 2.3: Trade Surplus between the People's Republic of China and the United States by Three Different Measures, 2005–2016

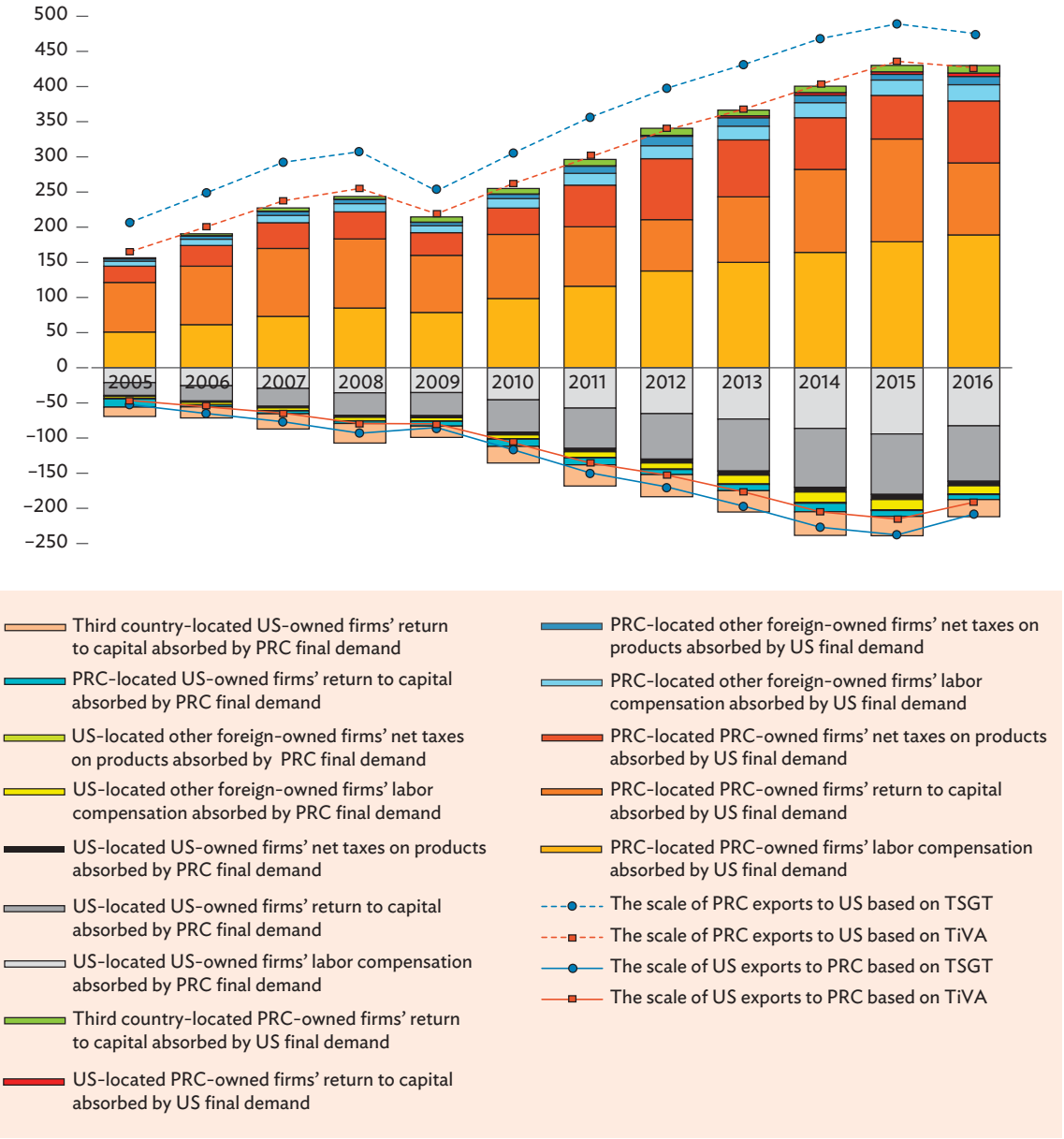


Note: The upper and lower bounds give the confidence interval of the estimation according to different technologies adopted by foreign-invested firms in the foreign-direct-investment host countries.
Source: B. Meng, Y. Gao, J. Ye, M. Zhang, and Y. Xing 2021. Trade in Factor Income and the US-China Trade Balance. *IDE Discussion Paper*. No. 819. Chiba, Japan: Institute of Developing Economies – Japan External Trade Organization.

These phenomena are presented in detail in Figure 2.4, which shows the sources of the TiFI-based PRC-US trade surplus by different factors. The figure shows the value added of PRC-located and PRC-owned firms and that of US-located and US-owned firms are the main components of the PRC-US trade balance. These two factors play, by definition, the same role in determining the conventional TiVA-based PRC-US trade balance. Therefore, the main difference between TiFI and TiVA for measuring the bilateral trade balance is in the treatment of the return to capital of each country's MNCs located overseas. Based on this chapter's definition of TiFI, the return to capital of PRC-located US-owned firms absorbed by the PRC's final demands is treated as a US export to the PRC, which are considered to be domestic transactions in the conventional TiVA measure. The return to capital of US-owned firms located in third countries absorbed by the PRC's final demands is also treated as a US export to the PRC in TiFI and designated as the value-added exports of third countries to the PRC in the conventional TiVA measure. The considerable difference between TiFI and the calculation of the TiVA-based approach in terms of measuring the US-PRC trade balance using TiFI is therefore mainly due to the huge presence of US-owned MNCs along GVCs that earn more factor income from their tangible and intangible capital in overseas markets than PRC-owned firms (Figure 2.4). In addition, as Figure 2.3 shows, the TiFI-based estimation of the PRC-US trade surplus in 2016 is close to the estimation using the conventional TiVA-based approach. This could be explained by the convergence of the

two measures being the result of the return to capital of PRC-owned MNCs in overseas markets, induced by increasing US final demand and decreasing the return to capital of US-owned MNCs in overseas markets, induced in turn by the PRC's final demand.[4]

Figure 2.4: Trade Surplus Sources between the People's Republic of China and the United States According to Trade in Factor Income



PRC = People's Republic of China, TiVA = trade in value added, TSGT = trade statistics in gross terms, US = United States.
Source: B. Meng, Y. Gao, J. Ye, M. Zhang, and Y. Xing 2021. Trade in Factor Income and the US-China Trade Balance. *IDE Discussion Paper*. No. 819. Chiba, Japan: Institute of Developing Economies – Japan External Trade Organization.

[4] Once returns to capital are divided into tangible and intangible parts, as done by Alsamawi et al. (2020), intangible assets are divided into more detailed categories, as done by Fu and Ghaur (2021). Knowledge stocks of R&D expenditure are considered intangible assets in a dynamic input–output system, as done by Kuroda and Huang (2020). More policy-oriented research needs to be done on these aspects.

Protecting Intellectual Property in the Age of Global Value Chains

Intangible assets play a critical role in GVCs. As highlighted earlier, they are the only source of income for factoryless goods producers, such as Apple and Nike. Trade in tasks between developing and industrialized countries primarily means exchanging fabrication services for the services of intangible assets. Trading IP services through GVCs is proving to be a boon to IP owners. To date, the capital stock of MNCs from advanced economies consists primarily of IP (brands, trademarks, patents, in-house knowledge), and the contribution of MNCs to GVCs consists primarily of services from those intangible assets. Because the role of IP in GVCs is large and growing, a full understanding of GVCs is not possible without studying IP and related issues. Take, for example, the firms in the S&P 500: most are involved in GVCs, with an estimated 90% of their market capitalization coming from IP (Ocean Tomo 2020). In other words, most of the value of large MNCs is in their patents, brands, and other intangible assets, since they do not own much capital stock. Because an estimated 90% of their capital stock is IP, roughly 90% of their profits are a return on IP. The overseas earnings of US MNCs are about $500 billion per year: 90% of that is $450 billion, so overseas royalties plus overseas profits on IP total about $580 billion a year for US firms, equivalent to one-quarter of their total corporate profits.[5] Hence, the use of IP in GVCs is a key business line of MNCs and significantly increases their incentive to do R&D and to innovate. Without GVCs, MNCs in advanced economies would earn much less from their innovations.

Pharmaceuticals, machinery, and electronics are among the sectors in which GVCs are knowledge-intensive—and it is particularly in those sectors that IP rights protection is key. Automobiles and textiles are less knowledge-intensive, but they, too, are becoming more knowledge-intensive. From 2000 to 2016, all sectors in Figure 2.5 increased the share of their revenue derived from creating new IP through R&D and acquisitions. Overall, that share rose from 5.4% of revenue in 2000 to 13.1% in 2016. This trend is most apparent in certain sectors: machinery and equipment firms spent 36% of their revenue on R&D and intangibles; those in pharmaceuticals and medical devices spent 80%.

The growing emphasis on knowledge and intangibles favors countries with highly skilled labor, strong innovation and R&D capabilities, and robust IP protection. The rise in knowledge-intensive production and trade has been accompanied by an increase in trade in services, both direct and indirect. In 2017, gross trade in services totaled $5.1 trillion, dwarfed by the $17.3 trillion in global goods trade. Even so, trade in services has grown by more than 60% than trade in goods over the past decade (McKinsey 2019). The IP charges of some subsectors, including telecommunications, information technology, and business services, are growing two to three times faster.

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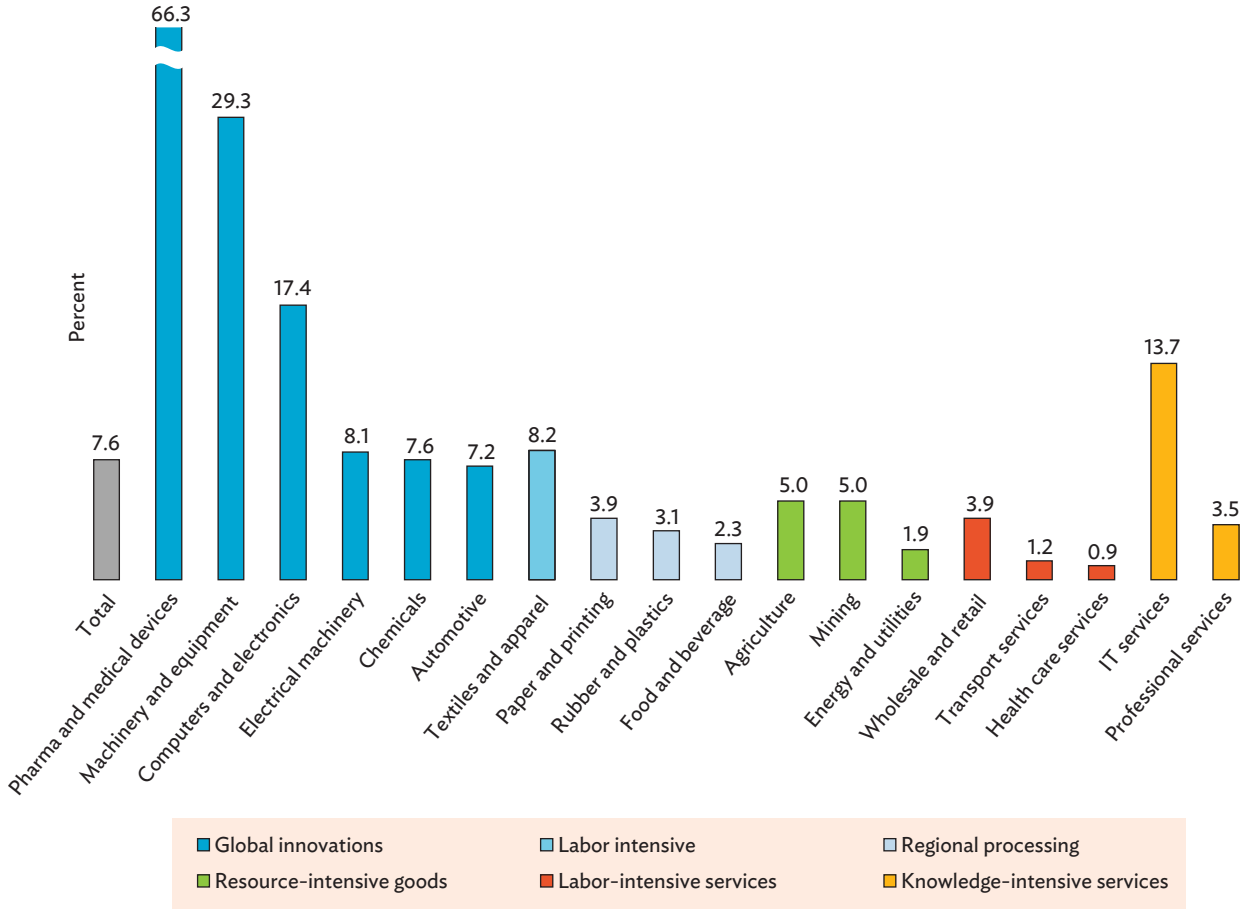
5 For more information, see Ernst & Young LLP. TaxNews Update. 29 May 2019. https://taxnews.ey.com/news/2019-1010-us-multinational-enterprisesrepatriated-a-record-665-billion-of-foreign-earnings-in-2018#:~:text=In%20its%20March%2027%2C%202019,to%20%24155%20billion%20in%202017.

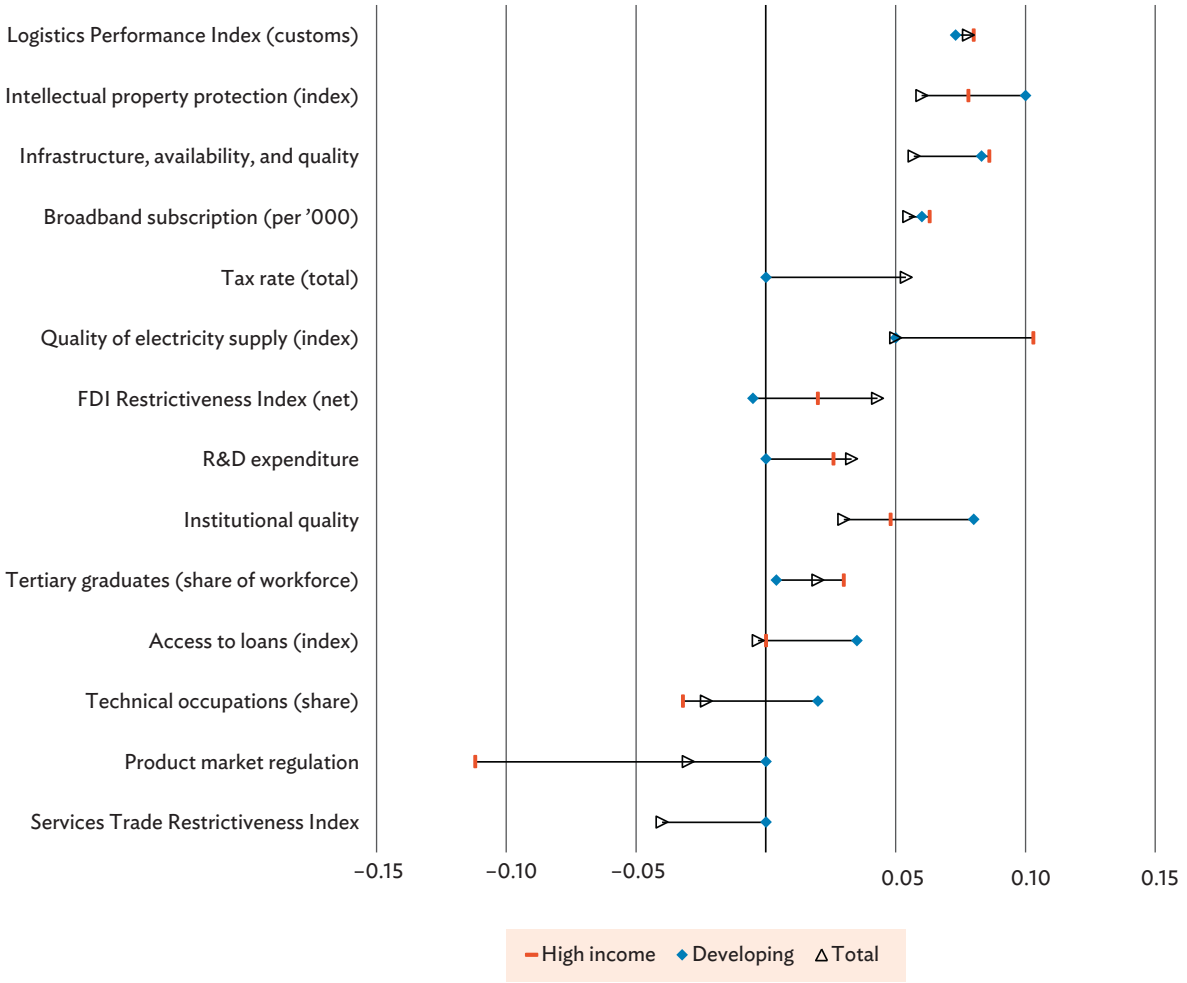
Figure 2.5: Knowledge Intensiveness of Global Value Chains—Change in Capitalized Spending on Intangibles as a Share of Revenue, 2000–2016[a]



IT = information technology, R&D = research and development, SG&A = selling, general and administrative expense.
[a] Intangibles include brands, software, and other intellectual property, capitalized based on the R&D and SG&A of about 24,500 nonfinancial companies, assuming a depreciation rate of capitalized SG&A at 20% and capitalized R&D at 15%. Capitalized expenses as of 2000 estimated based on multiplier to annual expenses from R. H. Peters and L. A. Taylor. 2017. Intangible Capital and the Investment-q Relation. *Journal of Financial Economics*. 123 (2). pp. 251–272. This uses different multipliers depending on company age.
Source: Authors based on McKinsey. 2019. *Globalization in Transition: The Future of Trade and Value Chains*. McKinsey Global Institute.

Since MNCs deploy their IP internationally, including in developing countries, they are naturally concerned about the protection of their IP rights. The International Property Rights Index 2020 shows that IP rights are generally very good in advanced economies and fairly good in most developing countries. The PRC scores modestly better than other large emerging markets, including Brazil, India, Indonesia, Mexico, Thailand, and Viet Nam. An OECD study examining key factors that affect GVC participation for advanced and developing economies found that IP rights protection is the single most important factor of GVC participation in developing economies, followed by quality and availability of infrastructure, institutional quality, and logistics (Kowalski et al. 2015) (Figure 2.6). This makes sense: to operate effectively, foreign investors need reasonably good infrastructure, logistics for moving goods in and out, and protection of their main asset—their intangible property.

Figure 2.6: Factors Affecting Global Value Chain Participation in Advanced and Developing Economies



FDI = foreign direct investment, R&D = research and development.
Source: Authors based on P. Kowalski, J. L. Gonzalez, A. Ragoussis, and C. Ugarte. 2015. Participation of Developing Countries in Global Value Chains: Implications for Trade and Trade-Related Policies. *OECD Trade Policy Papers*. No. 179. Paris: Organisation for Economic Co-operation and Development.

Building strong IP protection is increasingly important in the age of intangibles. Advanced economies have a strong interest in IP rights protection globally because they want their firms to collect the maximum rent on their intangible assets. It also needs to be recognized that the interests of developed countries are substantially different from those of developing ones. Developing countries have an interest in implementing sufficiently strong IP rights protection to attract foreign investment, including in hi-tech sectors, but much of their benefit from an open development strategy comes from advanced technologies (i.e., diffusion to their own firms). This is a natural process that goes back at least to the 18th century, when US firms appropriated textile technology from Great Britain. Developed countries, however, own most of the IP in the world and benefit from the strongest IP rights protection possible. For example, advanced economies favor long-term patents for pharmaceuticals; developing countries favor shorter-term patents. The COVID-19 pandemic illustrates this tension. Firms in advanced economies moved quickly to develop effective COVID-19 vaccines. Leading developing economies, including India and South

Africa, proposed that World Trade Organization–based patent protection on those vaccines be waived. The proposal is still under discussion and that no consensus has been achieved yet. This is a good start on meeting the vaccine requirements of the developing world, but it is far from sufficient (Box 2.1).

Box 2.1: The Debate Over Waiving Patents for COVID-19 Vaccines

The effort to vaccinate the world against COVID-19 is a real-world example of the debate over strengthening versus weakening intellectual property (IP) rights protection for key technologies. The most effective vaccines against COVID-19 have been developed by pharmaceutical companies in developed countries.

As of summer 2021, most jabs had been delivered in rich countries; poor countries lagged far behind in both access and distribution. India and South Africa have proposed a waiver of the patents on and the compulsory licensing of these vaccines so that production in the developing world can quickly ramp up. This is a hotly debated issue with good arguments on both sides:

Arguments in favor of waiving patents and compulsory licensing (Mazzucato, Ghosh, and Torreele 2021):

(i) IP rights were never designed for use during a health emergency. General exceptions have been made in the past to ensure patents are not a barrier to public health, for example, the exception for penicillin production during the Second World War.
(ii) Epidemic-response research and development has never relied on classic market-based incentives, such as patents. Rather, the main drivers have been government research funding and advance-purchase commitments aimed at defraying risk. Massive public investments have reduced industry risk from these efforts.
(iii) In a pandemic, it is imperative to remove as many barriers as possible to increase production, and patents are a fundamental and far-reaching obstacle.

Arguments for respecting patents (McMurry-Heath 2021):

(i) The proposal to waive IP protection undermines the very system that produced the life-saving science in the first place. Moreover, it weakens the incentive for companies to take risks in their efforts to find solutions when the next health emergency arises.
(ii) The fastest-developed COVID-19 vaccine (Pfizer Inc.'s) was created without government funding, and the timelines for all the vaccines developed by industrialized countries were dramatically shortened by private contributions—funding for labs, clinical-trial infrastructure, and the know-how needed to defeat the pandemic, amassed through decades of private investment and fueled by assurances of IP protection for discoveries made along the way.
(iii) IP is the magic bullet that turns ideas into products. It also increases productivity by providing the legal certainty that enables companies to collaborate globally. It is the licensing of technology, not the abrogation of patents, that in the case of COVID-19 gets jabs.
(iv) The scarcity of vaccines is not the result of IP concerns, but due to regrettable failures to tackle production and distribution challenges.

There is no simple right or wrong in this debate. It is likely that in the case of COVID-19 waiving patents would accelerate getting to grips with the pandemic, but it could well lead to a lessening of innovation in the future. This is the trade-off that the world has to confront.

Ideally, developing economies want to see their firms become owners of technology and brands. As a first step to this, the use of foreign knowledge acquired through direct investment enhances the productivity of workers, accelerates growth, and leads to spillover to domestic firms that become the suppliers of foreign firms. According to the International Monetary Fund, using foreign knowledge led to an additional 0.4 percentage points of labor productivity growth from 1995 to 2003 (Aslam et al. 2018). That quantitative effect then nearly doubled to 0.7% from 2004 to 2014, when developing countries experienced more than twice as much productivity from foreign knowledge than from their own R&D. This is indirect evidence that during this period GVCs were expanding and becoming more knowledge-intensive. Foreign knowledge for

production can be acquired through numerous ways: by licensing advanced technology, through inward direct investment, by legal diffusion of technologies (since IP rights are not meant to be permanent or complete), and IP theft.

Beyond the use of foreign knowledge in production, middle-income countries naturally aspire to move up the technological ladder and build their own domestic capabilities. This can also be encouraged through GVCs if nations are willing to embrace the tougher IP demands under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (Athreye, Piscitello, and Shadlen 2020). As MNCs become willing to locate their production in different countries, industrialists in those countries, hoping to become part of a GVC, may be willing to conform to the IP standards required by MNCs—and often with more stringent enforcement (Brandl, Darendeli, and Mudambi 2019). In fact, the tightening of IP regulations and the deeper integration between countries through the convergence of regulatory standards (Rodrik 2018) occurs in parallel with the expansion of GVC trade (Timmer et al. 2014). This led Chang (2002) and other scholars to protest that the stronger and more effective institutions for IP rights protection demanded of developing countries are not fair, because they are merely an attempt to "kick away the ladder" to prevent these countries from joining the elite club of developed nations. The PRC's rise shows, however, that opening up to MNCs and GVCs can be an effective strategy for technological development. Indeed, the PRC's rapid growth and the effect of its prosperity on the growth of middle- and low-income countries is testament to the success of these strategies, although, as Gomory and Baumol (2001) point out, such a strategy can create conflicts when incumbent countries feel that their market share is threatened.

Beyond the PRC's participation in GVCs, the country has adopted policies to force foreign MNCs to transfer strategically sensitive technologies to local firms (Branstetter 2018). These policies are a key component of the PRC's long-standing ambition to see its national champions replace the firms of industrialized countries currently at the forefront of core technologies. In many cases, technology transfers are required by the PRC's FDI regime, which closes off important sectors of the economy to foreign firms unless they enter into joint ventures with local entities that they do not control. In response, the US has taken unilateral actions to tighten technology transfer from outward investment (Lester and Zhu 2020). For instance, the Foreign Investment Risk Review Modernization Act, 2018 and related implementing regulations are designed to enhance the screening of PRC investments in many sectors. This will make it more difficult for PRC companies to invest in the US and it probably strengthened curbs on the practice in the PRC of acquiring technology through foreign investment. The US can also use its sanctions power to prevent US companies from investing in strategic sectors in the PRC. It remains to be seen whether the technology war between the US and the PRC will have a material effect on GVCs. It is not only the US that has pushed back against the PRC's technology policies. The European Union reached an investment agreement with the PRC in December 2020 that, among its provisions, prohibits forced technology transfer and strengthens IP rights protection.

Various strands of research indicate that the optimal IP rights regime for attracting foreign technology depends on stage of development. Gentile (2020) finds that licensing foreign technology is more likely with better property rights in place, but only in upper-middle-income countries, not in low- or lower-middle-income ones, and that licensing is also only effective in the case of affiliates of foreign parents. An Asian Development Bank study finds that different forms of IP rights have a stronger effect on innovation at different stages of development (Lee, Kang, and Park 2020). The sequence that emerges from the Republic of Korea's experience is from petite patents at an earlier stage of development to designs in export-oriented sectors and trademarks in domestic market-oriented sectors, and finally to patents at the later stage of development. The general thrust of this research is that the expected benefit of improving IP rights varies depending on the stage of development. In other words, there is no "one size fits all" when it comes to IP rights protection.

The Trend Toward Trade-Related Aspects of Intellectual Property Rights-Plus

Although TRIPS encouraged the expansion of GVCs, a tendency in recent plurilateral trade deals has been to go beyond the provisions of TRIPS to TRIPS-plus. The US, in particular, has been at the forefront of moves to extend IP rights protection beyond those laid out in TRIPS. Some important TRIPS-plus provisions, which primarily concern pharmaceuticals, are:

(i) **Data exclusivity.** This is the idea that, for a certain period, regulatory authorities are not allowed to rely on originators' safety and efficacy data to register a generic version of a drug. By implication, as long as the exclusivity lasts, generics producers have to submit their own data in order to enter a market. TRIPS, however, mandates data protection, but not data exclusivity. That provision obliges generics producers to repeat clinical trials, which they may not be able to afford, and these trials take time. This poses ethical questions, since repeating clinical trials implies withholding treatments that are already known to be effective from earlier trial participants. Alternatively, and more likely in practice, generics manufacturers have to delay the launch of their products until the end of the exclusivity period.

(ii) **Patent term extensions.** These are provisions to extend the duration of a patent beyond the 20 years required by TRIPS in order to compensate for "unreasonable" delays in granting a patent or in registering a medicine.

(iii) **Linkage between patent status and generic registration.** Regulatory authorities may not register generic versions of a pharmaceutical that is under patent. This is problematic because regulators probably lack the resources and manpower to check the patent status of each product. And where there is a patent, regulators might not have the expertise to assess whether it is valid, and if so, whether it has been infringed. Because of this, regulators will likely enforce all patents, even invalid ones, thereby creating additional and unnecessary hurdles for generic competition.

The linkage is also problematic because patents are private rights and, as such, they should be enforced by the rights of the holders and not by a government body.

(iv) **Limitation of the grounds for compulsory licenses.** This could, for example, preclude issuing compulsory licenses for reasons of public health. Requirements to limit the grounds for issuing compulsory licenses are TRIPS-plus since the TRIPS agreement leaves countries free to determine the grounds for issuing compulsory licenses.

(v) **Other TRIPS-plus requirements.** These deal with the administrative procedures related to patent applications or the granting and revocation of patents. One side effect of all TRIPS-plus provisions is that they complicate or delay the marketing of generics.

Conclusions

The rise of GVCs in tandem with great gains in the economic efficiency of MNCs has significantly changed the nature and structure of international trade and investment. At the same time, the complexity and sophistication of GVCs has increased due to transactions in intermediates multiple times across multiple borders and the emergence of factoryless manufacturers exporting services of intangible properties (IP including brands, trademarks, patents, and in-house knowledge) embedded in products via value chains. That increase in complexity and sophistication poses considerable challenges for conventional trade statistics, which should give an accurate understanding of "who gains what from where" in GVCs.

The challenge lies mainly in the fact that both the measure of conventional trade statistics in gross terms, and the measure of trade using an input–output-model in value-added terms, are based primarily on the value of goods and services crossing national borders (territory-based trade). This fails to accurately identify trade in intangibles along GVCs (beyond border–type trade) by factoryless goods producers, who use their IP to organize value chains and outsource all fabrication activities to contract manufacturers without licensing their IP to third parties, and MNCs that combine their IP with FDI investment in the production of factory goods. The dominance of GVCs in international trade requires a redefinition of the concept of exports and an expansion of the scope of exports to include trade in intangibles via GVCs and FDI activities.

The case study in this chapter begins by demonstrating that substantial exports by US factoryless manufacturers are "missing" from the official trade statistics. The four US factoryless companies (Apple, Nike, AMD, Qualcomm) used in the case study actually exported $27.9 billion in services of intangibles assets to the PRC via their sophisticated GVCs in 2018. But these are not counted as US exports to the PRC by official trade statistics. If they were, the estimation of US services exports to the PRC in the same year would increase 48.9% and the overall trade balance between the two countries would shrink 7.3%. The measure based on the input–output model shows that if US-owned

factor income induced by the PRC's final demand via FDI channels for factory-goods production was earmarked as part of US exports to the PRC, the US-PRC trade deficit would, on average, be just 68.0% of the gross term and 82.6% of the value-added term during 2005–2016.

These findings clearly demonstrate that without a proper measure of trade in intangibles along GVCs, the importance of international trade as a critical engine of growth in the 21st century is being greatly underestimated, and the role of GVCs in promoting economic development and industrialization is being substantially misunderstood. The proliferation of GVCs has also resulted in a clear international division of labor between developed and developing countries, with the former specializing in the creation of intangibles and the latter in the tasks of manufacturing tangible products. Conventional trade statistics based on the classic cloth-for-wine trade have unambiguously and substantially underestimated the benefits reaped by developed countries from today's unprecedented globalization. More importantly, this chapter demonstrated that the continued use of conventional measures of trade could lead to a great distortion of the current state of bilateral trade relations between industrialized and developing countries.

At least three factors are driving the phenomenon of "what you see in trade statistics is no longer what you get in income terms." First, MNCs may dilute their income (most of which is gained from their IPs) from subsidiaries operating in low-tax countries (which may not be the countries where the IP creation and value occurred) with income from subsidiaries in high-tax countries. This is to avoid taxation through international transfer pricing and other measures. Second, MNCs have strong incentives to strengthen IP rights protection and to encourage innovation, given both the relatively low cost of illegal copying or reproducing IP and the higher costs of R&D investment to create and maintain control of their IP. This is the reason most factoryless goods producers do not license their IP to third parties. And third, IP protection is no longer simply a matter of encouraging innovation. These days it is more importantly about protecting a new source of bread and butter for the home countries of MNCs.

For the first of the three factors, the OECD's standards of transparency and exchange of information for tax purposes (OECD 2002, 2014), and the endorsement of a global minimum corporate tax of 15% by the world's 20 largest economies, could potentially end the "thirty-year race to the bottom on corporate tax rates" (Strupczewski 2021). For the second factor, developing economies increasingly recognize that enhancing IP rights protection domestically (improving the relevant parts of the legal system and enforcing related regulations) not only helps attract and keep foreign investors but can also in the long run provide big incentives for their own innovation and brand-building. Internationally, the possible upgrading of TRIPS provides a basis for IP rights protection in the multilateral trading system. For the third factor, reaching a consensus on "mutual trust based" international investment rules with fair and equitable treatment of businesses is a crucial but challenging goal for supporting the development of

sustainable and transparent GVCs (Tuerk and Rosert 2016; Butler and Subedi 2017; UNCTAD 2018). Finally, a fundamental reform in the measurement of international trade, especially trade in intangibles along GVCs to better match and map income creation and distribution patterns in GVCs, warrants serious consideration. This may also require national account reforms.

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3

Productivity Growth, Innovation, and Upgrading along Global Value Chains

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Greater exposure to international trade improves productivity by increasing competition, expanding product markets, and improving access to production inputs. Productivity increases at the industry level because competitive pressure leads to a reallocation of resources to more productive firms, while the least productive ones are forced to exit the market (Melitz 2003; Melitz and Ottaviano 2008; Eslava et al. 2013). The productivity of firms can also increase because heightened competition from imported products pushes them to invest in new processes, technologies, and skills to survive (Shu and Steinwender 2019). The possibility to expand into larger export markets also incentivizes firms to improve the production efficiency and the quality of their products (Bustos 2011). And access to a larger range of intermediate production inputs potentially lowers the input costs of firms, improves product quality, and expands product variety (Fieler, Eslava, and Xu 2018; Goldberg et al. 2010; Amiti and Konings 2007). Indeed, a positive and significant causal effect of trade—measured as the sum of exports plus imports to a country's gross domestic product—on aggregate productivity has long been established in the economic literature (Alcalá and Ciccone 2004; Alesina, Spolaore, and Wacziarg 2000; Frankel and Romer 1999).

In today's global economy, 70% of international trade involves global value chains (GVCs) (OECD 2021). GVC trade is characterized by services, raw materials, and parts and components crossing borders, often many times, to be incorporated into final products that are then shipped to consumers all over the world. While countries traded raw materials and components before the advent of GVCs, the scale was nothing like that of today. This complex web of interactions among firms from different countries is the reason why GVC trade offers more opportunities for productivity growth than trade in final goods and services. By outsourcing parts of production to international suppliers, lead firms realize

efficiency gains in the form of lower costs or higher quality and so raise productivity (Bøler, Moxnes, and Ulltveit-Moe 2015). When a foreign firm and a local supplier are part of the same supply chain, they need to interact and coordinate to guarantee the chain functions smoothly. That face-to-face communication facilitates the transfer of tacit knowledge and increases domestic innovative capabilities (Hovhannisyan and Keller 2015; Santacreu-Vasut and Teshima 2016). Foreign outsourcing firms have an incentive to transfer the know-how and technology required for the efficient production of outsourced inputs because they will eventually be the consumers of those inputs.

This idea of domestic suppliers accessing new knowledge and resources from foreign markets and buyers is consistent with the so-called learning-by-exporting hypothesis. That said, it is also plausible that only the most productive firms have the resources to integrate themselves into GVCs, which is known as the self-selection hypothesis. Indeed, selling to foreign markets involves various costs, including a substantial upfront investment to customize products to match the standards and requirements of foreign buyers; transportation, distribution, and marketing costs; and the cost of hiring people with the skills to manage export networks. Recent empirical evidence shows that foreign investors carefully target the largest and most productive local firms to invest in and exploit their export networks—in other words, cherry picking (Blonigen et al. 2014; Branstetter and Drev 2014; Guadalupe, Kuzmina and Thomas 2012). So, a superior productivity performance by GVC-integrated firms could be at least partially attributed to the self-selection of originally productive firms into GVCs—and the findings on research and development (R&D) and knowledge spillovers in large private companies may not apply to other firms, industries, or the economy.

This chapter examines the nexus between GVC participation and productivity growth, GVC participation and innovation, and upgrading and innovation along GVCs. Empirically studying these relationships is challenging because it involves disentangling several channels through which GVC participation can potentially drive productivity growth—specialization, access to foreign inputs, knowledge spillovers, and upscaling—that are all at work at the same time. For example, only firms that have unrestricted access to imports of low-cost, high-quality intermediate inputs can afford to specialize in the tasks along the value chain that they perform most efficiently. An investment in technology and the restructuring of internal processes is needed to fully benefit from specialization and higher-quality imported inputs. And firms may need to have initial internal technological capabilities above a certain threshold for access to imported inputs to improve export performance (Torres Mazzi and Foster-McGregor 2021).

This chapter provides diverse perspectives on the concept of innovation from frontier or new-to-the-world innovation to new-to-the-country or new-to-the-firm innovation. Indeed, catch-up innovation, manifested in the successful implementation of new-to-the-country and new-to-the-firm ideas, is as important as frontier innovation for driving productivity growth.

Because no one dataset can capture all the complexity involved in a value chain, the chapter discusses evidence from studies based on different types of data and methodological approaches. For example, case studies based on detailed quantitative and qualitative data on the value chain of one firm or product are very insightful, but do not necessarily apply to other firms, even within the same country and industry. Large, nationally representative enterprise surveys contain granular detail on inputs, output, employment, and other characteristics, but little to no information on upstream and downstream firms, especially across countries. In fact, these surveys are hardly ever harmonized across countries. Datasets tracing cross-border linkages, such as greenfield investments or mergers and acquisitions, tend to be limited to one specific type of linkage along a value chain. It is worth noting that developing economies are noticeably underrepresented in many of these datasets. Input–output tables show the sale and purchase relationships between producers and consumers aggregated by economy sectors. Although they are less detailed than enterprise surveys, they provide a bird's-eye view of all cross-border linkages by economy sectors. And because input–output tables are built on the national account series of gross output, value added, and employment, they are available for many developed and developing economies.

This chapter prominently features the experiences of Asian economies because no other region epitomizes GVC participation as a driver of productivity growth and innovation better than Asia. In 2019, Asia's GVC participation was 67.4%, making it a key player in GVCs (ADB 2021).[1] Asia has seen the rise of economic powerhouses in the span of just a generation, from the export-led industrialization of Japan and the four Asian Tigers during the second half of the 20th century to the People's Republic of China (PRC) becoming the factory of the world and then to Southeast Asian economies successfully using GVCs as a path to participate in global-scale production and to move to higher value-added activities.

The rest of the chapter is organized as follows. The next section examines evidence on the impact of GVC-mediated access to foreign R&D on total factor productivity and innovation at the firm, industry, and economy levels. It identifies knowledge spillovers and access to imported inputs as the main drivers of productivity growth. The section focuses on the role of multinational corporations (MNCs) in facilitating knowledge transfers. This is followed by an analysis on whether GVC-oriented industrialization can boost productivity and employment at the same time and so lead to long-term economic development. This section also shows the key role that specialization and upscaling play in driving income convergence. The following section focuses on functional upgrading along GVCs and presents two case studies from India and the PRC on how firms in emerging economies can leverage the increasing modularization of manufacturing, especially in high-tech sectors, to rapidly catch up with industry leaders in output capabilities. The chapter concludes by drawing lessons from the evidence and findings presented.

1 GVC participation is approximated by the share of value added to gross exports that is used for further processing in cross-border production networks.

Knowledge Spillovers

An economy can benefit from its own R&D as well as the R&D efforts of its trade partners. When a domestic firm invests in R&D, new ideas, intermediate goods, methods to reduce costs, and final consumer products can be developed, allowing firms to become more efficient and profitable. Firms can also benefit from foreign R&D spillovers in embodied and disembodied form. Knowledge in embodied form is transferred through imports of goods and services that embody the skills, factors of production, and technologies used to produce them. Examples of disembodied knowledge transfers are blueprints, patents, and other intangibles and services.

It is harder for firms to draw on a foreign stock of knowledge than a domestic one because even when a technology is non-rival and codified for public use, part of it may be difficult to express or extract and thus harder to transfer. This is known as tacit knowledge, which is often gained from personal and practical experience and is essential for follow-on innovation. Tacit knowledge is often transferred through face-to-face communication, but effective communication between teams working in different locations from different countries and functional backgrounds is generally more challenging. Yet, access to foreign R&D is crucial because it can potentially expose domestic firms to the global frontier.

Evidence is now presented on the impact of GVC-mediated access to foreign R&D on productivity at the firm, industry, and economy levels. Particular focus is given to the relationship between foreign R&D and domestic innovative capabilities, because innovation plays a major role in boosting productivity at all levels of development, but not all productivity increases can be traced back to innovation. For example, the introduction of imported intermediate inputs may boost productivity not because importing countries acquired the knowledge embodied in these goods, but simply because these inputs have higher price-adjusted quality or they enhance the productivity of other factors of production—or both. Because MNCs and their foreign affiliates account for two-thirds of international trade and centrally govern the supply chain, thereby controlling access to distant knowledge and final markets globally, the effect of foreign direct investment by MNCs on the diffusion of knowledge is discussed.

Global Value Chain–Mediated Access to Foreign Research and Development and Productivity

It is well recognized in the economic literature that access to foreign R&D capital through trade increases productivity. The first study on this is based on pooled cross-country data for 22 high-income economies during 1971–1990 (Coe and Helpman 1995). A follow-up study constructing a dataset of 13 manufacturing industries in eight Organisation for Economic Co-operation and Development (OECD) countries during the same period estimated that foreign R&D accounts for roughly 20% of the total effect of R&D investment on productivity (Keller 2002). Nishioka and Ripoll (2012),

in an influential study using input–output tables for 32 economies and 13 manufacturing industries for 1995, 2000, and 2005, find that intermediate imports are associated with significant productivity increases.

Imports of intermediate goods improve firm performance. Evidence based on a 1979–1986 census of manufacturing plants in Chile (Kasahara and Rodrigue 2008) and nationally representative panel data of manufacturing firms in Hungary from 1992 to 2003 (Halpern, Koren, and Szeidl 2015) show that importing intermediate goods improves firm performance. Similarly, evidence from a nationally representative survey of 4,000 manufacturing firms in Viet Nam from 2009 to 2012 shows that firms that sourced inputs from foreign affiliates had higher total factor productivity growth, even though they did not receive direct technology transfers (Newman et al. 2015).

The literature emphasizes the importance of absorptive capacity for domestic firms to fully benefit from foreign R&D. Absorptive capacity is the ability of firms to internalize external knowledge, and it is studied at the level of the economy, the firm, and key individuals or groups within a firm (e.g., R&D researchers or management).

Countries where the ease of doing business and the quality of tertiary education are high tend to benefit more from their own R&D efforts, international R&D spillovers, and human capital formation (Coe, Helpman, and Hoffmaister 2009). Strong intellectual property rights are also associated with higher levels of total factor productivity and returns to domestic R&D, and larger international R&D spillovers. Xu (2000), in a study of United States (US) MNCs as a channel of international technology diffusion in 40 countries from 1966 to 1994, finds that only developing economies reaching a minimum human capital threshold benefit from technology transfer provided by US MNCs. Foster-McGregor, Pöschl, and Stehrer (2016) find that foreign R&D spillovers are stronger in countries with greater absorptive capacity measured as average years of secondary schooling and R&D spending.

Global Value Chain–Mediated Access to Foreign Research and Development and Domestic Innovation

That foreign outsourcing firms have an incentive to transfer the know-how and technology to produce an outsourced input suggests that access to foreign R&D through GVC participation could potentially boost domestic innovation. But the high degree of fragmentation of production activities in GVCs implies cross-border applications of very specific areas of parent-company know-how—and parent companies take great care to reduce the dissemination of their know-how into local economies. This cross-border deployment of technology should therefore be thought of more as technology "lending" than technology transfer, meaning that if parent companies decide to relocate specific production tasks to different countries, producers in domestic economies may not be able to continue performing those tasks independently (Baldwin 2014). In that case, access to foreign R&D through GVC participation will not increase domestic innovative capabilities.

Piermartini and Rubínová (forthcoming) investigate whether foreign R&D expenditure affects domestic innovation through GVC linkages. They combine data on the number of patent applications filed under the Patent Cooperation Treaty by the residence of inventors with measures of GVC integration from the OECD's Trade in Value Added database and R&D expenditure from the OECD's Research and Development Statistics to construct a panel dataset of 25 economies and seven manufacturing industries, accounting for more than 90% of business R&D spending in manufacturing from 2003 to 2012. Figure 3.1 shows the three main variables in this analysis—domestic R&D expenditure, patent applications, and the foreign R&D pool—by economy. Panel a shows the distribution of R&D expenditure and patent applications is very concentrated: Germany, Japan, and the US are clearly the innovation hubs as they together account for 72.4% of total R&D expenditure and 72.1% of patent applications in the sample. Panel b shows the importance of the foreign R&D pool relative to domestic R&D spending.

Figure 3.1: Main Indicators of Innovative Activity by Economy

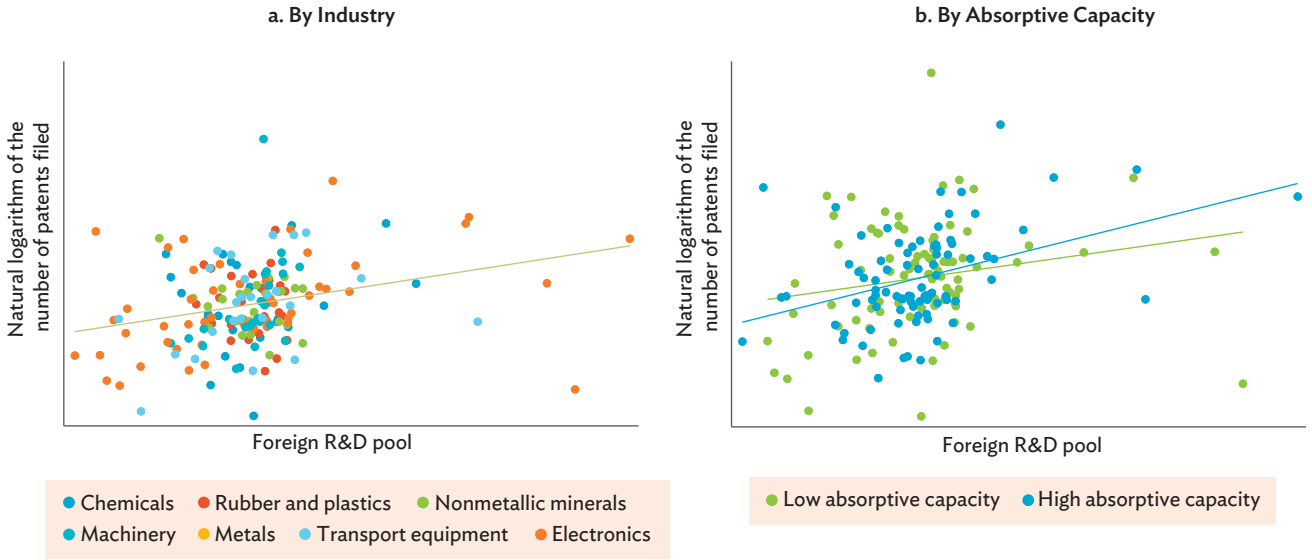
AUS = Australia, AUT = Austria, BEL = Belgium, CAN = Canada, CZE = Czech Republic, FIN = Finland, FRA = France, GER = Germany, HUN = Hungary, IRE = Ireland, ITA = Italy, JPN = Japan, KOR = Republic of Korea, MEX = Mexico, NET = Netherlands, POL = Poland, POR = Portugal, R&D = research and development, ROU = Romania, SPA = Spain, SVK = Slovakia, SVN = Slovenia, TAP = Taipei,China, TUR = Turkey, UKG = United Kingdom, USA = United States.

Source: Authors' adaptation of Roberta Piermartini and Stela Rubínová. Forthcoming. How Much Do Global Value Chains Boost Innovation? *Canadian Journal of Economics.*

The foreign R&D pool matters the most for economies that are highly integrated in the GVCs of the main innovators while having low domestic R&D spending themselves, such as Hungary, Mexico, and Slovakia. The foreign R&D pool as a share of own R&D is low for economies with low GVC participation, such as Romania and Turkey.

Figure 3.2 shows two key results from Piermartini and Rubínová (forthcoming) by using simplified cross-sectional correlations between the average number of patent applications from 2004 to 2012 and the foreign R&D pool in 2000, conditional on economy and industry fixed effects. Panel a shows that access to the foreign R&D pool mediated through GVC integration is positively associated with domestic innovation proxied by the number of patents filed under the Patent Cooperation Treaty. It shows the relationship is especially strong in GVC-intensive industries, such as electronics and transport equipment. In panel b, economy sectors are split into above- and below-median number of researchers per million inhabitants, which is a proxy for absorptive capacity. Consistent with the evidence on total factor productivity presented earlier, panel b shows that a higher absorptive capacity translates into a stronger relationship between the GVC-mediated foreign R&D pool and domestic innovation.

Figure 3.2: Relationship between Global Value Chain–Mediated Foreign Research and Development Pool and Domestic Innovation



R&D = research and development.
Notes: The horizontal axis is access to the foreign R&D pool mediated through global value chain integration; the vertical axis is the natural logarithm of the number of patents filed under the Patent Cooperation Treaty. The trend line is the simple correlation conditional on economy and industry fixed effects.
Source: Authors' adaptation of Roberta Piermartini and Stela Rubínová. Forthcoming. How Much Do Global Value Chains Boost Innovation? *Canadian Journal of Economics*.

Because Piermartini and Rubínová (forthcoming) is based on a sample of mostly OECD and emerging European economies, it does not say much about developing economies and their firms. De Marchi, Giuliani, and Rabellotti (2018) conduct a

systematic review of the literature on GVCs in developing economies to investigate whether the linkages between firms in a GVC affect their innovation performance. They identify 50 cases for which information is codified on local innovation taking place and the sources of learning— that is, sources within GVCs or internal to firms or external sources from non-GVC actors. They find that GVC participation is used as a privileged source of knowledge and technologies by firms in developing economies only in a minority of cases. And even then, these firms invested in considerable capacity-building to be able to innovate. In most of the other observed cases, sources of learning within GVCs were exploited only as a complementary source to other channels of knowledge acquisition, the most effective being collective learning, imitation, and learning from non-GVC actors. De Marchi, Giuliani, and Rabellotti (2018) posit that GVC knowledge may be too narrow or specialized and that a certain degree of knowledge variety is needed to innovate, as this chapter shows in detail later.

Another of their findings is the lack of innovation found in about half of the observed cases. Here, local firms displayed poor skills and knowledge creation efforts, along with a lack of interest in both GVC-related and other kinds of knowledge sources. This, again, points to the importance of absorptive capacity at multiple levels—the firm, the cluster, and all the way to the economy itself—in conditioning the extent to which suppliers in developing economies are able to take advantage of GVC-related knowledge.

The Role of Foreign Direct Investment by Multinational Corporations

MNCs can generate knowledge transfers through three channels—through backward spillovers from multinational clients to their local suppliers of intermediate inputs, through forward spillovers from multinational suppliers of intermediate inputs to their local buyers (also known as reverse spillover), and through horizontal spillovers from their foreign affiliates to other domestic firms in the same sector.

MNCs have an incentive to share knowledge and technology, and to encourage the adoption of new practices to get more or better-quality inputs from suppliers, thereby generating backward spillovers. At the same time, MNCs want to prevent technology leakage and horizontal spillovers that would enhance the performance of their local competitors. This can be achieved by paying higher wages to prevent employee turnover, seeking strong intellectual property protection, trade secrecy, and locating in countries or industries where domestic firms have limited imitative capacity to begin with. Local firms sourcing from MNCs can, for their part, potentially learn from the higher quality and greater variety of inputs that they get access to from an MNC entering upstream industry, thus generating forward spillovers.

Empirical evidence supports this basic framework. Two meta-analyses, one based on data from 47 countries and the other from 45 countries (Havránek and Iršová 2011; Iršová and Havránek 2013), find robust evidence of backward spillovers, while forward

spillovers are much smaller and horizontal spillovers tend to be nil on average. Even so, these meta-analyses suggest that positive horizontal spillovers exist when foreign firms form joint ventures with domestic firms and that all spillovers are stronger when investors have only a modest technology edge over local firms. Supporting the latter finding and the importance of absorptive capacity are studies based on data from large US firms showing positive spillovers from other technologically close firms and from the presence of foreign affiliates in the same industry (Bloom, Schankerman, and van Reenen 2013; Keller and Yeaple 2009).

MNCs also play an important role in the internationalization of R&D, connecting research teams from around the world and thus facilitating the flow of knowledge across borders. Branstetter, Li, and Veloso (2015), in an analysis of almost 4 million utility patents granted by the US Patent and Trademark Office from 1975 to 2010, identify 7,754 patents with at least one inventor residing in India at the time of invention and 12,419 patents with at least one inventor residing in the PRC.[2] Most of those patents were granted to local inventor teams working for foreign MNCs. A significant share of these patents also incorporated direct intellectual inputs from researchers outside India and the PRC. But spillovers from MNCs to local enterprises outside of MNCs were limited.

In sum, GVC-mediated access to foreign R&D increases total factor productivity and boosts innovation in advanced and emerging economies. Similarly, evidence shows that foreign affiliates of MNCs generate positive local spillovers, especially to their suppliers. Still, the positive effects are conditional on the absorptive capacity of local firms, which depends on human capital, own R&D investment, and broad institutional capabilities. The evidence from developing economies suggests that low absorptive capacity and large distance from the global technology frontier, in addition to the highly specialized nature of the knowledge flowing along a value chain, may prevent local firms from drawing on the knowledge and technology of lead GVC firms. MNCs also have the incentive to support their suppliers' innovation and upgrading in areas that are complementary to them, but to prevent innovation that could challenge their core competency. All in all, the evidence shows that globalization promotes the diffusion of knowledge and technology across borders, but further diffusion within borders—beyond the largest and often multinational firms—is not to be taken for granted.

Global Value Chain–Mediated Productivity Growth as a Driver of Long-Term Development

GVC participation can stimulate productivity growth through multiple channels, as discussed in the previous sections, but for economic development to occur, productivity convergence must be accompanied by sustained employment growth in modern sectors

2 Inventors from Hong Kong, China and Taipei,China constitute a separate category and are not included in the 12,419 patents with at least one inventor residing in the PRC.

(i.e., manufacturing and, increasingly, services). It remains to be seen, however, whether GVC-oriented industrialization can deliver on that. The global megatrend of automation is increasing productivity, but at the same time reducing relative demand for unskilled labor, thus chipping away at the comparative advantage of developing economies in labor-intensive production (ADB 2018). GVCs have enabled economies to industrialize by specializing in specific production stages, rather than building a whole supply chain at home. That makes industrialization easier and faster, and initially boosts productivity and employment. Yet this kind of industrialization is also less meaningful because it may not induce economies to build the capabilities necessary for long-term development (Baldwin 2014). Finally, the strict product and quality standards that firms producing for global markets must comply with require more automation and reduce the ability of developing economies to substitute unskilled labor for other product inputs (Rodrik 2018).

Pahl and Timmer (2020) investigate the relationship between GVC participation and the long-term growth of employment and labor productivity in manufacturing value chains. They combine national input–output tables with the United Nations Industrial Development Organization's INDSTAT2 dataset of formal manufacturing employment and value added to build an unbalanced panel of 58 economies and 13 industries—a total of 754 combinations—over 1970–2008. Out of the 58, the World Bank classified 38 as developing in 1990, spread across Africa, Asia, Europe, Latin America, and the Middle East. The data are divided into three 10-year periods going backward from 2008, and one 9-year period from 1970 to 1978. They find two meaningful results: first, a strong positive association of GVC participation with labor productivity growth in the export chain, which becomes stronger the further an economy is from the productivity frontier. This is consistent with the abundant literature on the impact of trade on total factor productivity. The second result is no significant association of GVC participation with manufacturing employment growth, except for economies close to the productivity frontier, where the association is negative. These results lend support to the so-called mixed-blessing hypothesis, according to which firms that participate in GVCs might be successful at absorbing advanced technologies, but less so in employing labor.

Gentile and de Vries (2021) use a task-based GVC accounting approach to examine how the scale of participation, the productivity level of the activities performed, and the types of activities carried out along the value chain drive income convergence. The study focuses on developing Asia, a region that has been successful in increasing employment in labor-intensive production activities.[3] While Pahl and Timmer (2020) study GVC employment, Gentile and de Vries (2021) distinguish between production and knowledge jobs.

[3] Developing Asia refers collectively to the 47 ADB regional members (excluding Australia and New Zealand) listed at https://www.adb.org/who-we-are/about#members.

Gentile and de Vries (2021) use the Multiregional Input–Output Database of the Asian Development Bank (ADB) and labor force survey data for a sample of 15 developing Asian economies—representing over 90% of total employment in the region—and 29 OECD countries from 2000 to 2018. They focus on the tasks carried out in developing Asian economies for final manufactured products produced anywhere in the world.[4] In this context, "income" is not the classic gross domestic product, but rather the value added generated within an economy for the worldwide production of manufactured goods. This includes value added from nonmanufacturing activities, such as business services, transport, finance, and the production of raw materials. This is the concept of "manufactures GVC income" or simply GVC income, introduced by Timmer et al. (2013). This approach implies a broad definition of GVCs that includes domestic producers delivering value added to domestic final production. Because manufacturing products are internationally highly contestable, it is reasonable to expect that most final manufactured products, even if they are produced and sold domestically, involve some imported intermediate inputs. Furthermore, firms selling final manufacturing products compete in foreign as well as domestic markets.

Similarly, GVC jobs are defined as jobs related to activities that are directly and indirectly involved in the production of final manufactured goods. This is not the classic definition of manufacturing jobs, because it includes jobs in nonmanufacturing activities if they contribute to final manufacturing output. The outsourcing of business services that were previously done in-house creates the impression of shrinking manufacturing employment when it is simply a reallocation of tasks to domestic services firms. One of the main advantages of the concept of GVC jobs is that it "recovers" those outsourced jobs.

Figure 3.3 shows the GVC income ratio—that is, GVC income per capita for the sample of 15 developing Asian economies relative to the OECD comparison-group average in 2000 and 2018. In 2000, with the exception of Taipei,China, all economies had per capita GVC incomes that were less than 25% of the OECD's average. In 2018, the developing Asian economies increased their competitive position in manufacturing GVCs, and GVC income per capita in the region increased faster than the OECD average. All 15 managed to reduce the GVC income gap except Nepal. GVC income rose rapidly in several of the large economies. The PRC's GVC income ratio rose from 0.15 in 2000 to 0.54 in 2018, Thailand's from 0.25 to 0.58, and Viet Nam's from 0.07 to 0.26.

Figure 3.4 shows GVC income per capita for the aggregate of the 15 developing Asian economies relative to the OECD average from 2000 to 2018. The line markers represent the years for which input-output tables are available in ADB's Multiregional Input–Output Database. GVC income convergence appears faster before 2010, but it continues during the 2010s. Levels are affected by excluding the PRC, but trends are qualitatively similar. The average income ratio for the 15 rose from 12% in 2000 to 34% by 2018.[5] Although impressive, this is still only one-third the OECD average.

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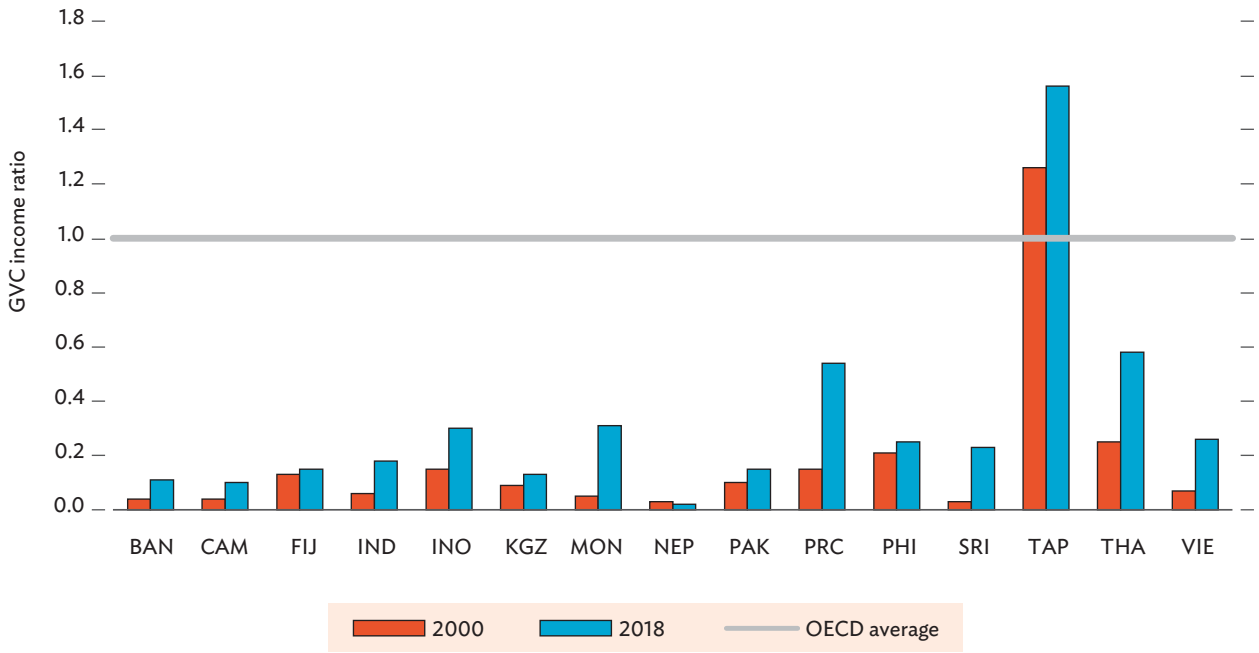
4 A similar analysis of services GVCs is not possible because input–output tables do not capture the cross-border flow of services in sufficient detail.

5 Excluding the PRC, it rose from 10% in 2000 to 22% by 2018.

Figure 3.3: Global Value Chain Income Ratio in 15 Developing Asian Economies Relative to the Organisation for Economic Co-operation and Development Average, 2000 and 2018



BAN = Bangladesh, CAM = Cambodia, FIJ = Fiji, GVC = global value chain, IND = India, INO = Indonesia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, OECD = Organisation for Economic Co-operation and Development, PAK = Pakistan, PRC = People's Republic of China, PHI = Philippines, SRI = Sri Lanka, TAP = Taipei,China, THA = Thailand, VIE = Viet Nam.

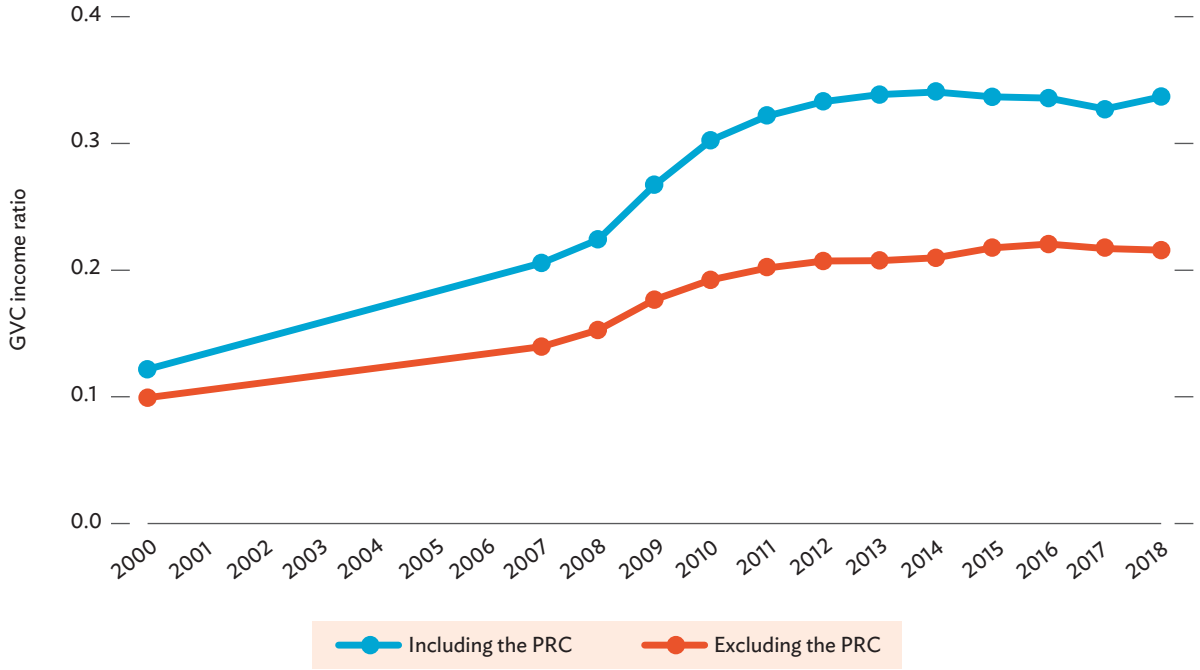
Notes:

1. GVC income ratio calculated as real GVC income in final manufacturing products, expressed per capita and at 2011 constant purchasing power parity relative to the (unweighted) average of 29 OECD countries.
2. The 29 OECD countries are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, Poland, Portugal, the Republic of Korea, Slovenia, Spain, Sweden, Turkey, the United Kingdom, and the United States.

Source: Elisabetta Gentile and Gaaitzen J. de Vries. 2021. Is Participation in Global Value Chains Driving Income Convergence in Developing Asia? A Task-Based Accounting Approach. Unpublished.

In the framework adopted by Gentile and de Vries (2021), an economy can increase GVC income through three main drivers. The first is an increase in the scale of activities carried out for GVCs of final manufactured products (i.e., the number of jobs involved in those activities). The second is increasing the productivity levels of those activities through either process upgrading (better organization of the production process or using improved technology) or product upgrading (improving quality or design or adding new features). The third is functional upgrading; this is the reallocation of jobs from low to high value-added activities within GVCs. The highest value creation generally occurs in more upstream processes (e.g., R&D and design) or more downstream processes (e.g., marketing) rather than in the middle (e.g., assembly) (Shih 1996). Most of this value added stems from intangibles, such as brands, basic R&D, design, and the digitalization of organizational processes, as discussed in Chapter 2.

Figure 3.4: Global Value Chain Income Ratio Aggregate in 15 Developing Asian Economies Relative to the Organisation for Economic Co-operation and Development Average, 2000–2018



GVC = global value chain, PRC = People's Republic of China.
Notes:
1. GVC income ratio calculated as real GVC income in final manufacturing products, expressed per capita and at 2011 constant purchasing power parity for the aggregate of the 15 developing Asian economies relative to the (unweighted) average of Organisation for Economic Co-operation and Development (OECD) countries.
2. The 15 are Bangladesh, Cambodia, Fiji, India, Indonesia, the Kyrgyz Republic, Mongolia, Nepal, Pakistan, the People's Republic of China, the Philippines, Sri Lanka, Taipei,China, Thailand, and Viet Nam. The 29 OECD countries are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, Poland, Portugal, the Republic of Korea, Slovenia, Spain, Sweden, Turkey, the United Kingdom, and the United States.
3. Line markers represent the years where input–output tables are available in the Asian Development Bank's Multiregional Input–Output Database.

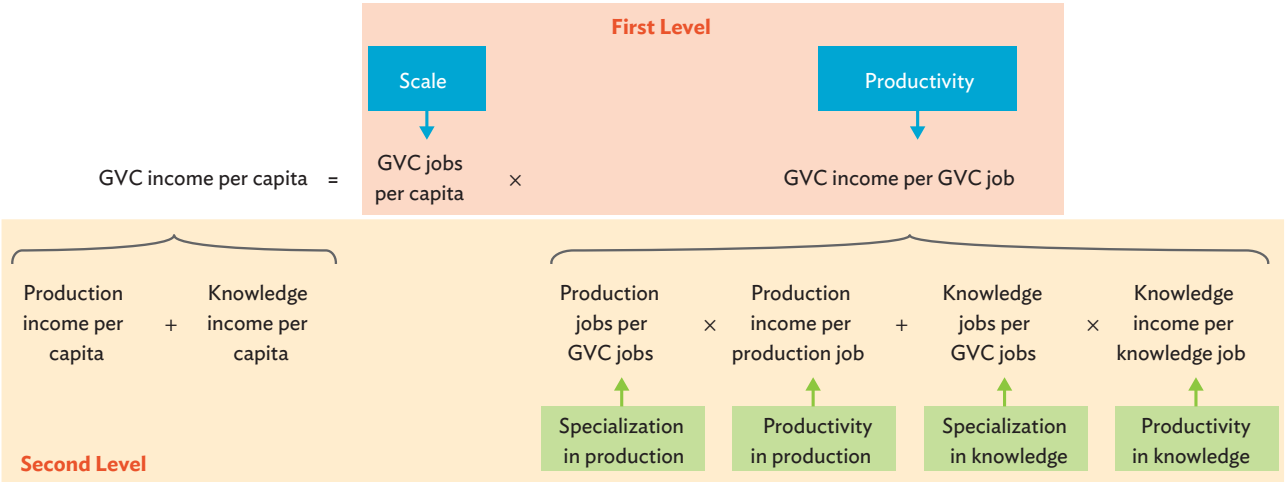
Source: Elisabetta Gentile and Gaaitzen J. de Vries. 2021. Is Participation in Global Value Chains Driving Income Convergence in Developing Asia? A Task-Based Accounting Approach. Unpublished.

GVC income per capita can be disaggregated at two levels (Figure 3.5). In the first, GVC income per capita is expressed as the product of scale (GVC jobs per capita) and productivity (GVC income per GVC job). An increase in scale means that a rising share of the population is involved in GVCs; an increase in GVC income per GVC jobs means that workers performing those jobs are getting more productive.

The second level of disaggregation sheds light on functional upgrading (Figure 3.5). Activities along a GVC are broken down into two categories: production activities, which are all the activities in the physical transformation process, such as assembly and parts and components manufacturing; and knowledge-intensive activities, which are all the activities involved in pre- and postproduction processes, such as R&D, design, marketing, and after-sales services. Because knowledge-intensive activities capture most of the value added embedded in final output, and a shift toward knowledge-intensive activities is an indication of functional upgrading, GVC income per capita can be disaggregated into the sum of production income per capita and knowledge income per capita.

Productivity can be disaggregated into the weighted sum of production income per production job (productivity in production) and knowledge income per knowledge job (productivity in knowledge). The weights are the share of production jobs to total GVC jobs (specialization in production) and the share of knowledge jobs to total GVC jobs (specialization in knowledge). An increase in the share of knowledge jobs to total GVC jobs is an indication that the economy is specializing in knowledge-intensive activities. Similarly, an increase in the share of production jobs to total GVC jobs would be an indication that the economy is specializing in production activities.

Figure 3.5: Disaggregating Global Value Chain Income per Capita

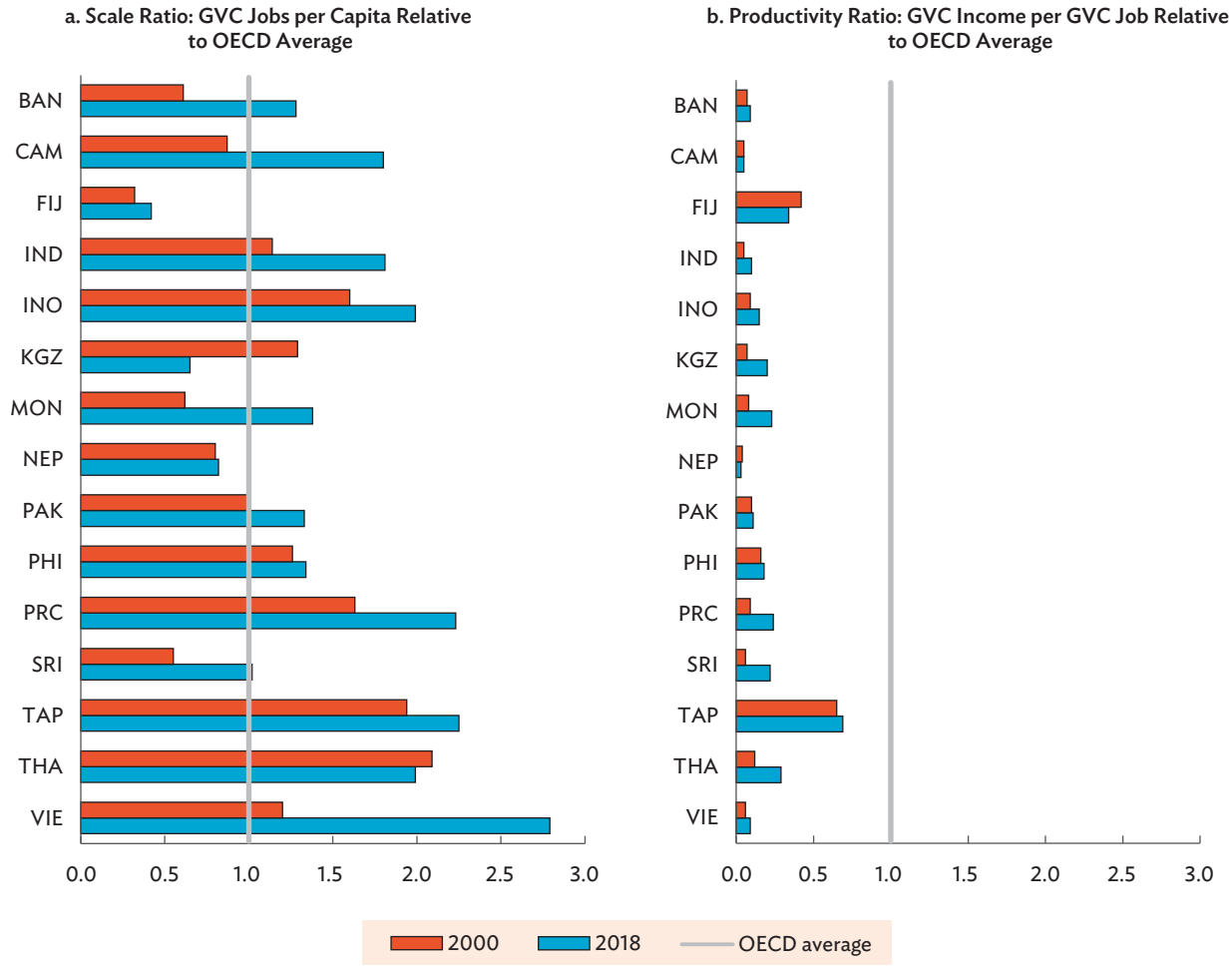


Source: Authors based on Elisabetta Gentile and Gaaitzen J. de Vries. 2021. Is Participation in Global Value Chains Driving Income Convergence in Developing Asia? A Task-Based Accounting Approach. Unpublished.

Figure 3.6 shows the results of the first-level disaggregation, where scale and productivity are divided by the OECD average. Panel a shows that in 2000, nine out of the 15 developing Asian economies had a scale ratio above 1, implying they had more GVC jobs per capita than the OECD average. That increased to 12 in 2018—and the ratio for India, Indonesia, the PRC, Taipei,China, and Thailand was above 2, which highlights the active involvement of workers from Asia in manufacturing GVCs. The scale ratio for the aggregate of the 15 economies was 1.34 in 2000 and 2.10 in 2018. This suggests the GVC income gap between developing Asia and the OECD is not due to the overall scale of their involvement in GVCs.[6] Panel b shows the gap in GVC income between developing Asia and the OECD shown in Figure 3.4 is mainly accounted for by differences in productivity. In 2000, developing Asia's productivity ratio was about 9% of the OECD's average. Although productivity has increased rapidly since then, it started from a low level, such that it was still at only 16% of the OECD average in 2018.

6 Structural transformation in OECD countries has been such that the output and employment share of services activities not related to manufactured products increased. This affects the observed changes in the ratios.

Figure 3.6: First-Level Disaggregation of Global Value Chain Income per Capita in 15 Developing Asian Economies, 2000 and 2018



BAN = Bangladesh, CAM = Cambodia, FIJ = Fiji, GVC = global value chain, IND = India, INO = Indonesia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, OECD = Organisation for Economic Co-operation and Development, PAK = Pakistan, PRC = People's Republic of China, PHI = Philippines, SRI = Sri Lanka, TAP = Taipei,China, THA = Thailand, VIE = Viet Nam.

Notes:

1. In panel a, the scale ratio is calculated as GVC jobs in final manufacturing products per capita relative to the OECD average. In panel b, the productivity ratio is calculated as real GVC income in final manufacturing products, expressed at 2011 constant purchasing power parity and divided by GVC jobs in final manufacturing products, relative to the (unweighted) average of 29 OECD countries.
2. The 29 OECD countries are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, Poland, Portugal, the Republic of Korea, Slovenia, Spain, Sweden, Turkey, the United Kingdom, and the United States.

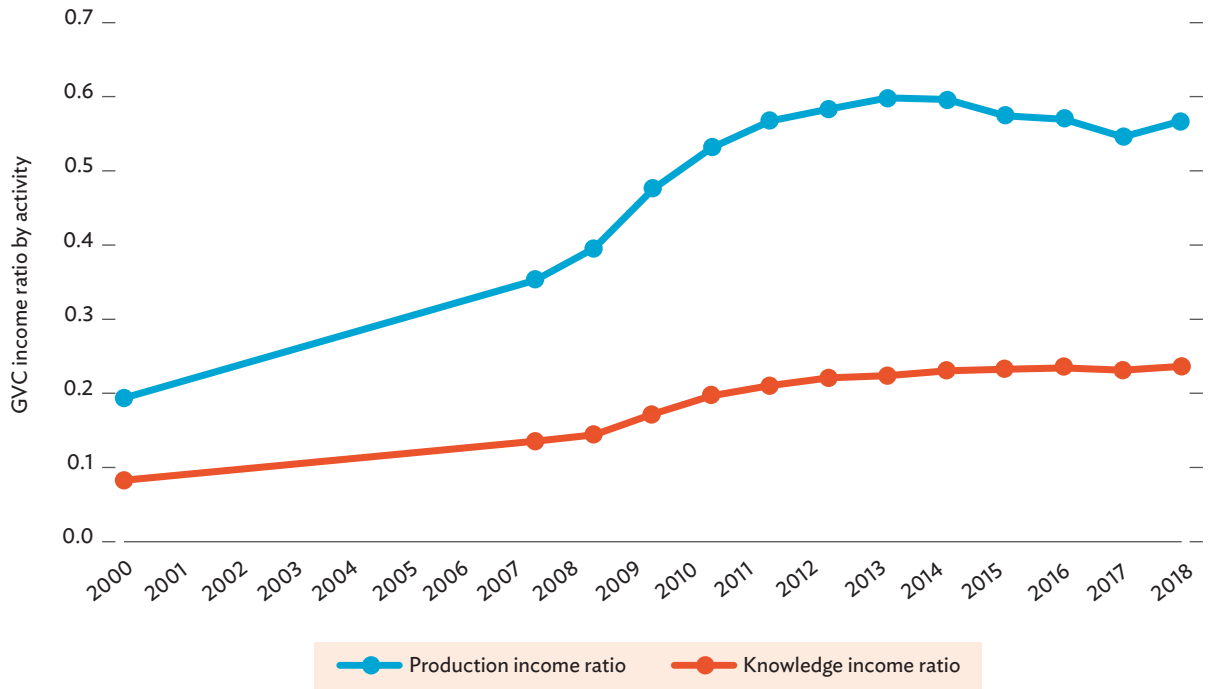
Source: Elisabetta Gentile and Gaaitzen J. de Vries. 2021. Is Participation in Global Value Chains Driving Income Convergence in Developing Asia? A Task-Based Accounting Approach. Unpublished.

Figure 3.7 shows the further disaggregation of the GVC income ratio in Figure 3.4 into the knowledge income ratio, defined as GVC income per capita accruing from knowledge-intensive activities relative to the OECD average, and production income ratio, similarly defined but for production activities. The figure shows a clear difference in convergence rates between production and knowledge-intensive activities. Here, developing Asia has been catching up much faster in production.[7] In 2018, GVC income from production activities was 57% of the OECD average and 24% for

[7] This pattern is qualitatively similar if the PRC is excluded.

knowledge-intensive activities. This indicates a convergence in income from knowledge-intensive activities, but from low levels such that there was still a major gap in 2018.

Figure 3.7: Global Value Chain Income Ratio Aggregate by Activity in 15 Developing Asian Economies Relative to the Organisation for Economic Co-operation and Development Average, 2000–2018

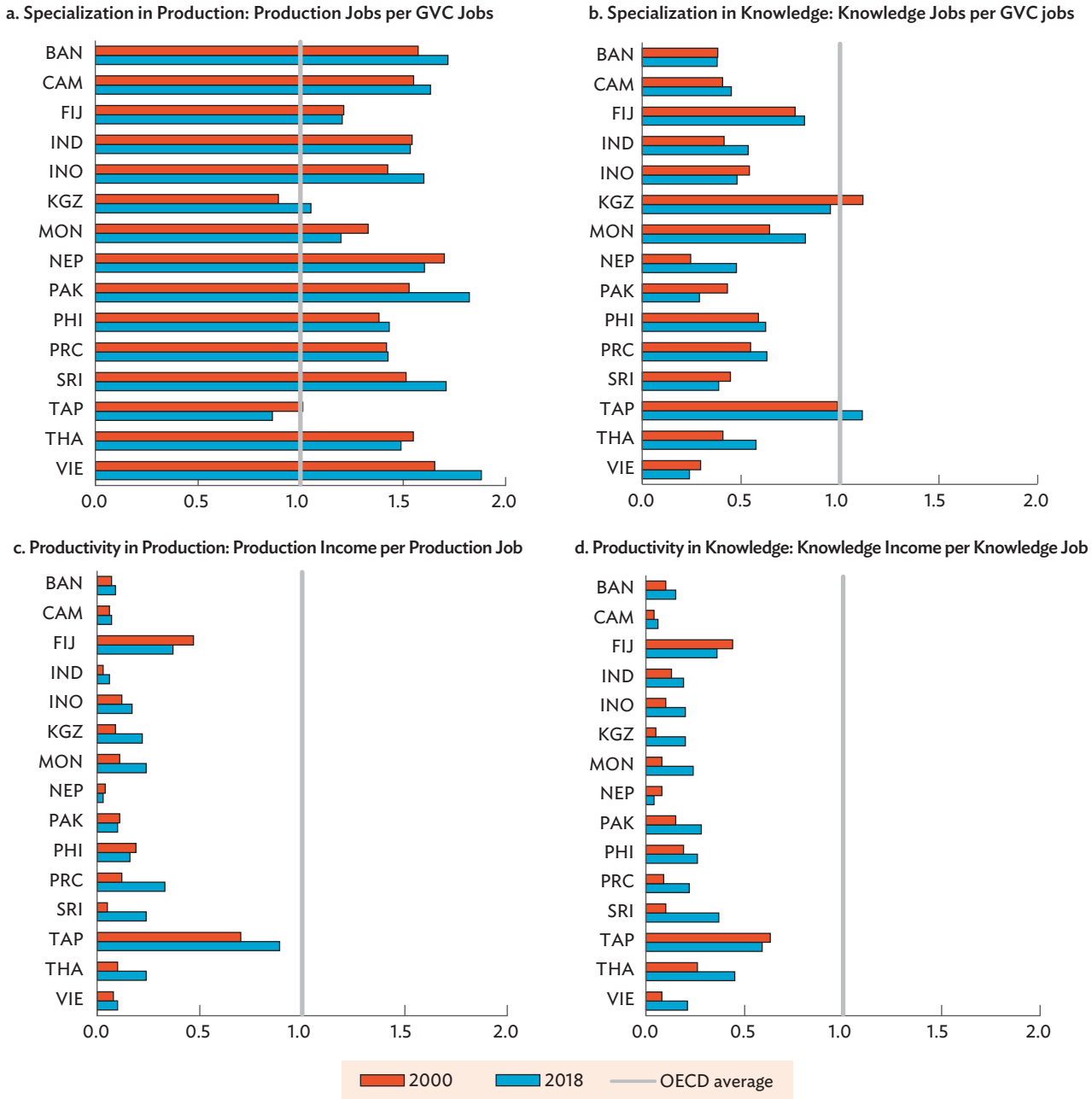


GVC = global value chain, OECD = Organisation for Economic Co-operation and Development.
Notes:
1. GVC income ratio calculated as real GVC income in final manufacturing products, expressed per capita and at 2011 constant purchasing power parity for the aggregate of 15 developing Asian economies and disaggregated into the sum of production income per capita and knowledge income per capita relative to the (unweighted) average 29 of OECD countries.
2. The 15 are Bangladesh, Cambodia, Fiji, India, Indonesia, the Kyrgyz Republic, Mongolia, Nepal, Pakistan, the People's Republic of China, the Philippines, Sri Lanka, Taipei,China, Thailand, and Viet Nam. The 29 OECD countries are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, Poland, Portugal, the Republic of Korea, Slovenia, Spain, Sweden, Turkey, the United Kingdom, and the United States.
3. Line markers represent the years where input–output tables are available in the Asian Development Bank's Multiregional Input–output Database.

Source: Elisabetta Gentile and Gaaitzen J. de Vries. 2021. Is Participation in Global Value Chains Driving Income Convergence in Developing Asia? A Task-Based Accounting Approach. Unpublished.

Figure 3.8 presents the results of the second-level disaggregation of the productivity ratio shown in Figure 3.5 into the specialization-in-production ratio, the productivity in production ratio, the specialization-in-knowledge ratio, and the productivity in knowledge ratio. Panel a clearly shows that GVC income convergence was mainly driven by an expansion of GVC jobs in production, whereas the share of knowledge-intensive jobs is roughly 50% of the OECD average, with the exception of Fiji and Taipei,China. These reflect a global division of labor whereby more knowledge-intensive jobs are in advanced economies and more production jobs are in developing Asia. Yet knowledge-intensive jobs increased in developing Asia from 2000 to 2018. Panels c and d show that most developing Asian economies in the sample increased productivity in both production and knowledge-intensive activities from 2000 to 2018.

Figure 3.8: Second-Level Disaggregation of Productivity in 15 Developing Asian Economies, 2000 and 2018



BAN = Bangladesh, CAM = Cambodia, FIJ = Fiji, GVC = global value chain IND = India, INO = Indonesia, KGZ = Kyrgyz Republic, MON = Mongolia, NEP = Nepal, PAK = Pakistan, OECD = Organisation for Economic Co-operation and Development, PRC = People's Republic of China, PHI = Philippines, SRI = Sri Lanka, TAP = Taipei,China, THA = Thailand, VIE = Viet Nam.

Notes:

1. In panels a and b, the specialization in production (knowledge) ratio is calculated as GVC jobs in production (knowledge-intensive) activities in final manufacturing products divided by total GVC jobs, relative to the (unweighted) average of 29 OECD countries. In panels c and d, the productivity in production (knowledge) ratio by activity is calculated as real GVC income of production (knowledge-intensive) activities in final manufacturing products, expressed at 2011 constant purchasing power parity and divided by GVC jobs in production (knowledge-intensive) activities, relative to the (unweighted) average of 29 OECD countries.
2. The 29 OECD economies are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, Poland, Portugal, the Republic of Korea, Slovenia, Spain, Sweden, Turkey, the United Kingdom, and the United States.

Source: Elisabetta Gentile and Gaaitzen J. de Vries. 2021. Is Participation in Global Value Chains Driving Income Convergence in Developing Asia? A Task-Based Accounting Approach. Unpublished.

However, all but Fiji, the PRC, and Taipei,China were below 25% of the OECD's average level of productivity for production activities, and productivity in knowledge is not much different. These findings suggest that the increased involvement of Asian workers in manufacturing GVCs, particularly in production activities, is driving income convergence in developing Asia. Productivity has increased, but this is from a low starting point. Thus, the region still has a long way to go before its productivity convergence is complete.

In sum, while exporting through GVCs is often seen as a panacea for weak industrialization trends in developing economies, the reality is more complex. Productivity growth is not necessarily associated with employment growth in developing economies, and the association even turns negative as economies get closer to the productivity frontier in manufacturing, possibly due to the labor-substituting effect of automation. Even in developing Asia, which has seen a massive increase in the scale of production activities, productivity convergence and functional upgrading have been slow and far from guaranteed, as shown by the diversity of outcomes across the 15 economies examined by Gentile and de Vries (2021). That study, however, also shows the importance of upscaling in driving income convergence and that the volume of the activity matters just as much as the domestic share of the value of the product in driving income convergence.

Upgrading and Innovation along Global Value Chains

Firms from developing economies typically face two challenges when entering international markets, particularly newly emerged high-tech markets: a technology gap and a marketing gap. The technology gap—difficulty in accessing needed technologies—is associated with weak technology and innovation capabilities. The marketing gap is the high barriers to entry into increasingly concentrated global markets, such as heavy information costs and investments to establish a brand (Schmitz 2007).

The modularization of manufacturing—the building of complex products from smaller subsystems that can be designed independently yet function together as a whole—has reduced the production complexity of high-tech products. This is because potential market entrants can source core technologies from international suppliers (or acquire the firms that own those technologies) and concentrate on noncore technology activities, such as assembly and brand development. In other words, the international division of labor along GVCs has solved the technological bottlenecks of manufacturing sophisticated products (Xing 2021a).

Two case studies are now presented on emerging economy MNCs that have caught up with and eroded the market share of established MNCs based in advanced economies. In both cases, the new market entrants overcame the technology gap by taking advantage of modularity in manufacturing, albeit by pursuing two different strategies. They also

overcame the marketing gap by using their knowledge of their domestic markets to create a competitive advantage and then gradually growing their presence in foreign markets.

It is worth noting that catching up in output capabilities means acquiring the technologies and skills relating directly to a product or service; this does not necessarily include the ability to enhance or develop that product (Awate, Larsen, and Mudambi 2012). The process, however, still involves new-to-the-country and new-to-the-firm innovation. The two case studies also emphasize the importance of marketing innovation in product design, packaging, placement, promotion, and pricing, as well as organizational innovation to be able to compete globally. In other words, the ability to develop the next-generation product is not the only way for a firm to be innovative.

Acquiring Technology through Outward Foreign Direct Investment in India's Wind Turbine Industry

Suzlon Energy Ltd., an Indian wind turbine manufacturer, entered the industry in 1995 as a start-up. Within 12 years, Suzlon had caught up with the industry technology frontier in its output capability. The combined worldwide market share of Suzlon and its subsidiaries was about 10% in 2009, making it the world's third largest wind turbine manufacturer.[8]

Suzlon's trajectory is a classic example of a successful springboard strategy in which emerging economy MNCs overcome their latecomer disadvantage in the global stage by aggressively acquiring strategic assets from mature MNCs to fortify capabilities and better compete against larger global players (Luo and Tung 2007). The process begins with an "inward internationalization" stage in which local firms acquire basic skills and capabilities from foreign firms. This stage is followed by outward foreign direct investment aimed at improving output capabilities. The newly acquired assets and knowledge are then transferred back to the home market and used to improve and upgrade these capabilities. The reinvigorated home base and strengthened capabilities are then used to compete globally (Luo and Tung 2018).

Table 3.1 summarizes Suzlon's springboard strategy in the early years. The sales agreement followed by a licensing agreement with German company Südwind Energy GmbH represents the inward internationalization stage. By combining operational knowledge of foreign technologies with knowledge of its domestic market, Suzlon deployed a strategy of selling locally manufactured turbines of technological sophistication comparable to its competitors at considerably lower prices—and became the clear leader in India's wind energy market in just 4 years.

8 The case study is drawn from Awate, Larsen, Mudambi (2012, 2015).

It is interesting to note how Suzlon pursued expertise in each of the core technological modules that a wind turbine is made of from different firms (Figure 3.9). This was possible because under a modular production system, the product can be broken down into functional modules according to given design rules that define the function of each module; how the modules interact, connect, and communicate with each other; and the standards for testing the performance of each module and its compliance with the design rules (Baldwin and Clark 1997, 2000). Producers can mix and match different modules to produce final products catering to diverse consumer preferences by following the design rules, and the decomposability of the production process is thus greatly enhanced.

Table 3.1: Suzlon Energy's Early Knowledge Acquisition Strategy to Become a Wind Turbine Leader

Year	Action	Objective
1995	Sales contract with German company Südwind Energiesysteme	To handle low-tech sales activities for Südwind in India and gain valuable industry experience
1996	Licensing agreement with Südwind	To gather the engineering and manufacturing expertise in wind turbine technology
2001	Acquisition of Dutch company AE-Rotor Techniek	To acquire specialized knowledge in the design and manufacture of rotor blades
2001	Licensing agreement with Dutch company Aerpac	To acquire expert knowledge in rotor blade design
2001	Acquisition of manufacturing and marketing rights from Enron Wind Rotor Production, the Dutch subsidiary of United States company Enron Wind	To acquire the molds, production line, and technical support and assistance for rotor blade manufacturing
2002	Acquisition of German company 215 Verwaltungs	To establish an research and development unit in Germany
2004	Joint venture with Austrian company Elin Motoren	To manufacture wind turbine generators in India
2006	Acquisition of Belgian company Hansen Transmission International	To acquire sophisticated technology for gearboxes and drive trains for wind turbines
2007	Acquisition of German company REpower Systems	To broaden the product portfolio to include the largest offshore wind turbines

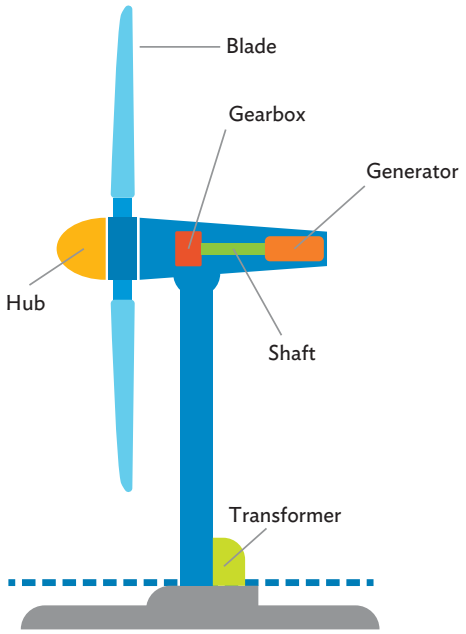
Sources: Authors' adaptation of Snehal Awate, Marcus M. Larsen, and Ram Mudambi. 2012. EMNE Catch-Up Strategies in the Wind Turbine Industry: Is There a Trade-Off between Output and Innovation Capabilities? *Global Strategy Journal*. 2 (3). pp. 205–223; Snehal Awate, Marcus M. Larsen, and Ram Mudambi. 2015. Accessing vs Sourcing Knowledge: A Comparative Study of R&D Internationalization between Emerging and Advanced Economy Firms. *Journal of International Business Studies*. 46 (1). pp. 63–86.

Next, is the outward foreign direct investment stage that corresponds to the technical agreements and acquisitions in 2001 and 2002. These early acquisitions were still output oriented—that is, they were aimed at getting skilled workers and the technologies required to catch up in output capabilities. Suzlon then targeted for acquisition firms that possessed significant R&D knowledge in different technologies and were active innovators. The joint venture with Elin Motoren GmbH in 2004 and the acquisitions of Hansen Transmission International AV in 2006 and REpower Systems AG in 2007 were aimed at building a knowledge portfolio in key technology areas.

In 2005, Suzlon started setting up R&D units in Europe, mainly in Denmark and Germany. As of 2015, the higher end of Suzlon's R&D knowledge still resided in its foreign subsidiaries, whereas the Indian operations had not generated a single patent.

To determine whether Suzlon's rapid output catch-up also facilitated catch-up in innovation capabilities, Suzlon's knowledge base is compared with the knowledge base of industry leader Vestas Wind Systems A/S, representing the technology frontier. Vestas is a Danish company that began manufacturing wind turbines in 1979 and was industry leader by 2009. Being the industry's pioneer, Vestas pursued a strategy of global in-house R&D, actively searching for new knowledge and competences.

Figure 3.9 Main Parts of a Wind Turbine



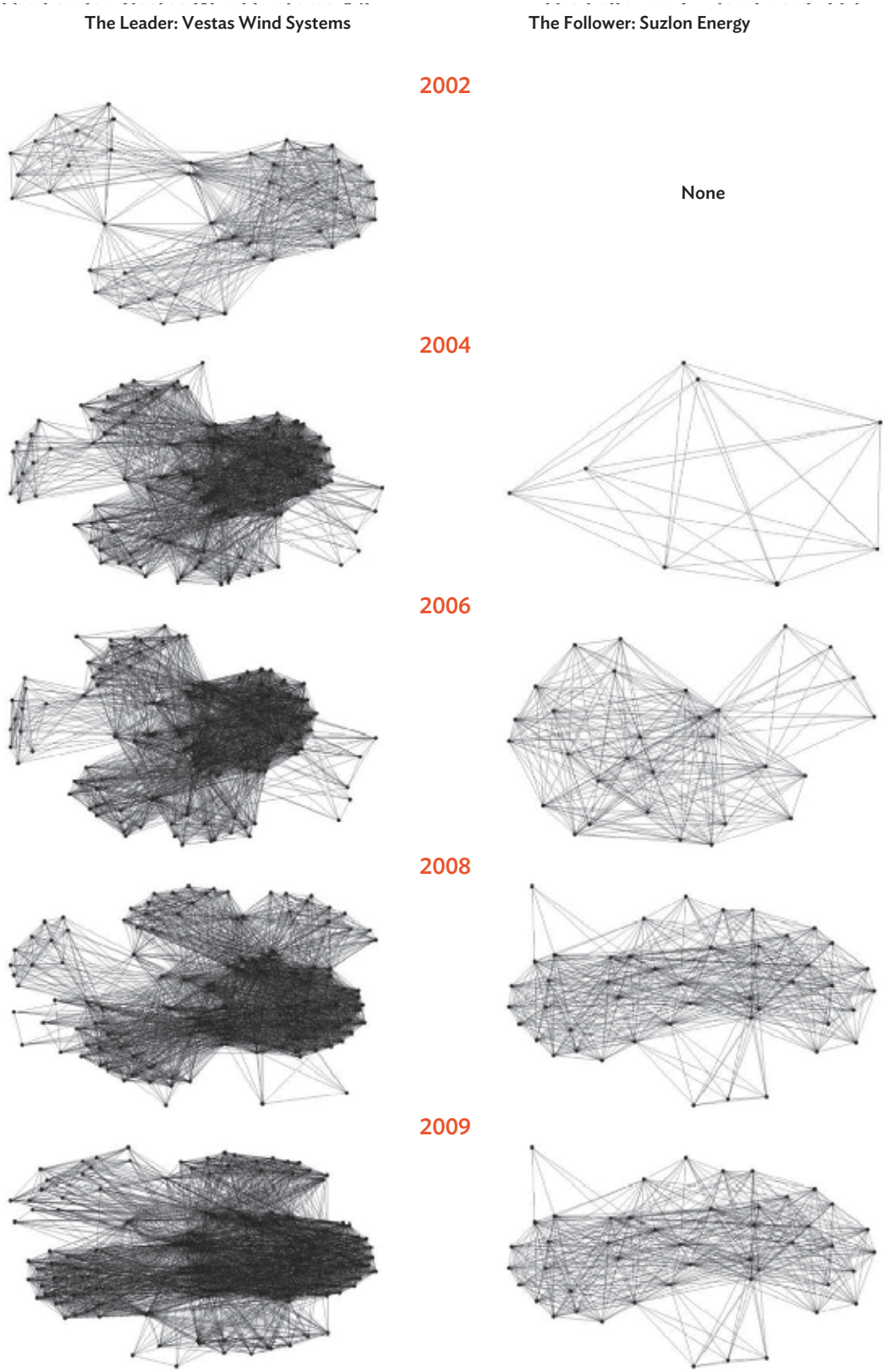
Source: Authors.

Figure 3.10 is a visual representation of the two firms' knowledge bases measured as the yearly networks of technology classes of backward-cited patents.[9] The knowledge bases are depicted as networks of technological domains from where each firm draws its knowledge. These are the technological classifications defined by the US Patent and Trademarks Office that appear in each firm's patent citations. The nodes in the network represent the various classes of technologies, and the links or connections between these classes show that each firm combined them to generate their patented innovations.

As the figure shows, industry leader Vestas's technology network got larger (more nodes) and denser (more connections among nodes) from 2000 to 2009, implying that the company draws knowledge from a larger number of technological domains. The dense networks also show that Vestas's deep technological knowledge enables the company to understand in what ways the different technologies are interrelated and to combine them in useful ways. Thus, Vestas's knowledge base is both deep and broad.

9 Backward citations reference work that is considered relevant to a current patent application, and they are a primary component of proving inventiveness in new patent applications. How many patents are cited and from which categories is a proxy for how deep a firm's knowledge base is.

Figure 3.10: Evolution of the Source Networks of Vestas and Suzlon



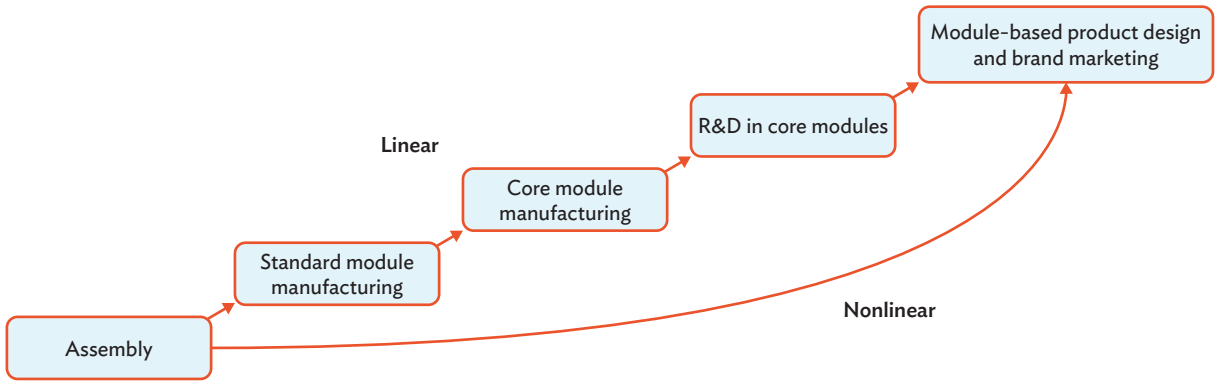
Source: Snehal Awate, Marcus M. Larsen, and Ram Mudambi. 2012. EMNE Catch-Up Strategies in the Wind Turbine Industry: Is There a Trade-Off between Output and Innovation Capabilities? *Global Strategy Journal*. 2 (3). pp. 205–223.

The figure clearly shows the effect of Suzlon's springboard strategy on its knowledge base. Its technology network barely had any nodes and links before its acquisition sprees in 2001–2002 and 2006–2007. But with every acquisition, Suzlon's knowledge base got larger, albeit much smaller and thinner than Vestas's. The drawback of such a knowledge base is evident in Suzlon's insignificant patent output. In other words, the springboard strategy certainly helped Suzlon to catch up in output capabilities. But the lesson here is that simply buying knowledge may not help generate new knowledge, an area in which firms in several emerging economies struggle.

Nonlinear Upgrading and the Rise of Local Smartphone Brands in the People's Republic of China

Firms can upgrade along GVCs by following two dynamic paths: linear and nonlinear (Figure 3.11). Upgrading along value chains step by step from low to high value-added tasks is a linear upgrading path. For instance, a firm starts with assembling mobile phones, then manufactures increasingly complex mobile phone components, and eventually produces its own brand of mobile phones. A nonlinear path is sourcing core technologies and jumping directly to brand building (Xing 2021b).

Figure 3.11: Linear and Nonlinear Upgrading Paths along Global Value Chains



R&D = research and development.
Source: Authors.

The unprecedented success of the PRC's smartphone industry is a classic case of nonlinear upgrading along GVCs. In the global smartphone market, homegrown PRC brands Huawei Technologies Co. Ltd., OPPO Co. Ltd., and Xiaomi Corp. are now three of the top five global smartphone brands.[10] PRC smartphone makers entered the industry by sourcing core technological components from foreign MNCs because they had limited technological capabilities themselves in core components. Because of

10 Counterpoint. Global Smartphone Market Share: By Quarter. https://www.counterpointresearch.com/global-smartphone-share/ (accessed on 23 August 2021).

this, they also focused on incremental innovations, marketing, and brand building. By taking advantage of the modularization of smartphone production and standard mobile platforms, the three firms successfully broke the monopoly of foreign rivals in domestic and international markets.

To show the dependence of PRC smartphones on foreign technology platforms, Table 3.2 lists the operating systems and core components used by the Huawei P30 Pro, OPPO R11s, and Xiaomi Mi MIX 2 smartphones, all of which were launched after 2018. All three models run on the Android operating system. All core components used in the OPPO R11s and Xiaomi MIX2 are sourced from companies in Japan, the Republic of Korea, and the US. It is those core components that determine the technological functions of the OPPO R11s and Xiaomi MIX2 and power them to compete with the smartphones of Apple Inc. and Samsung Electronics Co. Ltd. The foreign value added accounts for 84.5% of the manufacturing cost of the Xiaomi Mi MIX2 and 83.3% of the OPPO R11s (Xing and Huang 2021).

Table 3.2 Dependence of Huawei, OPPO, and Xiaomi Smartphones on Foreign Technology

Core component	Huawei P30 Pro	OPPO R11s	Xiaomi Mi MIX 2
Operating system	Android (USA)	Android (USA)	Android (USA)
CPU	HiSilicon (PRC)	Qualcomm (USA)	Qualcomm (USA)
Flash memory	Samsung (KOR)	Samsung (KOR)	Hynix (KOR)
DRAM	Micron Technology (USA)	Samsung (KOR)	Samsung (KOR)
Display	BOE Technology (PRC)	Samsung (KOR)	JDI (JPN)

CPU = central processing unit, DRAM = dynamic random-access memory, JPN = Japan, KOR = Republic of Korea, PRC = People's Republic of China, USA = United States.
Source: Yuqing Xing. 2021. Decoding China's Export Miracle: A Global Value Chain Analysis. Singapore: World Scientific.

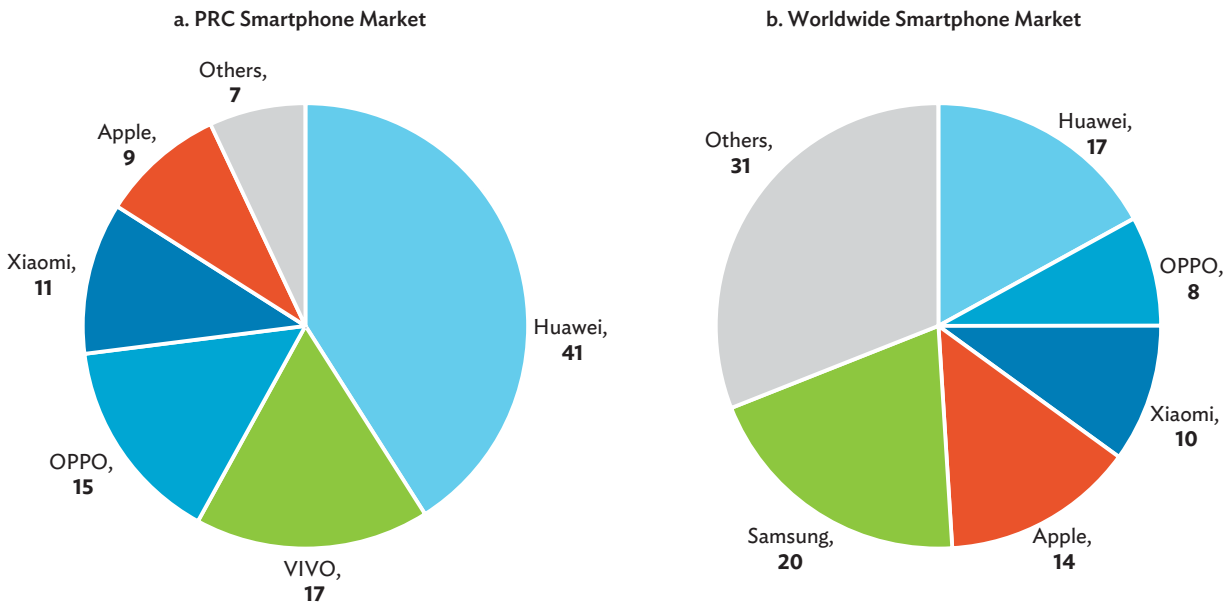
Huawei is regarded as the most innovative PRC company. In 2018, it invested $15.3 billion in R&D, outspending Apple (Bloomberg 2019). But besides the operating system, the Huawei P30 Pro uses dynamic random-access memory from US firm Micro Technology Co. Ltd. and flash memory from Samsung. In all, foreign parts and components account for 61.9% of the manufacturing cost of the Huawei P30 Pro.

Using foreign technology modules and platforms takes much less time and investment than developing core technology, such as chipsets and operating systems. The huge PRC market is conducive to marketing-focused strategies drawing on borrowed technology. By concentrating on marketing and product differentiation, PRC smartphone makers have capitalized on their advantage in understanding the preferences of Chinese consumers. Take OPPO: by positioning its product as the smartphone with the best camera capabilities in its marketing, the company successfully differentiated itself from its rivals.

The nonlinear upgrading strategy has been highly successful. PRC smartphone makers have reversed the dominance of foreign brands completely in the domestic market.

Panel a in Figure 3.12 shows that, in the first quarter of 2020, PRC brands accounted for more than 90% of the PRC's smartphone market, up from 10.4% in 2000 (Imai and Shiu 2007). The top four brands in terms of shipments—Huawei, OPPO, Vivo Mobile Communications Co. Ltd., and Xiaomi—are all local brands, accounting for 84% of the market.[11] Apple has a modest 9% market share in the PRC, while Samsung, the world's largest mobile phone maker, has almost disappeared from the PRC market.

Figure 3.12: Share of Smartphone Market by Brand, Q1 2020
(%)



Sources: Panel a: Counterpoint. China Smartphone Market Share: By Quarter. https://www.counterpointresearch.com/china-smartphone-share/; panel b: Counterpoint. Global Smartphone Market Share: By Quarter. https://www.counterpointresearch.com/global-smartphone-share/ (both accessed 23 August 2021).

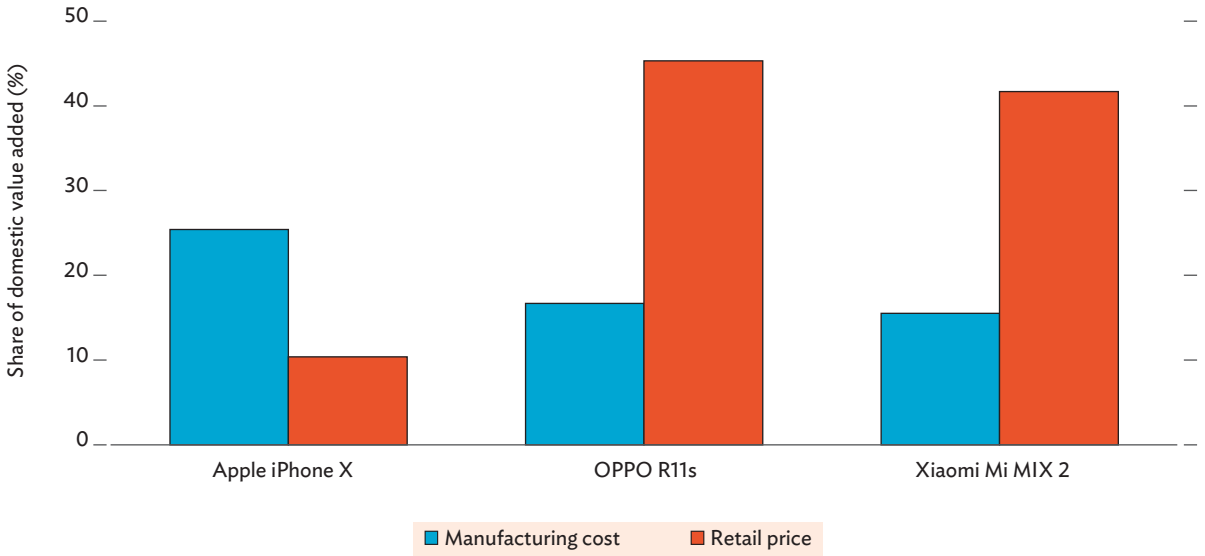
PRC original brand manufacturers, riding on their domestic success, began selling smartphones globally. Their presence and market shares in geographically dispersed foreign markets have grown, particularly in emerging markets, where affordable PRC-brand smartphones continue to be attractive to low- and middle-income consumers, who make up the majority of smartphone users in these markets. In India's smartphone market, for example, PRC brands had a 66% market share in the first quarter of 2019. Here, Xiaomi surpassed Samsung to become the biggest brand in India.[12] Panel b in Figure 3.12 shows that globally by the first quarter of 2020, Huawei, OPPO, and Xiaomi had taken three of the top five positions in smartphone shipments.

11 Huawei's 41% market share in the first quarter of 2020 includes Honor, a PRC smartphone brand founded in 2013 and owned by Huawei until 2020, when Huawei sold it to Shenzhen Zhixin New Information Technology Co.

12 Counterpoint. India Smartphone Market Share: By Quarter. https://www.counterpointresearch.com/india-smartphone-share/ (accessed on 23 August 2021).

As noted earlier, the potential for value creation is distributed unevenly across different stages of the value chain, and the bulk of this value added stems from intangibles, such as brands (Mudambi 2008). By pursuing a nonlinear upgrading strategy, firms can increase their value added in high-tech products even if they lack the technological capability. Figure 3.13 demonstrates this point by comparing the value added accruing to the PRC for three smartphones: the Apple iPhone X, the OPPO R11s, and the Xiaomi Mi MIX 2. All three are assembled in the PRC, but while Oppo and Xiaomi are local brands, Apple is of course a US brand. When value added is measured on the basis of manufacturing cost, the share accruing to the PRC is 25.4% for the Apple iPhone X, and less than 20.0% for both the OPPO R11s and the Xiaomi Mi MIX 2. But when the retail price, a proxy of the whole value added of a good, is used as a yardstick, the domestic value added of the OPPO R11s is 45.3% and 41.7% for the Xiaomi Mi MIX 2, much higher than that of the Apple iPhone X, at 10.4%. Brand ownership clearly contributes most to the increase in domestic value added of the two PRC smartphones.

Figure 3.13: Domestic Value Added of Three Smartphones Assembled in the People's Republic of China



Source: Authors' adaptation of Yuqing Xing and Shaopeng Huang. 2021. Value Captured by China in the Smartphone GVC: A Tale of Three Smartphone Handsets. *Structural Change and Economic Dynamics*. 58. pp. 256–266.

MNCs have evolved into factoryless manufacturers and derived income from intangible assets, including brands, as shown in Chapter 2. Xiaomi is factoryless but controls its large distribution network, as Apple does. Mi MIX 2 teardown data show that Xiaomi's gross profit and retail services, primarily provided through its online channels or offline Xiaomi Mi Stores, jointly account for 31.7% of the total value added, which is by far the largest contribution (Xing and Huang 2021). Hence, Xiaomi's brand ownership significantly enhances the value-added captured by the PRC.

The feasibility of a nonlinear upgrading strategy is critically dependent on the absence of political intervention in free and fair international transactions, allowing firms to source

freely parts and core technologies without being discriminated based on nationality. Geopolitical tensions and trade frictions can disrupt the smooth operation of firms relying on a nonlinear upgrading strategy. While Chapter 5 gives a comprehensive analysis on the risks of GVC participation, Box 3.1 presents the case of Huawei to illustrate the risks of pursuing a nonlinear upgrading strategy in a high-tech industry.

Box 3.1: The Risks of a Nonlinear Upgrading Strategy: The Case of Huawei

Huawei Technologies Co. Ltd., a multinational technology company from the People's Republic of China (PRC), lost its position as the world's second largest smartphone brand in 2018, when the Government of the United States (US) imposed increasingly stringent export controls and market access restrictions on Huawei on national security grounds (McCabe 2021). Out of the $70 billion Huawei spent on component procurement in 2018, some $11 billion went to US firms, including Intel Corp., Micron Technology Inc., and Qualcomm Inc. (Jiang and Martina 2019).

From May to August 2019, the US Department of Commerce's Bureau of Industry and Security added Huawei and its numerous subsidiaries to its export control entity list, which requires US companies to obtain a US government license before exporting parts and technology to Huawei (BIS 2019a and 2019b).

In May 2020, the bureau announced an expansion of US export controls on Huawei that further limited the company's ability to produce or develop products using US software and technology, as well as acquiring foreign-produced semiconductors manufactured using US-developed technology (BIS 2020). Under the new regime, even non-US suppliers, such as TSMC Ltd., are barred from supplying chips to Huawei and its affiliates, such as HiSilicon Semiconductor Co. Ltd, if the chips are manufactured using US-developed technology.

These restrictions have had a significant impact on Huawei, particularly on its ability to source hardware and software. For example, after being added to the entity list in May 2019, Huawei's smartphones were prohibited from using Google LLC's Android-based software suite Google Mobile Services, which had a direct impact on its overseas sales.

Huawei's ability to source high-end chips made in the US was also severely hampered. According to *Nikkei Asia* (2020), the company's purchases from the US were halted after the imposition of export controls in 2018, and the share of US-made components in Huawei phones dropped dramatically. In Huawei's top-end MATE30 5G, for example, the total value of components made in the PRC increased from 25% to 42%, while US components dropped from 11% to about 1%.

The impact of these restrictions is most evident when seen in terms of Huawei's global market share. In the first quarter of 2019, it had a 17% share in the global smartphone market, shipping 59.1 million handsets worldwide. By the first quarter of 2021, this had fallen to 4% (15.0 million shipped handsets). This market share does not include Huawei's sub-brand Honor, which was sold in 2020 to ensure its survival in the face of US sanctions (McMorrow 2020).

The rise and fall of Huawei in the global mobile phone market show not only the excessive dependence of the most innovative high-tech company in the People's Republic of China on foreign technologies, but also the risks of pursuing a nonlinear upgrading strategy along global value chains.

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Nikkei Asia. 2020. Huawei Teardown Shows US Ban Made Company Turn to Chinese Parts. 14 May.

Overall, the case studies from India and the PRC imply that moving up a value chain in high-tech sectors is not necessarily a linear process. Apart from participating in increasingly more technologically sophisticated production tasks, firms in developing

economies can leverage their competitive advantage to target high value-added functional segments. The firms in these case studies used their large domestic market to build their brands before expanding into foreign markets and, as such, can be seen as exceptional cases. While a large domestic market certainly helps to achieve scale at the early stages of integration into GVCs, the key to both success stories is that these firms leveraged their knowledge of the local context to create competitive advantage. The rising regionalism in GVCs discussed in Chapter 1 means that firms from small developing economies can leverage their regional markets for scale if there are no disruptions to trade and investment flows.

Conclusions

This chapter provides answers to three questions. First, what is the relationship between GVC participation and productivity growth, and how do GVCs affect the innovative performance of participating firms? It is important to understand these relationships because productivity is a critical factor in determining the standard of living in an economy. The evidence shows that GVC-mediated access to foreign R&D increases total factor productivity and, in advanced and emerging economies, boosts innovation. Conversely, low absorptive capacity and large distances from the global technology frontier, as well as the highly specialized nature of the knowledge flowing along a value chain, may prevent firms in developing economies from drawing on the knowledge and technology of lead GVC firms. Precisely because lead firms tend to work closely with their suppliers, the consequence of this may be that these end up being overly specialized and dependent on the lead firms. As De Marchi, Giuliani, and Rabellotti (2018) note, imitation is one of the most effective channels of knowledge acquisition, along with collective learning and learning from non-GVC actors.

The second question is whether GVC-mediated productivity growth is associated with sustained employment growth in high-productivity sectors. This is a necessary condition for economic development to occur. The chapter shows that GVC-mediated productivity growth is not necessarily associated with employment growth in developing economies, and that the association even turns negative as economies get closer to the productivity frontier in manufacturing, possibly due to the labor-substituting effect of automation. Similarly, Gentile and de Vries (2021) show that in developing Asia employment and productivity along value chains do not necessarily go hand in hand. That study also shows that, while there has been a lot of emphasis on functional upgrading as a driver of income convergence, in developing Asia the volume of activity matters just as much as the domestic share of the value of a product. As Kowalski et al. (2015) note, “important benefits can be derived from specializing in assembly activities and performing them on a large scale.”

The third question is whether firms in emerging economies can leverage the fragmentation of production underpinning manufacturing GVCs to catch up with industry leaders and successfully compete on a global stage. Indeed, moving up the value chain ladder is no longer necessarily a linear process. The increasing modularization of manufacturing, especially in high-tech industries, makes it possible even for firms with relatively limited technological capabilities to become industry leaders. This can be done by firms sourcing core technological components from foreign MNCs or using international expansion as a springboard to acquire strategic resources and reduce their institutional and market constraints at home. While a rapid catch-up in output capabilities is not sufficient to put the firms at the innovation frontier, the process still involves new-to-the country and new-to-the-firm innovation, which are as important as frontier innovation for driving productivity growth.

The case studies on India and the PRC could be perceived as outliers because they both have a large domestic market. While that certainly helps with achieving scale at the early stages of integration into GVCs, the key to both success stories is that those firms leveraged their knowledge of their domestic markets to create competitive advantage. With the rising regionalism in GVCs discussed in Chapter 1, even economies with relatively small domestic markets can successfully pursue these strategies by leveraging their regional markets for scale.

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4

The Role of Global Services Value Chains for Services-Led Development

Enrico Nano and Victor Stolzenburg

The emergence of global value chains (GVCs) has lowered the threshold for countries to participate in globalization. They offer a new path for development without having to establish complete production capabilities from upstream inputs to downstream final goods and after-sales services. Developing countries can plug into GVCs and specialize in specific economic activities in accordance with their comparative advantage to benefit from gains from trade and specialization.

This relationship between GVCs and development is often discussed in the context of manufacturing or agriculture, but the past few decades have witnessed an unprecedented shift of employment and output shares toward services. This structural change is characteristic of both developed and developing countries globally (World Bank and WTO 2020). As Figure 4.1 shows, services in developed countries employ about 75% of the workforce. In low- and middle-income countries, the share averages 45%, but many countries, including India, the Philippines, and the People's Republic of China (PRC), have much higher shares. Accordingly, services now account for more than half of global gross domestic product (GDP), a share that has been steadily rising since the early 1990s (Sachetti et al. 2019; WTO 2019). This trend is contributing to rapid growth in the trade in services, which more than doubled in value from 2005 and 2017 and grew 17% faster than the trade in goods (WTO 2019).

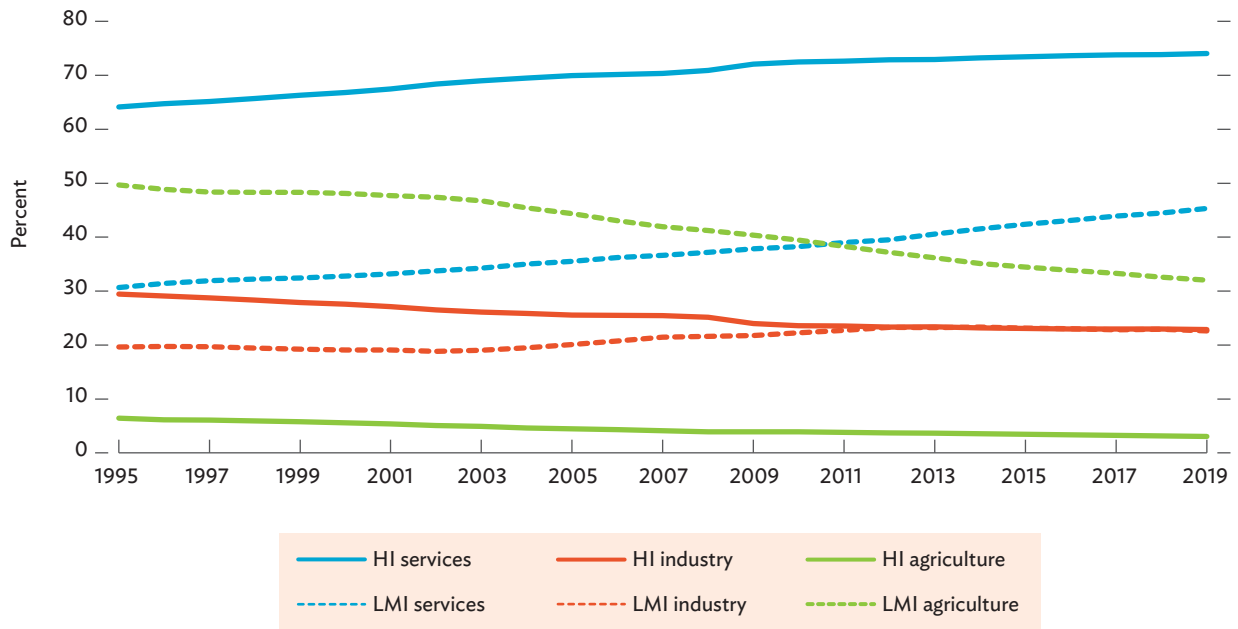
The expansion of services in employment, output, and trade shares is being driven in part by the growing number of services jobs created to support manufacturing; in other words, the servicification of manufacturing. Heuser and Mattoo (2017), in the *Global Value Chain Development Report 2017,* discussed how services are important inputs in almost all stages of a supply chain. In fact, the upstream position of many highly traded services,

with the exception of tourism, implies that services trade is mainly trade in intermediates and can therefore also be called trade in global services value chains. As Figure 4.2 shows, the share of exports of intermediates in total exports is about 62%; this is quite high for services sectors involved in GVCs, compared with the same indicator for manufacturing sectors.

Importantly, services not only contribute to manufacturing and agricultural value chains but they also, increasingly, form their own value chains, since the "production" process of certain services allows for fragmentation similar to that of goods. For example, the software production process can be separated into architecting, developing code, testing, implementation, marketing and distribution, maintenance, helpdesk, and training and education (Sharpe 2009). This enables countries to join services GVCs just as they joined goods GVCs. Two examples of this strategy are India for software services and the Philippines for business process outsourcing (BPO).

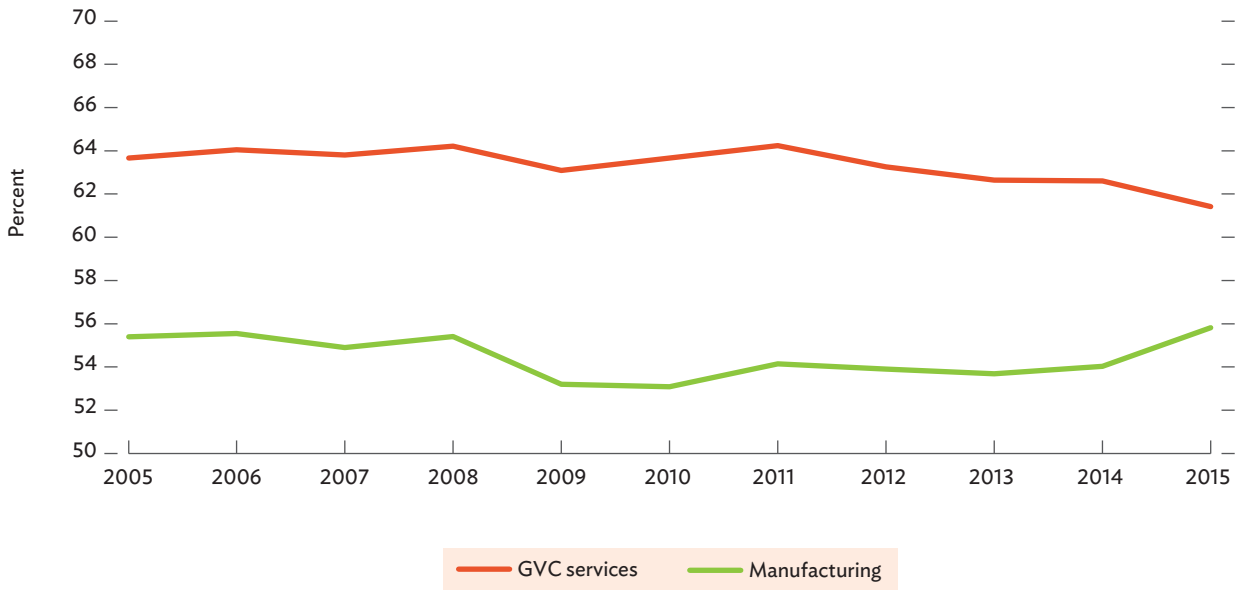
This chapter examines these services value chains to advance the discussion of services in GVCs started by Mattoo and Heuser (2017) in the *Global Value Chain Development Report 2017*. The following section presents case studies on services value chains in India and the Philippines to draw lessons for developing countries on the factors that enable integration into services value chains, as well as the benefits and disadvantages of these chains. The following two sections link the two case studies to the broader debate on services-led development and premature deindustrialization.

Figure 4.1: Employment Shares of Macro Sectors, 1995–2019



HI = high-income countries, LMI = low- to middle-income countries.
Sources: Authors' calculations based on International Labour Organization modelled estimates and World Bank. World Development Indicators Database. https://databank.worldbank.org/source/world-development-indicators (accessed 23 February 2021).

Figure 4.2: Share of Intermediate Exports to Total Exports, 2005–2015



GVC = global value chain.
Note: GVC services include telecommunications, information technology and other information services, financial and insurance activities, transportation and storage, and other business services.
Source: Authors' calculations based on Organisation for Economic Co-operation and Development Statistics on Trade in Value Added. https://www.oecd-ilibrary.org/trade/data/oecd-statistics-on-trade-in-value-added_36ad4f20-en (accessed 19 February 2021).

This allows for a more comprehensive assessment for policymakers, beyond what the two case studies can provide, and to look ahead to possible future developments. The chapter closes with conclusions and policy recommendations.

Joining Services Global Value Chains

While offshoring is often discussed in connection with manufacturing, it has also become an important part of the globalization of services. Seeking cost efficiency through offshoring, companies outsource their noncore business processes to specialized third-party service providers, which can then offshore their labor-intensive operations to developing countries with lower labor costs. Similarly, large multinational corporations (MNCs) directly offshore their labor-intensive services to cost-competitive locations by setting up "global in-house centers" (UNCTAD 2014). Two leading destinations for these strategies are India and the Philippines, whose GVC participation is to a large extent driven by services.[1]

[1] This section is based on two background papers analyzing in detail the services GVCs of two countries: the software services industry in India (Huang, Jai, and Xing 2021) and BPO in the Philippines (Fermo and Xing 2021).

Background

India is deeply integrated into the value chains of the global software industry, providing services such as routine software programming and maintenance, as well as the information and communication technology (ICT) services of business process management to global customers. Between 1990 and 2010, India became a leading destination for MNCs to outsource their labor-intensive software and BPO services, and the rise of this industry has significantly contributed to India's economic growth.

To understand this development, it is important to note that software development processes can be fragmented just like the production process of cars or other goods. The main value-adding stages of the software services value chain can be divided into three phases: predevelopment, development, and postdevelopment. Predevelopment has two major value-adding activities: research and development (R&D) and analysis of the needs of users. Development includes conceptualization, design, coding, and testing. Postdevelopment consists of marketing, distribution, and after-sales services.

The high modularity of the software development process enabled the rise of software services value chains, through which many tasks can be outsourced to countries, such as India, where these activities can be carried out more effectively and cost-efficiently. The on-site offshore model has been particularly instrumental in the development of India's software services industry. In this model, higher-end tasks requiring frequent face-to-face client interaction are carried out on-site by information technology (IT) professionals dispatched by Indian firms. But less demanding tasks are done offshore by software engineers in offices in India. This model is able to arbitrage wage differences between software engineers across countries and enables round-the-clock production. As a result, it reduces the costs of IT services and delivery times. This has enabled India's software services industry to capture most of the global market for middle- to low-end coding services, while software architecture, conception, and design are typically still done by companies well established in these tasks, such as IBM Corp. and Accenture PLC, or by clients themselves.

The experience of the Philippines is similar to that of India. Innovations in ICT enabled firms to offshore routine or noncore office functions to developing countries, giving rise to BPO value chains. BPO companies offer 24-hour services that include call centers and voice services, the handling of queries of customers abroad, and higher value non-voice BPO functions. Voice services cover most call center operations, which involve either calling customers located abroad or receiving client calls. BPO in the Philippines tends to focus on direct customer care and consists of relatively routine functions. Higher value non-voice BPO functions include medical and legal transcription, finance and accounting, human resources activities, and high-end processes, such as animation, business and financial research, and data science analytics. As BPO evolved, functions extended into so-called (IT)-BPO to encompass, initially, IT-related outsourcing services and later on to IT-business process management that covers services going beyond outsourcing and more into offshore management.

The first offshore services company in the Philippines started in the early 1980s. The first wave of BPO investment was in the 1990s as MNCs started setting up offshore subsidiaries, including in the Philippines. The most rapid growth was due to foreign direct investment (FDI) inflows. Equity capital investments have expanded significantly since 2005, with the United States (US) being the largest source. This was made possible in large part by the surge in IT business parks and cyberparks to cater to the Philippines' expanding outsourcing business. The Philippines became a leading destination for BPO services in the 2000s and, since around 2010, is the acknowledged call center capital of the world.

Determinants of Integration: Comparative Advantage in Services Tasks

The determinants of India and the Philippines integrating into services GVCs are mostly linked to typical comparative advantage, but combined with supportive idiosyncratic factors. Both countries are abundantly endowed with relatively low-paid workforces that have the relevant skills. For instance, the minimum daily wage in Manila (₱537) is about the same as the effective hourly minimum wage in the US ($11.80) in 2019. Estimates for India suggest the overall cost of software development is only half that in the US (NASSCOM 2013). The skills needed in software services and BPO are first and foremost proficiency in English, high literacy, and sufficient training in the use of digital technologies. India has the world's second largest English-speaking population and the second highest number of graduates in science, technology, engineering, and math (McCarthy 2017). The EF English Proficiency Index ranks the Philippines second among Asian countries in the top 100 of countries. In contrast, software services and BPO are largely independent of physical infrastructure beyond local IT parks and do not require large upfront capital investments, both factors for which India and the Philippines do not have a comparative advantage.

Government interventions have advanced the comparative advantage for software and BPO services. Policies to liberalize central services, such as telecommunications deregulation, in both countries in the 1990s were critical for facilitating services growth by fostering competition through increased entry into the domestic market. India has been a strong advocate for liberalizing the temporary movement of professionals in regional and multilateral negotiations. It has also given substantial support for physical, technology, and education infrastructure. Both India and the Philippines have invested heavily in export processing zones and IT parks, which provide the necessary environment for services value chains. There are now 55 special zones in India and the Philippines. Education reforms in the two countries have been partly driven by the need to ensure a steady supply of English-speaking workers with technical skills. India has not only increased the number of schools but also announced plans to set up 17 new institutes of technology (Jalote and Natarajan 2019). Public sector support for services investment via fiscal incentives is strong in both countries. The Philippines, for instance, grants a tax holiday of up to 8 years to foreign investors.[2]

[2] It is important to note that the empirical evidence on tax incentives tends to be mixed at best, as it often creates free-rider effects (Slattery and Zidar 2020).

Private sector engagement has been similarly important. In both countries, private firms have made substantial investments in training and skills development. Indian IT services firms have spent some $1.6 billion on training in large campus-like training facilities. Public–private partnerships in the Philippines support 125 schools and regional, provincial, and specialized training centers to provide the necessary skills for BPO workers.

A relevant idiosyncratic factor for the success of the Indian model is the presence of Indian expatriates in IT sectors abroad, especially Silicon Valley. Many MNCs in India were set up by Indians working abroad before returning home (Bhatnagar 2006). The return migration of Indian IT professionals has led to important knowledge inflows and global business networks. The diaspora also acts as intermediary for substantial business opportunities by advocating for and helping to match foreign buyers with Indian suppliers.

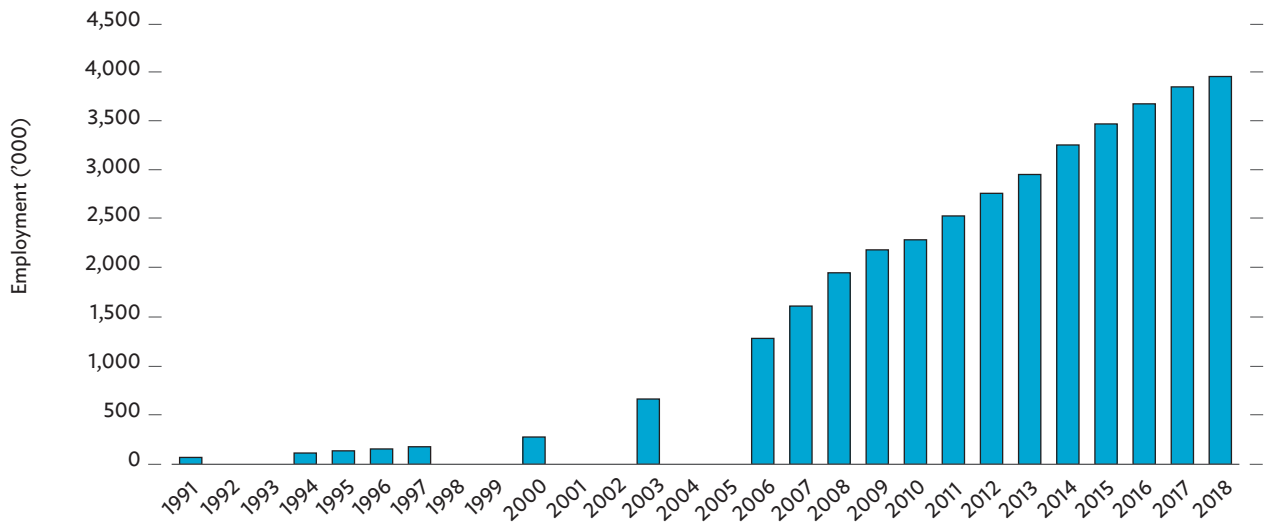
As a result of all these factors, the 2018 Tholons Services Globalization Country Index ranked India first and the Philippines second. In A. T. Kearney's Global Services Location Index, the Philippines was among the top seven of 50 countries from 2014 to 2017 and named an "industry leader" in 2017.

Benefits and Challenges of Services Value Chains in India and the Philippines

Services value chains are a major contributor to economic growth and sources of foreign exchange for both countries. In 2018, India's IT industry generated $167 billion in revenue and $125 billion in exports, with the ratio of IT revenue to GDP at 6.1%, up from 3.2% in 2002, and the ratio of IT exports to total exports at 39.1%, up from 20.0%. For employment, no other industry has generated as many well-paid jobs in India over the past decades. In 2018, the IT industry directly employed about 4 million people. Estimates indicate that indirectly it supports an additional 12 million jobs (Jalote and Natarajan 2019). The average growth rate of IT industry employment over the past 3 decades stands at an impressive 16%; it started out with just 72,000 direct-employment jobs in 1991 (Figure 4.3). The rising demand has led to steady wage increases in India's IT industry. According to NASSCOM (2016), wages rose 8%–12% over the past decade, although most of this increase went to mid- and top-level employees.

The development of the Philippines' BPO industry has been similarly impressive as that of software services in India. The industry had double-digit annual revenue growth from 2004 to 2016—and a minor slowdown since then. BPO revenue was an estimated $26.1 billion in 2019, compared with $1.3 billion in 2004. This revenue accounts for about 7% of GDP and is nearly equivalent to the Philippines' annual foreign remittances inflow. In 2011, BPO exports were 67.5% of total services exports, up from 22.0% in 2004. BPO employment rose from 94,000 in 2005 to an estimated 1.3 million in 2019. In 2018, the aggregate compensation generated by the industry was $9.8 billion, a 21-fold increase on 2004's $471.4 million. Average BPO wages are generally considerably higher than the national average.

Figure 4.3: Information Technology Services Employment in India, 1991–2018



Note: Data collected annually only since 2006.
Sources: A. Arora, V. S. Arunachalam, J. Asundi, and R. Fernandes 2001. The Indian Software Services Industry. *Research Policy*. 30 (8). pp. 1267–1287; S. Huang, A. Jai, and Y. Xing. 2021. Plugging into Global Value Chains of the Software Service Industry: The Experiences of India. Unpublished; National Association of Software and Service Companies.

The benefits beyond growth and employment are important for both countries. Their IT and BPO services exports have made a significant contribution to the participation of women in the workforce. More than 50% of BPO workers in the Philippines and 34% of IT workers in India are women—shares that are substantially higher than the national average at 46% for the Philippines and 21% for India. Importantly, about 25% of female employees hold managerial positions in India's IT industry. The two industries have also contributed to skills upgrading and higher educational attainment, with the IT industry helping to push the number of engineering graduates to over 700,000 per year in India.

An important concern for both countries is that their participation in services GVCs involves largely routine and low value-added tasks. Estimates suggest 46% of the Philippines' BPO IT workers are low-skilled (IBPAP 2016). India mostly specializes in routine software services and struggles to get into higher-end niches, such as generic software packages and software as a service.[3] This is in sharp contrast to other major software-developing countries, such as Ireland and Israel, and due to most GVCs in which firms from developing countries participate, at least initially, being unipolar. Here, a dominant foreign lead firm is in a critically functional position. The lead firm centrally governs the GVC by shaping what is done, how it is done, and who controls access to knowledge, technology, and final markets globally.

[3] Software as a service is a software licensing and delivery model in which software is licensed on a subscription basis and centrally hosted. As of 2020, Amazon Inc., Google LLC, and Microsoft Corp. were among the biggest software-as-a-service firms.

Firms in developing countries integrating in GVCs typically face both a technology gap (an inability to perform complex tasks) and a market gap (no direct access to end-user and end-market). So, they have little choice but to depend on lead firms to fill these gaps. This dependence imposes constraints and challenges to the growth of firms in developing countries trying to integrate into GVCs.

One ramification of the specialization in routine and repetitive tasks, coupled with workers being expected to work long hours and flexible shifts, is high worker attrition in both India and the Philippines because the most talented emigrate to final-demand markets. Staff turnover can reach 44% a year in call centers, and the repetitiveness and psychological burden of dealing under pressure with customers results in low productivity (Yu, Wang, and Jiao 2020).

Firms are responding to this by increasingly investing in artificial intelligence (AI), which is already capable of replacing routine and low-skill IT and BPO tasks. Evidence from the PRC shows that although call center revenue grew in 2018, the number of call center agents fell by 161,000, a drop of over 30% (Yu, Wang, and Jiao, 2020). Although using AI increases productivity and releases workers from the most routine and burdensome tasks, it also lowers employment and wage growth at the lower end of the employment pyramids of both industries—just as automation threatens low-skill employment in manufacturing. This pressure is likely to move up the skills ladder as AI becomes more refined and capable.

Prospects for Services Value Chains in India and the Philippines

Several reasons are behind a major share of services GVCs in India and the Philippines being stuck in routine and low value-added operations, as just discussed. Upgrading often requires a dynamic domestic market with intensive interactions between users and developers. The domestic markets of both countries do not yet satisfy this requirement even though these markets are growing. It is worth noting that India's IT exports are more than three times higher than its domestic IT revenue. Moreover, more advanced products demand a high level of R&D, marketing capabilities, and expenditure, which puts most small firms from developing countries at a disadvantage. For India's IT majors, the percentage spending of total revenue on R&D is about 1%. This is substantially less than at Google or Microsoft, which spend about 15%. Some 275 global software and computer services firms are in the top 2,500 global R&D spenders. Of the these, 161 are from the US, 32 from the PRC, and only 5 from India (CTIER 2016).

Other structural barriers for the two countries include the high cost of capital, rising wages, and concerns over the sustainability of the on-site offshore model. This model, as a nonpatentable process innovation, is being increasingly copied throughout the world by competitors that can offer even lower wages. Furthermore, the nature of services trade is changing, which puts data regulation high on corporate agendas. Restrictive data regulation policies from local storage requirements to transfer limitations could be a

drag on productivity in this environment and lower FDI. Other current risks to services value chains in India and the Philippines are discussed in Box 4.1 and Chapter 5.

Box 4.1: Risks to Global Services Value Chains in India and the Philippines

Beyond the structural factors that threaten the participation of India and the Philippines in global services value chains are current risks from the COVID-19 pandemic and policy shifts.

India has suffered acutely from the pandemic. Data from Johns Hopkins University show the country had over 30,000,000 COVID-19 cases as of July 2021. This has caused severe economic disruptions that have been aggravated by lockdowns and overseas travel bans.

Spending on information technology services in India fell by 4.0% in 2020, although it bounced back and is expected to rise by 2.3% in fiscal year 2021 (ending 31 March 2021) (NASSCOM 2021). But the risk beyond the immediate effect of the COVID-19 crisis is that it might cause a reevaluation by lead firms of the perceived resilience of offshore destinations, which could harm the economic prospects of India and the Philippines.

The other main risk is increasing policy uncertainty. The software services model continues to depend on the temporary movement of people, but both the COVID-19 pandemic and policy shifts in key final-demand markets have rendered this business model less reliable. For instance, the granting of H-1B visas in the United States has become more restrictive in recent years. More generally, geopolitical developments, including the trade conflict between the United States and the People's Republic of China, may result in firms postponing foreign direct investment due to the increased policy uncertainty.

The Economic Policy Uncertainty Index shows that global economic policy uncertainty has more than tripled since 2010, and studies have shown the effect of this can be substantial (Handley and Limao 2015; Pierce and Schott 2016).

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India and the Philippines need to upgrade and move into higher value-added operations in the chain to sustain their success in global services value chains. Here, both countries have made some progress. In the 2000s, Indian companies HCL Technologies Ltd., Infosys Ltd., Tata Consultancy Services Ltd., and Wipro Ltd. (to name a few) entered the market and gained market share from established MNCs. They offer a range of services, including higher value-added tasks, such as handling large and complex projects involving end-to-end solutions on IT infrastructure management and IT consultancy. At the same time, MNCs started moving their R&D centers to India—1,250 of them to date, which employ 400,000 software engineers. In the 2010s, this triggered a rise of Indian "unicorns," predominantly consumer-led IT platform start-ups largely focused on the Indian market. These firms, initially replicas of US companies, have pioneered unique innovations for the Indian market.[4] By the end of 2019, 18 of these IT start-ups each had a market capitalization exceeding $1 billion.

[4] For instance, Flipkart Online Services Pvt. Ltd. is an equivalent of Amazon and Ola Electric Mobility Pvt. Ltd. is a competitor of Uber Technologies Inc.

The BPO and IT industries of both countries try to support this trend jointly with the public sector. An example of this is the 17 institutes of technology planned in India to ensure a supply of workers with the skills for higher value-added tasks. The Philippines is supporting science and technology education, and English proficiency. The programs for this intend to raise the skills of 1 million workers over 5 years by offering training grants for near-hires, upskilling vouchers, scholarships, student grants, and tertiary education subsidies for individuals. The programs also include train-the-trainer programs, massive open online courses for teachers, and teaching opportunities for industry veterans. The governments of both countries are investing heavily in communication infrastructure by setting up high bandwidth networks in most cities and large towns. Importantly, government procurement has been used to support domestic IT demand that allows firms to develop broader expertise. In India, examples include the Ministry of Corporate Affairs' system for corporate tax filing and the income tax management system, and the passport and rail reservation system developed, maintained, and managed by domestic IT companies.

Lessons from the Case Studies

Three important lessons emerge from the case studies. First, becoming part of GVCs has led to sustained economic benefits for India and the Philippines in income, employment, and social inclusion. Second, human capital is a key factor for comparative advantage in services GVCs—and much more so than in manufacturing. Without a trained or trainable population, starting with knowledge of English, a country is unlikely to be competitive with other outsourcing destinations. And third, technological trends, including AI and cloud computing, can severely reduce the labor intensity of services GVCs, which especially affect the less skilled. To stay competitive and move up the GVC, investments must continually be made in upskilling and reskilling the workforce to tackle the challenges from rapid technological change. This needs to be combined with the faster development of domestic services markets and larger domestic R&D investment. Strong local business networks and economic interactions are crucial to upgrade along the value chain.

Growth, Specialization, and Barriers to Trade

Although the case studies of India and the Philippines are instructive on the benefits and implications of joining services value chains, they capture only very specific services in the IT and BPO industry, and are driven in part by idiosyncratic factors. To derive more general lessons, this section connects the findings of the case studies to a broader debate on services-led development. Because data on services GVCs remains limited, this focuses on services trade more generally. And since about two-thirds of this is trade in intermediates, the lessons from studies on services trade can be instructive for services GVCs.

Services create most jobs globally, and they do so earlier in the economic development process. This has been called premature deindustrialization (Rodrik 2016; Ghani and O'Connell 2016). A debate is ongoing on whether services-led development can replace industrialization for economic development, especially in the context of export-led growth relevant for global services value chains. Helble and Shepherd (2019) show how structural transformation—moving employment and value creation from agriculture to manufacturing to services—is driven by both demand and supply factors. For demand, as countries get richer, they first see increased demand for manufactured goods and then for services, such as those for health and recreation. For supply, a major concern with manufacturing is that it has become increasingly mechanized and less labor-intensive, mostly because of technological progress. So, the sector is not able to absorb the large amounts of labor available in developing countries. Many services are harder to automate and have become progressively more tradable. For these reasons, services could be the main driver of future growth and employment.

Dani Rodrik takes a more nuanced view than this on the role of services and GVCs for economic development (Rodrik 2016, 2018). He recognizes that GVCs ease the entry of firms in developing countries into global markets. He highlights, however, the scarce evidence on the employment effects of GVC participation and the unequal diffusion of the benefits of export activity throughout an economy. It is along these lines that Rodrik (2016) describes premature deindustrialization as being detrimental for development, and argues that trade and globalization are the likely cause. He argues that deindustrialization in developed countries leads to lower prices of manufactured goods that spill over to developing countries. As a result, developing economies "import" prematurely deindustrialization from advanced ones without having enjoyed the same rapid productivity growth and opportunity for convergence to high-income levels that manufacturing can offer.

The premature-industrialization critique has its detractors (among them, Nayyar, Cruz, and Zhu 2018). Ravindran and Babu (2021) argue that premature industrialization may only lead to an increase in income inequality if workers who lose their jobs move to informal and low-productivity market services. But if employment shifts to business market services or nonmarket services premature deindustrialization need not worsen inequality. Moreover, endogenous growth theory stipulates that R&D, a service, is *the* engine of growth (Romer 1994). This relates to the tendency for growth in high-skill services to raise innovation, which is the ultimate source of growth. One of the main criticisms of services is that they are nontraded, although this view is rapidly changing. Rodrik (2016) also argues that services do not generate spillovers. But evidence of substantial economy-wide spillovers of certain services sectors is growing, as discussed later in this section. Rodrik (2016) suggests that these spillovers are not a source of large numbers of "good jobs," which is true for some services but not all, and might point to improving working conditions in certain low-skill services. Regardless of the theoretical approach, the diversity of sectors within the services aggregate is a key issue to be considered in all analyses (Jorgenson and Timmer 2011).

Other concerns over services-led development were first raised in the cost–disease hypothesis that suggests structural change may be responsible for a slowdown in productivity growth Baumol (1967). Recent research, however, argues that productivity growth in services suffers from mismeasurement, and that the observed difference in the productivity growth of contracting goods and expanding services might also be explained by a negative elasticity of worker efficacy for employment shares. If this is the case, goods and services having similar productivity growth rates is a plausible alternative characterization of recent growth patterns (Young 2014). Research also suggests that even if the hypothesis applies, there are services sectors with high productivity growth. The sufficient degree of substitutability between high- and low-productivity services sectors means that major declines in aggregate productivity growth rates are unlikely in the future (Duernecker, Herrendorf, and Valentinyi 2017; Sen 2020). Because productivity growth is particularly high in many traded services, including finance, transportation, and telecommunication, services value chains are essential for sustaining this positive trend in productivity growth.

Baldwin and Forslid (2020) argue that services-led development relying on globalization, digitization, and other technological advances will naturally become the main development path for low- and middle-income countries. Here, the main argument is based on developing countries being typically well-endowed with low-cost labor. But if manufacturing becomes increasingly capital-intensive, the comparative advantage of developing countries cannot be fully exploited. However, this can be done with services (production and exports) due to the large workforces of developing countries and the prominent diffusion of ICT firms without the need for expensive upfront capital investment. A new development model, boosted by declining labor-cost shares in manufacturing due to automation and the smaller cost of trading services because of digitalization, would then allow developing countries to increase their participation in services GVCs.

This has the important benefit that services are typically less polluting than manufacturing so that a services-led development path would be greener (Ghani and O'Connell 2016). Besides lower pollution, services GVCs can contribute to achieving environmentally-related Sustainable Development Goals by fostering GVCs in clean energy, as well as environmental protection and remediation. Services GVCs are also a key contributor to gender-equality Sustainable Development Goals, since their employment shares are more equal across genders, as discussed in the section on labor markets and inequality.

Nayyar and Cruz (2018) also recognize that manufacturing is no longer the main source of productivity growth, since many characteristics relevant for development, such as scale, technology diffusion, and greater competition, are now shared by several services. They point out a different critical issue: human capital (as highlighted in this chapter's case studies). Highly-traded services are typically skills-intensive, and the importance of skills rises with productivity (Buera and Kaboski 2012). In populations characterized by low educational attainment, high-skill services may not be able to absorb all the excess

labor coming from the shrinkage in agriculture and manufacturing. The unmet demand for human capital may therefore prevent the international trade in services from being the next driving force for growth and job creation in developing countries unless the tradability of low-skill services increases (Hallward-Driemeier and Nayyar 2018).

This mirrors arguments by Baldwin and Forslid (2020), who similarly suggest that labor is the key factor of production for most services, but caution that knowledge transfers in services tend to be harder and slower than technology transfers in manufacturing. It is through the long-lasting accumulation of human capital that workforces can develop the skills, knowledge, and experience necessary for a growth-push based on services. While constraints in the manufacturing-led model mostly relate to capital, competencies and ultimately time are constraints in the services-led model. This chapter has already highlighted how India and the Philippines, considered the poster children of services-led development, have been able to improve the education of their workforces by liberalizing services sectors, among other policies. This liberalization increased household earnings and returns to education that kicked off a human capital–accumulation process that increased the supply of skilled labor. This in turn attracted private sector investment, including foreign investment, that increased the demand for educated workers, which initiated a positive feedback loop (Nano et al. 2021).

Recent empirical studies show that national GDP growth is strongly correlated with growth in services, a relationship that has become stronger and greater than that of manufacturing and agriculture growth. Loungani et al. (2017), in a cross-country analysis on 192 countries from 1970 and 2014, find that per capita GDP growth has a 0.60 correlation coefficient with movements in services value added, compared with a 0.24 coefficient with movements in manufacturing value added. Per capita GDP growth from 2010 to 2014 is also more strongly associated with services exports than with manufacturing, agriculture, and mining exports. This strong evidence in favor of a services-led growth model replacing the older manufacturing paradigm raises the question of what can be done from a policy perspective to boost this source of growth.

The literature based on computable general equilibrium models points to welfare gains from the liberalization of services; these range from 2% to 7%. A World Trade Organization study of 148 countries from 2000 to 2014 estimated larger gains in GDP per capita for developing and least-developed countries around a mean of 6.3% (WTO 2019). Opening up services also seems to yield larger gains than opening up merchandise trade. Chadha et al. (2000) compare the effects of an equivalent reduction by one-third in the trade barriers of goods and services trade. Using data from five developed and 15 developing countries, they find positive welfare gains for both groups, but larger ones for developing (2.5%) than developed countries (2.0%).

Aggregate growth originating from services GVCs is directly dependent on the trade costs of services, which are almost twice as large as those in merchandise trade and mostly originate from policy barriers (WTO 2019). Francois and Hoekman (2010) find that liberalizing services can ignite positive growth dynamics, both aggregate and micro. They identify productivity gains and inward FDI as the main channels, activated by increased domestic efficiency and competitiveness. Similarly, Shepherd (2019), using a structural gravity model, shows the impact on manufacturing exports and output of services liberalization is larger than a reduction in tariffs. The results from this are important for gauging the spillover effects of services liberalization on other economic sectors. Because services are crucial inputs for firms in manufacturing and other industries, reducing trade restrictions on services trade can deliver important benefits for the rest of the economy as well.

On similar lines, Beverelli, Fiorini, and Hoekman (2017) focus on the impact that discriminatory barriers to trade in services has on manufacturing productivity. Using a large sample of developed and developing countries, they show that relaxing restrictions on the trade in services positively affects the productivity of manufacturing firms that make large use of services in their production processes. It also has a positive mediating effect on institutions in importing countries. Arnold et al. (2016) and Arnold, Javorcik, and Mattoo (2011) corroborate these findings by focusing on two very different case studies: India and the Czech Republic. By using firms' panel data, they analyze the effect of different dimensions of services reforms, from delicensing to privatization and foreign ownership, on manufacturers that rely on services as intermediate inputs. They find that services liberalization boosts the productivity of downstream manufacturing firms, particularly foreign-owned ones.

Winkler (2019), focusing on developing countries, studies productivity spillovers from services to manufacturing firms. This analysis is based on the World Bank's Enterprise Surveys of 105 low- and middle-income countries from which a large firm-level cross-section database is constructed (24,000 services and 38,000 manufacturing firms). The author finds evidence of positive spillovers between the two sectors, in particular from services firms with high technological intensity and productivity. The size of the spillover tends to increase with the services intensity of manufacturing firms and in general with their absorptive capacity, size, exporting behavior, foreign ownership, and national income level. As a result, Winkler (2019) suggests that services liberalization is a sound policy to boost the magnitude of productivity spillovers from services to manufacturing firms. Evidence also shows that manufacturing firms that more intensively use services are more resilient to external shocks, such as import competition (Bamieh et al. 2020).

Technological change in itself has brought and continues to deliver great benefits to developing countries, including the quality and accessibility of services through digital means. For example, Industry 4.0 technologies are enabling new business models and opening new markets for innovative firms and entrepreneurs in developing

countries (Chapter 6). Digital-intensive services, which have experienced large productivity increases in recent years, could become a primary driver of economic growth in developing countries by enabling significant productivity improvements in manufacturing and services. Industries that are heavy users of ICT services are associated with greater value-added contributions to the overall economy. Because of this, restrictive digital regulations, particularly on data and the internet, have the potential to inhibit productivity growth (van der Marel 2019).

Labor Markets and Inequality

Services in most developing countries tend to perform better than agriculture and manufacturing in labor market outcomes and total productivity. This, coupled with above-average earnings, has attracted many people to move from rural to urban areas and has advanced economic growth in many low-income countries (Diao, McMillan, and Rodrik 2019). Labor demand in manufacturing industries, however, has been stagnant or even declining in both advanced and developing economies (Loungani et al. 2017). An important question here is how services GVCs affect employment, earnings, and their distribution across different socioeconomic groups. The answer is not straightforward. Recent theoretical research points to strong but ambiguous effects that services trade can have on labor market outcomes when there are labor market frictions.[5]

A reason for this ambiguity is that services are comprised of very diverse subsectors. For instance, most of the subsectors discussed in the previous sections, such as software development and BPO, are highly traded while other services are more dependent on local demand. In finance, business services, IT, and telecommunications, it is easier to boost productivity, particularly through technological innovation, to reach the frontier set by developed countries. Although these services have considerable potential to increase growth through trade, they also require a highly skilled workforce and therefore have a lower potential to absorb large amounts of low-skilled workers. And vice versa: retail and personal services (and similar subsectors) are less traded, characterized by a high level of informality, and difficult to innovate with productivity-enhancing technologies. These services rely on more low-skilled and unskilled labor, but they also pay lower wages. That said, the employment effect of the expansion of high-tech services, which are typically capital-intensive, is minor when compared with their multiplier effect. Moretti (2010) estimates that for each new ICT job about five complementary, additional local jobs are generated. The rest of the section on labor markets and inequality examines in greater detail the evidence on the labor market effects of services trade.

5 See WTO (2019) for a review of the literature.

Employment

Services trade is an important source of employment in many developing countries. WTO (2019) finds that exports of cross-border services support some 10% of all jobs in Costa Rica, South Africa, and some other countries. As noted in the section on joining services value chains, estimates suggest ICT in India supports up to 16 million workers directly and indirectly and has generated more jobs than any other sector over the past 20 years. Even so, the empirical evidence on the impact of services trade on labor market outcomes is inconclusive. Particularly in developed countries, opposite forces seem to be at play, leading to mixed results—and this can be seen in Germany, Ireland, Italy, and the US, among other countries. Automation and offshoring practices are lowering demand for domestic labor in manufacturing and services, particularly if the tasks performed at home and abroad are substitutes (Harrison and McMillan 2011). But higher productivity and lower input costs due to GVCs increase demand for domestic labor. As a result, the aggregate impacts of trade in services on employment are reported to be small and imprecise (Görg and Hanley 2005; Eppinger 2017; Liu and Trefler 2019).

The case for developing countries is quite different. Because low- and middle-income countries are usually offshore locations rather than offshoring economies, the negative substitution effect of services offshoring is less prevalent (WTO 2019). But the opposite phenomenon—reshoring—is a potential force working against the beneficial effects of offshoring for developing countries. There are several reasons why firms decide to repatriate production from host countries. Real wages have grown strongly in classic offshoring locations, decreasing their cost advantages (Bacchetta et al. 2021). Relocating production may also be advantageous when combined with automation, which can lower labor demand in both developed and developing countries by competing with low-cost labor (Acemoglu and Restrepo 2020). Indeed, several services are at risk of reshoring decisions, including telecommunications (e.g., call centers), financial services (e.g., accounting), and medical services (WTO 2017).

The evidence in favor of reshoring is scant and even more so for services. It is largely anecdotal and limited to individual industries and locations (de Backer et al. 2016; Veugelers et al. 2017). This could be even more the case for services value chains in which established relationships and sunk-cost investment ensure a high degree of stickiness (Antràs 2021; Jakubik and Stolzenburg 2020). By contrast, the empirical evidence on the effects of offshoring in developing countries not only points to greater employment volatility but also to better working conditions. Bergin, Feenstra, and Hanson (2011) show that US firms use offshoring, particularly services imports, to adjust to demand fluctuations instead of permanently replacing domestic functions. These shocks transmit across borders to low-wage countries, such as Mexico, which experience employment swings that are twice as large as those in high-wage countries. This can help explain the high attrition rates of offshore sectors discussed in the section on joining global value chains. Offshoring firms, however, also bring benefits to the workforces of host countries. Messenger and Ghosheh (2010) find that while some BPO

firms in India have an annual staff turnover of 100%, BPO workers there have higher wages and nonwage benefits, shorter working hours, and better employment conditions.

The evidence on the overall effect of services trade on employment in developing countries is still quite scarce and mostly related to case studies in specific sectors and countries. Faber and Gaubert (2019), studying tourism in Mexico, find large positive effects on employment and earnings in tourist destinations compared with nontourist areas. Specifically, they find a 2.5% increase in local employment for a 10% increase in tourism sales. These findings are partly due to spillover effects on local manufacturing, but they do not consider general equilibrium effects in relation to the negative impact on less-touristic municipalities. Thus, the aggregate effects on employment and wages could be much smaller. In another study on Mexico, Atkin, Faber, and Gonzalez-Navarro (2018) focus on the entry of Walmart Inc. into the country. They analyze the role of imports through FDI and do not find a significant aggregate impact on employment, again due to the general equilibrium effects on local stores. But they do find higher real wages due to lower prices.

Earnings and Income Inequality

Because trade in services is associated with higher growth and GDP per capita, this often also translates into higher average earnings, as highlighted by Messenger and Ghosheh (2010), Atkin, Faber, and Gonzalez-Navarro (2018), and Faber and Gaubert (2019). Fiorini and Hoekman (2019), using an econometric approach, explain how liberalizing trade in services by increasing incomes can help achieve many of the Sustainable Development Goals. The main channel for this works through improving access to services by eliminating barriers to services trade and investment, as well as to the domestic services industry, to increase competitiveness and performance, thereby raising average earnings and so helping to achieve the Sustainable Development Goals.

Increasing aggregate earnings does not imply their equal distribution and, indeed, doing so may actually increase income inequality. Concerns are growing that services trade may lead to two potential layers of inequality. First, services jobs in both developed and developing countries, are typically more skills intensive than jobs in manufacturing and agriculture, particularly those in GVCs. This results in earnings growth disproportionately accruing to highly skilled workers and discriminating against those with low educational attainment, who are also the most vulnerable to technological change in the labor market. Second, the concentration of services in urban areas may widen the urban–rural divide. Still, services trade is also expected to help close wage and gender gaps at the workplace given the high share of women employed in services (WTO 2019). Evidence from Nano et al. (2021) from India shows that liberalizing telecommunications, finance, and insurance can help close gender gaps in education, as discussed in the following section on inclusive jobs.

Wage polarization is progressively characterizing labor markets in many developed and developing countries (WTO 2017). With most low-skilled labor being pushed into services jobs, evidence is consistently showing that earnings growth takes place at the tail of distribution—that is, at the low and high end of services jobs—with the middle part of distribution becoming poorer in real terms (Autor, Dorn, and Hanson 2013; World Bank 2016). But it is also argued that the GVCs of services industries offer opportunities for both job creation and labor reallocation to tackle this growing polarization (Loungani et al. 2017). Evidence also shows that the polarization of labor markets, which is largely due to automation and routinization, is lower in developing countries. Based on a sample of 85 countries since 1990, Das and Hilgenstock (2018) show that lower-income countries are significantly less exposed to routinization than the richer ones.

Cross-country empirical evidence shows a negative correlation between changes in income inequality and changes in services exports. This may imply that a services-based growth model is more inclusive than the standard goods-based one (Loungani et al. 2017). These authors propose two potential explanations for this stylized fact. The first is linked to the labor market reallocation mechanism, which implies that mainly low- and middle-income workers benefit from upward labor mobility. The second is the gender patterns in labor market outcomes. If the employment of women is higher in countries with a deeper integration in services GVCs, these countries will also tend to show lower gender gaps in earnings, thereby exerting downward pressure on overall income inequality.

Inclusive Jobs

A related issue is how services value chains contribute to more inclusive labor markets. Although a services-led economy provides important sources of inclusive growth, it also leads to new challenges (Ngai and Petrongolo 2017). One of them is that services are more likely to be characterized by temporary employment than manufacturing (WTO 2017). Khatiwada (2019) explores how Asia's developing economies can provide access to decent employment through a services-led growth model. The path identified relies on the earlier discussion of productivity in this chapter. Here, the workforce shifts from low- to high-productivity sectors. Khatiwada (2019) identifies two main challenges to this approach. The first is the low level of infrastructure investment in developing countries: to push services productivity, countries need to expand their infrastructure. The second is human capital accumulation. To develop a skilled workforce, large investments in training and upskilling are needed, as is reducing unemployment and informal employment.

This corroborates the evidence on India and the Philippines that shows trade in services, being skills intensive, is beneficial, especially for more educated workers (Mehta and Hasan 2012; Fermo and Xing 2021). A positive side effect of this is that services trade raises the incentive for workers in developing countries to get more education. Evidence from India suggests that opening up telecommunications, finance, and insurance, among

other sectors, as well as services exports from BPO, increased educational attainment (Nano et al. 2021; Jensen 2012; Shastry 2012). Nano et al. (2021) find that India's services liberalization explains about 5% of the country's rising educational attainment and close to 10% of the narrowing gender education gap. Shastry (2012) shows that as a result of increased educational attainment, the rise in India's skills premium was less pronounced. These patterns are also typical of a growing young population. Trade in services can be essential for satisfying the demand for education and digital services of young people. Countries characterized by a large base in the age pyramid are more accustomed to using digital technologies, thereby facilitating imports of education services. This, in turn, can narrow gender-employment gaps as long as women are overrepresented in education services (WTO 2019).

In line with this and as already highlighted in this chapter, Lan and Shepherd (2019) show how services can be vital for achieving gender equality in Asia's developing economies. Using country data, they argue that the speed at which structural change for women workers has taken place in most regions in Asia is explained by the high demand for women in services and their comparative disadvantage in manufacturing. This resonates with Pitt, Rosenzweig, and Hassan (2012) and Cortes, Jaimovich, and Siu (2018), who argue that services rely on cognitive and social skills in which women tend to have a comparative advantage relative to men, as opposed to the physical strength needed in agriculture or manufacturing. Lan and Shepherd (2019) then use a dataset of firms to study the role of management led by women in the success of firms. They find that these firms are more prevalent in services than in manufacturing, and services firms with women in senior management have higher productivity.

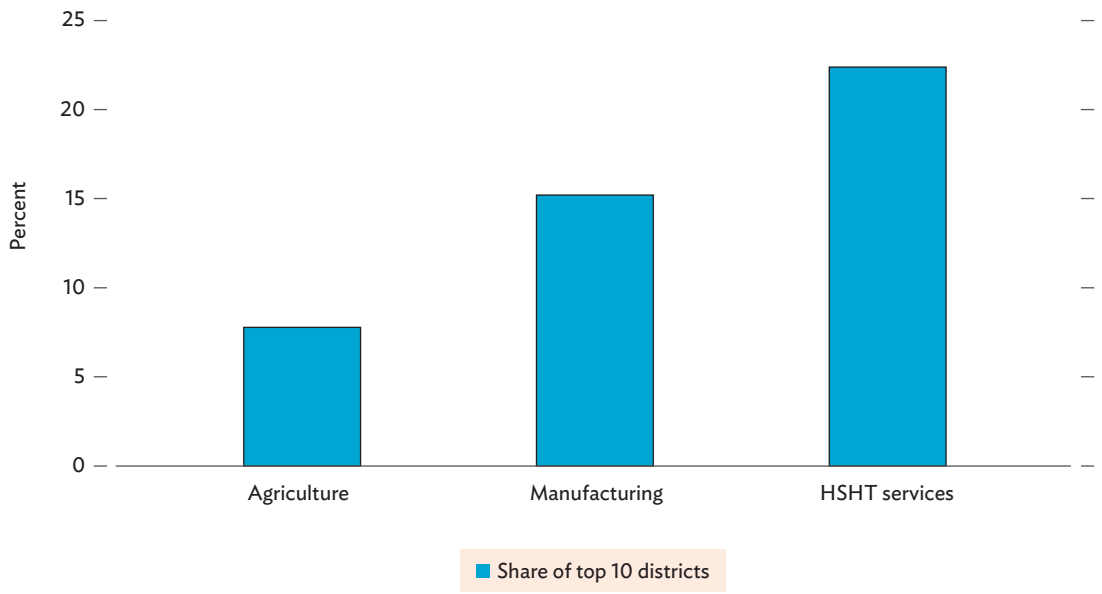
Despite 11% growth in the proportion of women in high-skill services jobs globally since 1991, it is still very low in developing countries, at an average of 3% of these positions (World Bank and WTO 2020). In most developing countries, women in the workforce also tend to be concentrated in the least-traded services sectors, such as health, education, and social work, with wholesale and retail trade being the exceptions (WTO 2019). This pattern can limit the gains accruing to women from trade and in particular from the general servicification of economies. For instance, women working in GVCs are 10% more likely to hold formal jobs than women who do not work in GVC-integrated sectors. In fact, firms participating in GVCs and foreign-owned firms tend to have higher shares of women workers (World Bank and WTO 2020). These concerns, however, could subside as more services become more intensively traded.

Structural differences in labor markets also relate to firm size. Micro, small, and medium-sized enterprises (MSMEs) operating in services have both advantages and disadvantages compared with manufacturing MSMEs. While services MSMEs are less internationalized than manufacturing MSMEs, they are about 2 years ahead of manufacturing MSMEs when they start exporting. One reason for this that services MSMEs are more ICT-intensive, so that getting access to international markets and starting to export seems to be easier for them. Many services are also increasingly

tradable across borders due to lower trade costs, and this can benefit particularly services MSMEs in developing countries, which have historically lacked market access (WTO 2019). Evidence from data on MSMEs from more than 100 countries shows that services MSMEs are less likely than manufacturing ones to suffer from barriers to trade. This is particularly so for access to finance, which tends to be more limited in smaller firms, since services MSMEs typically have lower fixed costs than manufacturing MSMEs and are less dependent on external finance (Lejárraga et al. 2014).

Inequality among regions within a country is a concern for services-led development, particularly for services value chains. Highly traded services sectors tend to be more clustered than manufacturing or agriculture. Agglomeration forces related to the interaction of skills-sharing are particularly important for these services (Diodato, Neffke, and O'Clery 2018). This is aggravated in the case of services value chains by export activity being already disproportionately concentrated in larger cities compared with overall economic activity (Bakker et al. 2021). In line with this, Topalova (2007) and WTO (2019) report that most workers in Indian cities are employed in the services sector. Figure 4.4 shows that high-skill and highly traded services sectors in India are significantly more concentrated than agriculture and manufacturing. The 10 districts with the highest employment in high-skill and highly-traded services, out of approximately 400 districts, account for almost a quarter of sector employment. The corresponding share for agriculture is 7.8%, only about a third, and 15.2% for manufacturing, only about two-thirds.

Figure 4.4: Spatial Employment Concentration Across Sectors in India, 2011



HSHT = high-skill and highly-traded.
Note: HSHT services include banking, insurance, information technology and computer services, professional services, and telecommunications.
Source: Authors' calculation based on data from the National Sample Survey Organization of India for 2011.

Evidence from developed countries tends to be even stronger. Employment in highly-traded services in the US is mostly located along coastal areas with much higher population density than inland areas (Gervais and Jensen 2019). As a result, development led by services value chains could widen the urban–rural divide. The counterargument to this is of course that by attracting workers to cities, services trade can lower inequality linked to urban–rural gaps (Young 2013).

Trade in Services and the Labor Market in the Future

While the empirical evidence does not show large net effects of services GVCs on employment and earnings, recent research indicates a positive outlook for workers in developing countries in the coming decades. Because of the expansion of digital technologies and fast-speed internet across the globe, the tradability of services will continue to increase as structural barriers to physical distance fall. Innovation in translation and robotics, among other areas, could make trade possible in areas that have long required physical presence and face-to-face interactions.

Baldwin and Forslid (2020) argue that this allows for telemigration, whereby the cross-border supply of services from emerging and advanced economies is enabled by falling services trade costs. Countering the disruptive role of automation, telemigration could offer large opportunities to developing countries by allowing trade in services in sectors that can absorb low-skill employment, but are less susceptible to automation. For instance, trade in health and education services has some of the strongest growth rates across all sectors (WTO 2020). Telerobotics—that is, a remotely controlled robot—could even facilitate trade of personal services, such as care, cleaning, and protective services, by combining the advantages of automation with uniquely human skills related to dexterity and empathy. In other words, factors that are likely to be immune to full automation in the foreseeable future.

Important limitations for telemigration are still preventing its full potential from being unleashed. These include policy barriers, such as different national jurisdictions, the need for occupational licenses being only available to domestic suppliers, cultural barriers, lack of trust in the quality of foreign suppliers, and the still limited global spread of some key technologies (WTO 2019). For instance, a platform for the remote supply of services such as Upwork Inc. is affected by both contractual difficulties and technological limitations. Many of these constraints have limited the share of the cross-border delivery of services in total trade and, consequently, also the impact they can have on aggregate labor market outcomes. Tackling these barriers, especially in sectors that are less susceptible to automation, could be a significant opportunity for future services-led development.

The COVID-19 pandemic will likely accelerate the use of broad-based telemigration. Almost all countries have implemented lockdowns, encouraging employees to work from home and employers to facilitate this swift transition. Benefitting from the

technological advancements of the past few decades, such as videoconferencing and real-time translation technology, and the diffusion of high-speed internet networks, firms have adapted processes and invested in equipment to support working from home. Evidence suggests that both workers and managers consider this a success, including from a productivity perspective (OECD 2021). In the future, teleworking might become increasingly prevalent. If it does, policy barriers will be the main barrier to telemigration.

Conclusions and Policy Recommendations

This chapter combines insights from two case studies on services GVCs in India and the Philippines with a broader review of the literature on services trade to shed light on the factors driving integration into services value chains and their effects on development. The main finding is that human capital is the most important factor for integrating developing countries into services value chains. Most highly-traded services are relatively skill-intensive and require proficiency in English. This explains why India and the Philippines have had such success in exporting services.

A conclusion that can be drawn from the development impact is that the global growth of services shows that services-led development is likely to become the main growth strategy for developing countries. While technological progress from robotization to additive manufacturing continues to reduce the demand for labor in agriculture and manufacturing, many services relying on creative or social skills remain labor-intensive. A point to highlight is that global services value chains are central for developing countries to capitalize on this ongoing structural transformation. These value chains provide access to markets in developed countries where demand has increasingly shifted toward services. In addition, high cross-border trade costs for services that require face-to-face contact are gradually reduced by advances in information technology allowing for virtual presences. Many highly-traded services sectors are also increasingly innovative and benefit from high productivity growth easing concerns related to Baumol's cost disease, as discussed in the section on growth, specialization, and barriers to trade.

The chapter, in its analysis on what global services value chains imply for labor markets and the potential of services-led development as an employment creator, finds that little research has been done on the employment effects in developing countries. But from what there is, the evidence does not show significant aggregate employment gains. The case studies on India and the Philippines underscore concerns that automation and AI can threaten low-skill labor in certain services. Even so, future trends, such as falling trade costs for services, have the potential to unlock major employment gains. And services value chains are likely to be more inclusive than manufacturing and agriculture value chains. Services are subject to lower barriers for MSMEs and employ a higher share of women. Importantly, services value chains are also often greener than agricultural or manufacturing GVCs, which allows developing countries to participate in trade without the high costs for the environment that the industrialization of advanced

and emerging economies caused. That said, services value chains could potentially increase skill divides and regional inequality.

Four key policy recommendations can be drawn from this chapter's findings. First, as already highlighted by Heuser and Mattoo (2017) in the *Global Value Chain Development Report 2017*, services sectors are still subject to high and persistent trade barriers. These are often rooted in regulations and therefore less visible and concrete than tariffs on goods. Tackling these barriers is paramount for both developed and developing countries to facilitate services-led development. Second, human capital becomes even more important in economies driven by services value chains. While the high demand for skills for these value chains leads in itself to higher educational attainment by raising disposable incomes and returns to education, policy can accelerate this. The cost of schooling, accessibility of education, and information asymmetries are the main obstacles to increasing educational attainment, particularly in rural areas of developing countries. Already low-cost policies for providing better information on job opportunities have shown to be effective in lowering these barriers. Rolling out these policies on a larger scale, while also investing in costlier programs, such as increasing the number of schools and investing in infrastructure for accessibility, are necessary to fully capitalize on services-led development. Third, by focusing these programs on rural areas, policymakers can ensure that the impact on regional inequality is dampened and that the globalization of services is inclusive. And fourth, the development of domestic markets for services and higher R&D investments are necessary to be able to move up services value chains. Countries have different tools to support these factors, including government procurement and R&D incentives.

It is important to note that the services sector is highly heterogenous. Hence, conclusions taken from case studies or econometric work based on services subsectors have limited external validity on the impact of services trade in other subsectors. While software and BPO services are high-skilled, tourism, hospitality, and personal services tend to be low skilled. These services also differ in their susceptibility to automation, their exposure to digital progresses, and many other factors. This chapter's findings are therefore only applicable to the subsectors which the cited research examines. Nevertheless, some factors, such as the importance of human relative to physical capital, and higher inclusiveness and sustainability, apply to almost all services, such that some conclusions are broadly applicable.

The interaction between digital progress and services leads increasingly to a transformation where traditional boundaries between services become less clear. Hence, traditional associations within a services sector related to skills- and technology-intensity might become misleading when, for instance, employment in the retail trade is driven by high-tech firms, such as Amazon.

The global trend toward services is unlikely to stop. Given this, policymakers should focus on maximizing the benefits from this trend rather than focusing on whether premature deindustrialization is beneficial or not. This is not to say that the discussion on premature industrialization has no value, because it provides important insights on which issues policymakers need to tackle to make services-led development as inclusive and sustainable as possible.

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5

Rising Risks to Global Value Chains

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The expansion of global value chains (GVCs) has plateaued since the global financial crisis of 2008–2009 due to the slowdown in hyperglobalization (Chapter 1; Antràs 2020a; World Bank 2020). Old and new risks to GVCs, as well as shocks, threaten the continued viability of these chains. The risks and shocks include extreme weather events, trade and technology wars, increased protectionism, geopolitical tensions, and COVID-19. IMF (2021a) defines risk as the effect of uncertainty on objectives—and by inducing uncertainty, shocks constitute an underlying source of risks, along with limited information and an imprecise understanding of the sources and mechanisms triggering shocks, which contributes to uncertainty. Given all this, the first three sections of this chapter are taken up by an overview of the sources, mechanisms, and effects of the three main types of meta-risks: geopolitical, environmental, and those stemming from the COVID-19 pandemic.[1] While addressing primarily the implications of the three risks for GVCs, these sections also take note of reverse causal effects, where GVCs exacerbate those risks.[2] The chapter then examines the relative resilience of GVCs to shocks depending on the nature and magnitude of the shock as well as on GVC features, industry and firm topographies, availability of substitutions, degree of transactional stickiness, and type of shock (geopolitical, environmental, COVID-19). The subsequent section examines mutual interactions across all three risks and their compounded

1 This chapter leaves out a vast literature on managerial, operational, cost, and other standard risks that are amply analyzed in the business literature. On the limited attention to the effects of trade policy on GVCs until 2018, when GVCs became a primary target of tariffs, see Grossman and Helpman (2020).

2 Studies on the impact of GVCs on environmental degradation are more common than studies on the impact of geopolitical risk on GVC-related environmental and pandemic risks or studies on the effects of all three meta-risks on GVCs, this chapter's main theme.

effects. The chapter concludes with policy recommendations and a discussion on future directions in the burgeoning analysis of risks to GVCs.

Sources, Mechanisms, and Effects of Geopolitical Risks on Global Value Chains

Geopolitical shocks have not only become a primary concern for the future of GVCs in recent years but also entail important implications for whether and how states can handle environmental and pandemic shocks. Concerns over political risk have never been absent from the typical list of potential risks to GVCs, but they have gained only nominal attention in most business-oriented analyses of risk focusing primarily on domestic sources, including potential social, economic, and political upheavals within countries.[3] This chapter focuses on broader systemic and interstate geopolitical risks, whose sources may lie in the domestic politics of states, but are diffused globally and entail a high potential for unleashing vicious cycles and downward spirals.[4] These meta-risks, triggered by trade and technology wars, export controls, boycotts, cyberattacks, and other typically unilateral uses of coercive economic statecraft, have wider and deeper second- and third-order implications for GVCs than conventional business risks.[5] Trade-related geopolitical meta-risks, including the trade tensions between the United States (US) and the People's Republic of China (PRC), and Brexit, were the biggest threats to global economic growth in 2019 (Lund et al. 2020), with negative implications for the subsequent management of COVID-19.

Sources of Geopolitical Risks

Varying proclivities of states to embrace or discourage interdependence via GVCs can be traced to two contrasting domestic political-economy strategies. These are animated by disparate political incentives and yield different domestic distributional consequences. Real-world strategies never match ideal types by definition, but rather lie along a continuum. Ideal-type outward-oriented strategies emphasize economic growth via access to global markets, capital, and technology; regional cooperation and predictability; and domestic macroeconomic stability that reduces uncertainty, encourages savings, enhances foreign investment, and fosters GVC participation. These outward-oriented strategies seek to lower tariffs, behind-the-border barriers, and transaction costs, as well as foster

3 A 2016 survey of 1,409 GVC professionals puts geopolitical risk 12th out of 13 risks (O'Marah 2017).

4 For a more detailed analysis of geopolitical risks, see Solingen and Inomata (2021) and Solingen (2021).

5 Baldwin (2020) defines economic statecraft as the use of economic means to pursue foreign policy objectives—whether noble or nefarious—and distinguishes it from other forms of statecraft, including diplomacy, military statecraft, and propaganda. This chapter focuses on economic statecraft of the nefarious type that unleashes or exacerbates geopolitical and geo-economic tensions. Meta-risks, including militarized interstate disputes, military threats, displays or use of force, and other offensive signals short of actual war, are not a focus of this chapter, but they can have crucial interactions with economic statecraft.

private entrepreneurship—and they have been at the heart of East Asia's GVC expansion (Escaith and Inomata 2013).

These strategies underscore the pursuit of absolute mutual gains from GVCs, and they have allowed firms from East Asia, Europe, and the US to lubricate trade, maximize efficient production, and contribute to technological upgrading (Inomata and Taglioni 2019). Firms in the PRC have been able to leap over classical developmental phases via access to US brands and markets (Xing 2021a, 2021b). As technology and innovation became ever more central to growth, the opportunity costs of discarding that GVC infrastructure have arguably risen. GVCs have also connected East Asian economies more deeply than ever and in more intricate patterns that arguably helped states transcend erstwhile armed hostilities. Despite asymmetries, states focused on maximizing absolute gains from participating in GVCs that buttressed outward-oriented strategies.[6]

By contrast, inward-oriented, hypernationalist strategies benefit politically from rejecting, restricting, or disrupting GVC interdependence, considered anathema to self-reliance. Protectionist, populist, and techno-nationalist policies aim to substitute foreign sourcing and offshore production with domestic production and to retract GVCs from perceived adversarial suppliers of intermediate goods and services, a trend that has intensified in recent years.[7] Turns to inward-oriented strategies are the deeper sources underlying current trade and technology tensions. Contemporary research traces inward-looking turns in developed countries to an interrelated cluster of economic anxiety, inequality, loss of manufacturing jobs to industrializing countries, including the "China shock," and technological change (Autor, Dorn, and Hanson 2013; Acemoglu and Restrepo 2020).[8] GVCs led by multinational corporations (MNCs) promoted efficiency on a global scale, but not necessarily fair income distribution within states or across GVCs (Meng, Ye, and Wei 2020). But others find the aggregate detrimental economic effects of globalization on US manufacturing labor to have been modest, although concentrated geographically and temporally (Krugman 2021a; Posen 2021). Mutz (2021) emphasizes noneconomic "sociotropic" considerations fueling populist turns, especially nationalism, self-sufficiency, and other social-psychological biases that often bear little association with economic data. Indeed, nationalism and populism have not eluded some East Asian economies that have benefitted disproportionately from globalization.

6 On incentives for outward-oriented political leaders to tame conflict, see Solingen (2007) and Kastner (2007). On intricate patterns connecting East Asian economies through GVCs and their potential effects on dampening armed conflict, see Solingen and Inomata (2021).

7 Techno-nationalism is a subset of mercantilist thinking that, in its extreme form, restricts most exports of technology, innovation, and scientific knowledge to maximize geopolitical advantage, technological self-reliance, and state power.

8 Wang et al. (2018) argue that inputs from the PRC helped downstream US firms expand employment in nonmanufacturing sectors and boost real wages.

The rise of inward-oriented strategies has brought asymmetries in trade balances, barriers to market access, tariffs, subsidies, and industrial policy back to the fore, along with concerns over relative gains (who gains most), raw distributional considerations, and real or presumed risks to national security. Hence inward-oriented strategies emphasize risks *from*—rather than risks *to*—GVCs, especially risks associated with the diffusion of strategic technologies. As Chapter 2 notes, the dramatic expansion of trade in services and intangible assets, research and development (R&D), product design, branding, know-how, and marketing and retailing via GVCs have exacerbated distributional concerns. Most GVCs are becoming more knowledge-intensive, especially pharmaceuticals, medical devices, machinery and equipment, computers and electronics, and information technology (IT) services.

Unsurprisingly, technology wars have zeroed in on GVC decoupling and reshoring, especially in high value-added tasks, as conduits for enhancing self-reliance, preventing diffusion of frontier technologies, and protecting intellectual property (IP) and national security. Fueling this approach is a contested assumption that Thucydides Traps are inevitable in cycles of great power transitions, inducing high mistrust, uncertainty, and war.[9] According to this view, technological diffusion arguably endows adversaries with greater economic power. Furthermore, economic and technological power are fungible and can be transformed into military and other forms of power. This reasoning thus underscores an assumption that economic exchange entails negative security externalities (Gowa and Mansfield 1993). Preventing those externalities requires the identification of "choke points" or foundational, cutting-edge technologies with broad applicability and thwarting their diffusion throughout the industrial and military complexes of adversaries, as well as creating dependencies by monopolizing production. While generating heightened geopolitical risk, these zero-sum strategies also help rally hypernationalist support at home.

Distributional analysis of complex GVCs, with intermediates crossing borders at least twice, is intricate. Nuances in relative gains, especially in knowledge-intensive sectors, can lead to competing interpretations of the benefits and risks in GVC interdependence. GVCs embed both features of competition and collaboration, and of absolute and relative gains. Different balances of gains and costs can be wielded within the malleable arena of domestic politics. GVCs can thus not only become casualties of geopolitical risk but also help fuel it.

Causal Mechanisms in Geopolitical Risk

With relative gains as the animating principle underlying economic exchange, inward-oriented strategies generate geopolitical risks that affect GVCs through supply, demand, or both through the following mechanisms:

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9 Allison (2017) adapted the original insight from Thucydides to US-PRC relations, but both the putative "trap" as a typical empirical pattern and even its applicability to the Peloponnesian War is contested (Waldron 2017; Nye 2017). On the conceptual vagueness and empirical inaccuracy of "balance of power" categories in international relations scholarship, see Vasquez (1999).

(i) **Magnifying generalized uncertainty.** Geopolitical risk does this over the short and longer time horizons of GVCs. The trade policy uncertainty index of Ahir, Bloom, and Furceri (2019, 2021), which has been fairly stable since 2005, began rising as the US-PRC trade war intensified in 2018. It declined slightly with the December 2018 agreement halting the escalation of tariffs and spiked again in 2019 following expanded US tariffs, as the index reached tenfold previously recorded highs. The jump—felt most strongly in the Americas and Asia—foreshadowed declines in gross domestic product (GDP) growth. The US-PRC trade tensions may have added 20% to global uncertainty since 2016 at one point, according to the index. Constantinescu, Mattoo, and Michele (2020) find that the rising economic policy uncertainty since mid-2018 was associated with a 1% decline in world trade growth, with similar effects on GVC trade, suggesting the effects could potentially be even more negative in the longer term due to withheld investment. Countries with high levels of GVC engagement have been adversely affected by the US-PRC trade tensions, but some third parties have benefitted via trade diversion. Firm-level surveys confirm rising uncertainty induced by the trade and technology war, with 86% of US-China Business Council members reporting that bilateral trade tensions had hurt their PRC business by mid-2020 (US-China Business Council 2020). One survey found that only 9% of surveyed firms relocated manufacturing or sourcing out of the PRC in 2019 (AmCham China 2020). The three most important justifications for relocating—rising significantly from 2018—were an uncertain policy environment, the PRC's labor costs, and US tariffs. Another survey found that US-PRC trade tensions—manifested in retaliatory tariffs, uncertainty of supply on all ends, and shifts to alternative suppliers—affected 81% of US firms operating in the PRC by 2019, up from 73% in 2018 (US-China Business Council 2019). About 30% of respondents in this survey—twice as high as in 2018—reported slowed, delayed, or canceled investment in the US or the PRC due to increased costs and uncertainty from geopolitical tensions. Uncertainty over the US-PRC economic relationship was the primary reason for decreased investment by 27% of firms in technology and R&D-intensive industries and for 33% in services in the 2021 China Business Climate Survey (AmCham China 2021a).

(ii) **Reducing trust in the integrity of global value chains.** Preserving and expanding GVCs hinge on data-based technology—big data, artificial intelligence, Internet of Things, cloud computing—that requires globalizing markets that reward large-scale R&D investments. This entails mutual trust to offset the fact that big data unsurprisingly triggers concerns over national security and personal privacy. Yet beyond-production GVC activities related to these technologies are precisely those most likely to be affected adversely by rising mistrust aggravated by geopolitical risk. Inward-looking turns have led to plummeting trust between the US and the PRC and also in regional and global contexts. This weakens trust in the viability of complex GVCs, especially those pivoted on data technology. Rising nationalism and unilateralism have undermined confidence in international institutions whose primary mission is to build trust. They do so through various mechanisms, such

as helping states overcome collective-action problems, reducing uncertainty, lowering transaction costs, enhancing information about preferences and behavior, monitoring compliance, detecting state defections from their commitments, increasing opportunities for cooperation, diminishing the costs of retaliation, facilitating linkages across issue areas, and offering focal points or salient solutions (North 1981; Keohane 1984; Williamson 1985). These institutions underpinned freer economic exchange and the expansion of GVCs through outward-oriented policies in earlier decades. Rising unilateralism has also undermined macro regional arrangements, but two recent ones—the Comprehensive and Progressive Agreement for Trans-Pacific Partnership and the Regional Comprehensive Economic Partnership—may help strengthen trust and expand GVCs among partners.

(iii) **Diluting the expected benefits from participation in global value chains relative to their political or economic costs.** This happens because the political costs of participation in GVCs rise in inward-looking environments that emphasize risks from GVCs while sidelining the negative externalities from decoupling. The high complexity of GVCs—compounded by the enhanced role of services, data, and IP intangibles—renders popular scrutiny over whose interests are served by GVCs, and at whose expense, harder to scrutinize. GVCs become legitimate foci of attention and suspicion, as well as useful targets of populist manipulation and misinformation, further mollifying nationalist constituencies and increasing support for putative gains from self-reliance. Retracting such policies once they have been unleashed becomes politically more costly, turning the politics of GVCs into a double-edged sword. On the one hand, as Chapter 2 notes, gains associated with GVCs, especially for MNCs, obscure their actual contribution to national income, because conventional statistics do not include the transfer of intangibles via GVCs. On the other hand, GVC decoupling can make middle-income traps stickier and harder to avoid for industrializing countries, thereby hindering the promised road to prosperity.[10] While private firms embedded in GVCs have been the engines of employment creation, decoupling hinders their global competitiveness, destabilizes stable and predictable production platforms, and severely reduces their ability to climb the value-added ladder in manufacturing and services.[11]

(iv) **Inducing vertical contagion.** Geopolitical risk does this through spiraling retaliatory responses to export controls, boycotts, sanctions, cyberattacks, and other forms of coercive economic statecraft. For instance, the Made in China 2025 industrial policy plan approved in 2015, the 2016 "innovation driven" development strategy, and the 2017 restructuring of artificial intelligence value chains geared to attain self-sufficiency in wide-ranging high-tech sectors became self-fulfilling

[10] Middle-income traps could reduce per capita GDP by 50% of what it might be in 2050 (Nag 2011). On middle-income traps and upgrading through GVCs, see Engel and Taglioni (2017).

[11] One example of positive technical spillovers is the Republic of Korea's reliance on its high levels of GVC participation to begin exporting 90% of its COVID-19 test kits by April 2020 (Miroudot 2020).

precursors of spiraling disputes (Shih 2021). In 2018, the Trump administration unleashed tariffs and calls for reshoring GVCs to counter the PRC's forced technology transfers, government subsidies to state-owned firms, limits on market access, failures to enforce IP, and trade imbalances. By 2020, the PRC doubled down on "internal circulation" policies explicitly deployed to bolster domestic supply chains and state-owned enterprises. The Biden administration's first GVC policy report in June 2021 emphasized building resilience through investment in innovation, inclusive worker diversity, and domestic manufacturing capacity by small and medium-sized enterprises (White House 2021). That report also stressed that the domestic production of all essential goods is neither possible nor desirable, that GVCs must be globalized, and that resilience requires international cooperation and strong relations with allies and partners sharing basic values, including workers' rights and environmental protection. It urged reciprocity, transparency, fair-trade practices, protection from cyberattacks, and stronger international trading rules, including enforcement mechanisms.[12]

Tit-for-tat escalatory GVC policies and technology restrictions might accelerate substitution by domestic firms, but could also preclude them from accessing services, operating systems, and other core inputs (intangibles) from leading global suppliers and limit the proceeds of foreign sales of intangibles for R&D use.[13] Similar contagious dynamics have emerged in GVC-related disputes between Japan and the Republic of Korea and those involving the Republic of Korea and the PRC, India and the PRC, and the PRC and Australia, among others. Adverse unintended effects dominate in many cases, leading to vicious circles, downward spirals, and suboptimal outcomes for all. The pursuit of ostensible efforts to accelerate self-sufficiency, extreme decoupling, and technology-denial trigger responses that heighten the very risks intended to be avoided in the first place, creating a "self-reliance paradox."

(v) **Exacerbating horizontal contagion effects.** Geopolitical risk spills over upstream and downstream, as well as onto other GVC nodes and third parties along a GVC and beyond. Whether tariff barriers are imposed to offset asymmetric tariffs, subsidies, or other unfair trade practices, they notoriously trigger contagion throughout networks, as discussed later in greater detail.

(vi) **Decreasing the movement of people and expertise across global value chain nodes.** Human beings are at the heart of GVC infrastructures, especially in services and intangibles. Undermining the mobility of this vital component of GVC operations also undercuts other beneficial interactions. As tensions rise, they often spill over into additional domains where mobility is curtailed, triggering sanctions

12 Related legislative packages complement this ambitious blueprint that dwarfs in comparison with PRC spending on industrial policy and infrastructure.

13 Xing (2021a, 2021b) finds GVC redeployment to other countries to be even more damaging for the PRC than the direct effects of tariffs, undermining the country's export capacity significantly in the longer term by severing PRC firms from GVCs, where the latter obviate the costs and risks associated with R&D, brand development, and marketing.

and detentions of foreign scientists, scholars, journalists, and other foreign nationals, all of which decrease valuable exchanges.

Effects of Geopolitical Risks: What's at Stake

To understand what is at stake, it is important to consider the impressive growth in the parts and components trade in Asia and the Pacific. For instance, the PRC's regional share of imports rose from 12% in 1995 to 40% in 2017, its import volume surged twelve fold, and its export volume fourteen fold in the same period (Solingen and Inomata 2021). Furthermore, US shares from the PRC in the parts and components trade increased from 3% in 1995 to 21% in 2017 and from 5% to 25% in the same period for other sources in Asia and the Pacific. Nearly all countries in this region increased the domestic value added of services embodied in their gross exports to global markets from 2000 to 2016 (Mariasingham et al. 2020). Yet a recovery in GVC participation rates from 2016 to 2018, especially in complex GVCs, stalled from 2018 to 2019 with the onset of US-PRC tensions.

No definitive quantitative assessment of the cumulative effects of geopolitical shocks on GVCs is yet possible as they are still unfolding. Moreover, the effects of the COVID-19 pandemic were superimposed on preexisting geopolitical shocks, conflating the two effects. A simulation by the Organisation for Economic Co-operation and Development finds that "localized global regimes"—dominated by inward-looking strategies averse to GVC trade—are more vulnerable to shocks, magnified risks of food insecurity, and higher costs of adjustment OECD (2021).[14] By contrast, "interconnected economies" adjust more painlessly and increase the security of supply via both international and domestic substitution. Grossman and Helpman (2020) estimate that tariff levels of 25% on intermediates impose sizable welfare losses on the country imposing them; this rises further at higher tariff levels, which also encourages GVC relocation to lower-cost tariff-exempt sites or reshoring. Gentile, Li, and Mariasingham (2020) find that a full-scale US-PRC tariff war layering an additional 25.00% tariff on all bilateral imports (beyond those of May 2019) would decrease US GDP by 0.22% and the PRC's by 0.47%, employment by 0.31% in the US and 0.55% in the PRC, and trade by over 2.00% in the US and 4.00% in the PRC. Lower investment in the PRC would amplify those effects, leading to a potential GDP contraction of 1.00% in the PRC and 0.22% in the US (this simulation excludes trade in services). As Chapter 3 points out, export controls and market access restrictions imposed under national security considerations resulted in Huawei Technologies Co. Ltd. losing its ranking as the world's second largest smartphone company, with its market share shrinking from 17% in early 2019 to 4% in early 2021.

[14] Regimes raising import tariffs on all traded products to 25% and domestic subsidies by 1% would result in lower economic activity, lower incomes, and higher GDP losses when exposed to a 10% cost increase in imports and exports.

Geopolitical risks affecting large economies enmeshed in GVCs typically diffuse through the global economy. Cascading effects of uncertainty linked to calls for GVC "decoupling" are evident in trade, investment, and firm performance, and the expectations of Japanese firms, affiliates, parent companies, and third-country subsidiaries of firms from the world's third largest economy. The analysis in Zhang (2021) of survey data from 2017 to 2020 from Japan's Ministry of Economy, Trade and Industry shows significant declines in sales, exports, and employment of affiliates in the PRC with the highest exposure to trade between North America and the PRC. The level of concern over conflict and geopolitical risk from US-PRC relations, the Democratic People's Republic of Korea, and the trade dispute between Japan and the Republic of Korea was relatively low in 2017, but it had doubled by early 2020. The later section on relative GVC resilience and adaptation to risks discusses firm-level adaptations to geopolitical uncertainty.

Many consider geopolitical risk to be the main challenge to globalization (Antràs 2020a). Geopolitical shocks target highly vulnerable components, sectors, and industries with high input specificity and limited geographic mobility; GVC hubs with a high potential for diffusing throughout an economy; knowledge-intensive GVCs in specialized and localized ecosystems with unique suppliers and difficult-to-substitute expert pools; and dual use (civilian and military) frontier technologies. Geopolitical shocks have heterogeneous effects across locations, sectors, firm types, and income levels contingent on the specific GVC targets and mechanisms analyzed earlier. They can lead to declines in the GVC participation rates of targeted countries, affecting smaller firms in particular, although large knowledge-intensive firms typically become core targets. Although Viet Nam in particular but also other Southeast Asian countries may have benefitted economically from US-PRC geopolitical entanglements, all of them regard with trepidation pressures to align with potentially bifurcated GVCs that could erode those economic gains in the longer term. Australia, India, and Japan launched the Supply Chain Resilience Initiative to confront uncertainty over further inward-oriented turns in the US and the PRC.

Transpacific geopolitical shocks have also reinforced trends toward the regionalization of complex GVCs. Both market-based incentives to reduce costs and political incentives to circumvent extended World Trade Organization (WTO) negotiations have enhanced the intra-regional shares of complex GVC trade in Asia, Europe, and North America (Xiao et al. 2020). The US withdrawal from the original Transpacific Partnership and the 2020 completion of the Regional Comprehensive Economic Partnership, along with other regional institutional developments, have also reinforced GVC regionalization. Geopolitical considerations are also buttressing renewed efforts to diversify into pan-American, eastern European, Mediterranean, and other regions adjacent to main GVC hubs.

Other effects of geopolitical risk and coercive economic statecraft are more sparsely addressed in the economics literature, including the likelihood that declining levels of GVC interdependence will also reduce barriers to more severe—militarized—interstate conflict. Hence, peace could also be at stake. A long lineage of scholarship on international relations since the Enlightenment's Doux commerce assumed that greater economic interdependence

heightens the cost of major armed conflict, lowering its probability and enhancing cooperation.[15] Gains from trade, in this view, are substantial enough to take primacy even when they do not necessarily eliminate other ambitions. A competing theory holds that economic interdependence has not—and cannot—prevent major armed conflict, often wielding the failure of the pre-1914 first wave of globalization to prevent World War I. Decades of research have not dispelled disagreements over the relationship between economic exchange and militarized conflict, largely because empirical studies differ on underlying causal mechanisms, competing referents of interdependence and conflict/cooperation, model specification, measurement, data sources, and temporal boundaries. Studies have also primarily addressed gross bilateral trade, foreign direct investment (FDI), and preferential trade agreements, but not explicitly GVCs.

GVCs engender novel mechanisms that may further raise the costs of forgoing interdependence and arguably foster stronger incentives to uphold peaceful exchanges than would be the case in their absence. These effects might be especially relevant to knowledge-intensive complex GVCs where intangibles bind states in ways that transcend classical trade or financial interdependence. Alternatively, the battle for higher value-added shares could overwhelm incentives to maximize trade, growth, and employment. These incentives underpinned decades of striking GVC expansion in East Asia and induced restraint in handling disputes. In turn, the resulting geopolitical stability, predictability, and cooperation lubricated further GVC expansion, which would have been unimaginable during the period of wars in East Asia in earlier times or in other world regions with much shallower GVC infrastructure. The world is at an inflection point: geopolitical tensions could heighten GVC vulnerability or GVCs could prove more resilient to these tensions than were early 20th century forms of economic exchange. Either scenario makes GVCs pivotal to the region's future direction.

Sources, Mechanisms, and Effects of Environmental Risks on Global Value Chains

Environmental risks are hazards with adverse, probabilistic consequences for human beings or the environment (Whyte and Burton 1980). This chapter's focus is on the environmental risks associated with geophysical (e.g., earthquakes, volcanic eruptions), meteorological (e.g., extreme temperatures, storms), hydrological (e.g., floods, landslides), and climatological (e.g., drought, wildfires) hazard events (UNDRR 2020). Although the number of large disasters in terms of human casualties has declined, the economic damage from disasters triggered by natural hazards has increased significantly, as data from the Emergency Events Database show.

15 Different mechanisms include the opportunity costs of war, declining spoils from plunder, trade as a signaling mechanism, trade as facilitating changes in state preferences over outcomes, trade as fostering shared norms against hypernationalism, and trade agreements as facilitating trust and helping to overcome credible commitment problems.

The devastating floods in western Germany and Zhengzhou caused by record rainfall, as well as record-breaking fires in California and an unprecedented heatwave in western Canada, among many other such events in 2021, vividly illustrate how global warming and extreme weather exert massive destruction and disruption worldwide. These events disrupted the operations of many major MNCs, sparking concerns over the potential impact on global supply chains (Koehl 2021; Patton, 2021).

Sources of Environmental Risks

Some environmental risks stem from natural causes while others are anthropogenic (created by human activity), including climate change, environmental pollution, deforestation, erosion of natural habitat, and biodiversity loss. The scientific evidence on climate change and the associated environmental risks is compelling. Increased production and resource extraction has greatly contributed to detrimental changes due to the burning of fossil fuels and the release of greenhouse gas (GHG) emissions. Climate change can lead to land and ocean temperature rises and rising sea levels, intensifying environmental risks by increasing the frequency and severity of hydrometeorological hazards, as well as the size of the area affected (Hoegh-Guldberg et al. 2018; IPCC 2021). Other forms of environmental degradation, such as air and water pollution, deforestation, and the decline of biodiversity, are also undermining the productivity, resilience, and the adaptability of nature, fueling extreme risk and uncertainty for economies, GVCs, and well-being (Dasgupta 2021).

Growing international trade associated with GVCs has contributed to climate change by increasing energy consumption and CO_2 emissions in GVC-related transportation and production (World Bank 2020; Meng et al. 2018; Wu, Hou, Xin 2020). GVCs can lead to rising GHG emissions through four main channels. First, GVCs are associated with greater distance between regions in the distribution network, and greater distances translate into higher GHG emissions from transportation, which is estimated to be responsible for 3.5% of total global emissions (Cristea et al. 2013). Second, participating in GVCs further accelerates the growth of the global energy footprint, in which stronger backward linkages can increase energy use. Zhang et al. (2020) find that GVCs resulting from MNCs' assets and suppliers abroad account for about 20% of CO_2 emissions, although this figure has fallen slightly since 2011. Third, international carbon leakage—production moving to countries with less stringent climate measures—leads to the burden-shifting of emissions and threatens climate mitigation targets. And fourth, the cost-benefit of GVCs has resulted in an abundance of production and excessive waste in products, including electronics, plastics, and food. It is estimated that a record 53.6 million metric tons of electronic waste was generated worldwide in 2019, up 21% in just 5 years (Forti et al. 2020), and 242 million metric tons of plastic waste is generated annually (Kaza et al. 2018). Beyond climate change, the impact of GVCs also extends to other environmental indicators, such as biodiversity loss. Lenzen et al. (2012) estimate that about 30% of threats to global species are driven by international trade in commodities, including coffee, tea, and sugar, and textiles and other manufactured items.

The emergence of GVCs has also given rise to higher exposure to environmental risks, as GVCs are often accompanied by large-scale clustering and agglomeration where firms in the same or connected industries tend to locate close to one another. Production centers are often developed in coastal areas and river basins with high population concentrations and lower transport costs. Although industrial agglomeration reduces production costs and enhances cooperation between firms, it can potentially lead to higher exposure to environmental risks when disasters triggered by natural hazard happen in areas of concentrated population and industrial activity (Gereffi and Luo 2014).

Even so, GVCs also have mitigating effects on GHG emissions and climate change. International trade may lead to lower CO_2 emissions if production and distribution via GVCs entail lower emissions than domestic production (le Moigne and Ossa 2021). Without international trade, domestic production would increase to meet consumption needs. Moreover, technology spillovers through participation in GVCs contribute to the diffusion of new environmentally sustainable technology, thus facilitating the transition toward carbon neutrality in both developed and developing countries. Participation in GVCs also means that supplier firms must comply with global standards and environmental certifications to meet the demand of lead firms, which can cut down their carbon footprints.

Overall, the rise in environmental risks can be traced to an increase in industrial activity, including the expansion of GVCs. By expanding the geography of industrial activity, GVCs have also increased the exposure and vulnerability to environmental risks. Yet, GVCs can also help address environmental risks by diffusing environmentally friendly technology and standards.

Causal Mechanisms in Environmental Risk

Environmental risks can pose significant threats to economic systems through the direct impact on firms and individuals exposed to natural hazards, as well as indirectly through the effect of these hazards on suppliers and customers. The rise of GVCs means that firms are more interconnected through input–output linkages where different stages of production are spread across geographical locations. GVC interdependence enables greater efficiency, but it also creates vulnerabilities. Relatively small environmental shocks can result in significant supply chain disruptions. Adverse shocks can affect both domestic and global economies via direct and indirect channels and from both the supply and demand side. Some of the specific mechanisms include:

(i) **Disruption due to lost production.** Direct supply effects occur when firms stop producing due to an environmental-related disruption (e.g., a disaster triggered by natural hazard). Disasters not only result in human casualties but also cause destruction of capital assets, inventory, and infrastructure. From a macroeconomic perspective, the negative impact on output delivers a shock to the aggregate supply curve, resulting in a decline in real output and employment, as well as potential negative impacts on economic growth. Long-term environmental shifts, such as climate change, could

also affect the availability and productivity of raw materials and production factors. Examples of these impacts include land and capital destruction from rising sea levels, crop productivity impacts on agriculture, and labor-productivity impacts resulting from rising temperatures and stress on human health (Dell, Jones, and Olken 2012). The impact of climate change on agricultural productivity alone can lead to a decline in welfare equivalent to 0.27% of GDP worldwide, with larger losses in developing countries (Costinot, Donaldson, and Smith 2016). Tourism services are also highly susceptible to climate change through changes in snow cover, rising sea levels, coastal degradation, and extreme weather.

(ii) **Indirect effects due to disruptions from upstream suppliers**. Problems at any point in a GVC can reduce output substantially if inputs enter production in a complementary fashion (Jones 2011). Some widely adopted supply chain management strategies, such as the just-in-time practice and lean supply chain management, correspondingly raise the chances of a supply chain disruption during a disaster–induced disruption (Abe and Ye 2013). Although this mechanism applies to both domestic and global value chains, the presence of cross-country input–output linkages in GVCs means the indirect impact of an environmental risk can potentially affect firms in other countries. This impact is most acutely felt in complex industries, such as automobiles and semiconductors, where substitutes are difficult to find. Tokui, Kawasaki, and Miyagawa (2017) find that about three-quarters of Japan's output loss from the 2011 earthquake and tsunami resulted from indirect effects through supply chain disruptions.

(iii) **Rising demand for certain goods and services.** In the immediate aftermath of disasters, demand rises sharply for food, medical supplies, and emergency equipment, as well as for services to aid the relief efforts. Capital-intensive services, such as telecommunications and transportation, are in high demand, but domestic capacity to deliver these services is often severely diminished (Xu and Kouwoaye 2019), resulting in shortages and rising prices of essential goods and services. The rising demand is often met by supplies from unaffected locations, including imports. Meanwhile, disasters can trigger demand for nonessential goods and services to decline, causing many businesses to lose the sales they normally rely on.

(iv) **Demand effects transmitted to other sectors.** The rising demand for essential goods can lead to increasing prices of raw materials and intermediate inputs, affecting upstream sectors. Conversely, the negative impact on the income of businesses and households can suppress the prices for products and intermediate inputs in upstream sectors, potentially resulting in an economic contraction.

(v) **Cost of moving goods and personnel across borders.** GVCs are underpinned by complex transportation and logistics that move intermediate and final goods across borders. The effects of climate change could be manifested in damages to trade infrastructure, such as ports and roads, and shipping and flight routes, from more frequent extreme weather events or rising sea levels, causing supply,

transport, and distribution chain disruptions (Dellink et al. 2017; IPCC 2014). Transport disruptions translate into supply chain disruptions that act as amplifiers of disaster-induced economic shocks (Colon, Hallegatte, and Rozenberg 2021).

Effects of Environmental Risks: What's at Stake?

The emerging consensus in the literature is that environmental risks, including climate change, exert a negative impact on economic output, and the negative impacts become disproportionately larger as temperature rises increase (Kahn et al. 2019). GVCs can worsen the impact of environmental risks by transmitting the adverse shocks to upstream and downstream activities.

Examining the impact of disasters on GVCs provides insights into the potential effects of environmental risks. Carvalho et al. (2021) find the propagation of the shock of the 2011 Japan earthquake accounted for a 0.47% decline in the country's real GDP growth in the year following the disaster. The shock not only affected the disrupted firms' immediate transaction partners but also their suppliers' suppliers and customers' customers. This indirect propagation effect corresponded to roughly a 2–3 percentage points decline in annual sales growth. The potential propagation of shocks over an economy's production network can affect a significant fraction of firms, resulting in volatilities in aggregate economic performance. Inoue and Todo (2019) predict that the indirect effects due to propagation from a mega earthquake on major industrial cities in Japan are substantially larger than their direct effects. Barrot and Sauvagnat (2016), in a study on effects of disasters over 30 years in the US, find that affected suppliers impose substantial output losses on their customers, especially if they operate in industries producing differentiated goods, if they have a high level of R&D, or if they hold patents. These findings suggest that input specificity, especially reflected in the intangible components of GVC trade (patents, R&D, and so on), is a key determinant of the propagation of idiosyncratic shocks in an economy. The sales growth and stock prices of firms fall significantly when a disaster hits one of their specific suppliers.

GVCs not only transmit shocks within domestic economies but also play an important role in cross-country transmission. When suppliers in source countries are affected by disasters, it is not uncommon for firms to report production delays and profit losses as their suppliers fail to provide parts and components on time. For instance, Thailand's 2011 floods affected hundreds of manufacturers and cut off the supply of about 100 components to the country's automakers. With many suppliers hit by the flooding, automakers scrambled to procure replacement parts and assess the extent of the disruption on their supply chains. Toyota Motor Corporation's production lines in Malaysia, North America, Pakistan, the Philippines, and Viet Nam had to be adjusted to make up for the output disruptions in Thailand (Abe and Ye 2013). After the 2011 Japan earthquake, the unavailability of Japanese inputs caused both domestic and international production to fall sharply—automobile production, for instance, fell by 24% in the Philippines, 19.7% in Thailand, and 6.1% in Indonesia. And the production of electrical components fell by 17.5% in the Philippines and 8.4% in Malaysia (Abe and Ye 2013).

Boehm, Flaaen, and Pandalai-Nayar (2019) study the role of trade and MNCs in the cross-country transmission of shocks by examining the US affiliates of Japanese MNCs after the 2011 Japan earthquake. They find that US firms highly dependent on Japanese inputs suffered large output losses after the earthquake; their drop in exports corresponding to roughly one-for-one with the drop in imports, suggesting there was virtually no scope for substitution for other inputs for these firms. Längle, Xu, and Tian (2020), in a study on the US hurricane season in 2005, find that PRC processing manufacturers with tight trade linkages to the US reduced their intermediate imports from the US in the months following the hurricane season. They find, however, no consistent evidence of international propagation of supply shocks along GVCs. Similarly, Kashiwagi, Todo, and Matous (2018), in a study on the impact of 2012's Hurricane Sandy using datasets that map firm-to-firm transactions, find no propagation of negative shocks outside the US, possibly because internationalized US firms are generally more productive and have better access to information about global markets. Firms embedded in GVCs can more easily substitute partners whose operations have been hampered by a disaster.

Overall, historical incidences of disasters suggest that GVCs can propagate idiosyncratic shocks and affect the suppliers and consumers of firms via domestic, regional, or global production networks. The impact of disasters can also extend beyond national borders and affect foreign firms with direct and tight linkages to affected firms. There is so far little empirical evidence of shock propagation to foreign firms that does not have direct trade linkages to a disaster-affected region, suggesting a limited scale of GVCs in transmitting disaster shocks across countries. Because the frequency and severity of disasters and other environmental risks are projected to increase, risks to GVCs are likely to grow substantially (Lange et al. 2020). Increased instances of disasters and supply chain disruptions will further affect the organization of GVCs, potentially leading to shifts of GVC centers to regions with lower exposure to environmental risks.

Sources, Mechanisms, and Effects of Pandemic Risks on Global Value Chains

COVID-19 triggered chaos from city lockdowns, the closure of national borders, and social distancing, unleashing a global economic crisis. The sudden restrictions in both the domestic and international movement of people and business operations were a blow to lifestyles and the conventional GVCs supporting them, triggering unprecedented uncertainty and challenges to global governance.

Sources of Pandemic Risks

Pandemics have occurred throughout human history (e.g., smallpox, tuberculosis, the Black Death) and they appear to be increasing in frequency (e.g., the 1918 influenza pandemic, HIV/AIDS, the 2009 swine flu pandemic, and COVID-19). The source of pandemic risks is viral. In most cases, cross-species transmission events lead to

outbreaks in humans (Menachery et al. 2015). It might not be possible at this stage to determine precisely how humans were initially infected with COVID-19, but scientists must be given sufficient time to reach the final answer.

COVID-19 triggered pandemic proportions not only because of its epidemiological features but also due to heightened levels of transnational connectivity and mobility related to human activity, including via GVCs. Epidemiologically, the COVID-19 virus spreads more easily and causes more serious illnesses in some populations. The virus can also take longer before becoming symptomatic, and people can be contagious for longer periods compared with influenza viruses. Some variants of COVID-19 spread faster and are more transmissible or infectious, thus vaccination levels of 58%–94%, higher than for most adult-vaccine benchmarks, may be required to end the COVID-19 pandemic (Lund et al. 2020). Beyond specific virus characteristics, much easier, faster, cheaper, and more frequent cross-border business travel supporting GVC operations, as well as tourism and other travel categories, have affected the risk and rate of human-to-human transmission. This explains why countries have applied a wide range of localized or national lockdowns and border control measures to minimize COVID-19's spread. The next section examines in detail some of the mechanisms of pandemic transmission through GVCs, including findings related to the effects of lockdowns on GVCs.

Causal Mechanisms in Pandemic Risk

The mechanisms through which the COVID-19 shock affected GVCs include:

(i) **Adjustments in demand and supply**. These adjustments trigger "stress responses" (e.g., risk avoidance behavior) by individuals, firms, investors, governments, and other market agents via multiple channels, both domestically and internationally. For example, people tend to be more self-restrained in work and consumption activities taking place in "3Cs" environments—closed spaces with poor ventilation, crowded places with many people nearby, and close-contact settings. Consequently, declines in labor force participation, increases in absenteeism, and decreases in working hours have affected the supply of labor in GVCs (Cowan 2020; ILO 2021). Quarantine measures and lockdowns accelerated remote working, leading to a surge in demand for information and communication technology goods, medicines, and online services. Demand plummeted for many manufactured goods and services, including airlines, tourism, restaurants, sports, and other services that are highly dependent on face-to-face communication (OECD 2020). Uncertainty about when economies and sectors will recover has resulted in shifts in medium- and long-term investment decisions. Mandatory and nonmandatory policy measures, including city lockdowns, school closures, social distancing, and national border closures, also pose risks to GVCs.

(ii) **Globalization.** This mechanism is a significant factor in the spread of COVID-19 risks (Bogoch et al. 2020; Lau et al. 2020; Linka et al. 2020). Higher stages of globalization are characterized by easier, faster, cheaper, and more frequent

cross-border travel supporting business operations in GVCs. The COVID-19 virus is unprecedented in its capacity to take advantage of highly globalized contexts and spread at surprising speed across borders (Mas-Coma, Jones, and Marty 2020). Countries with higher levels of socioeconomic globalization were initially exposed to higher case–fatality ratios (confirmed deaths to confirmed cases), but subsequent waves diffused through other countries (Farzanegan, Feizi, and Gholipour 2020).

(iii) **Highly complex and integrated GVCs.** The complexity of modern GVCs amplified the risks from COVID-19. No country is completely immune to the health and economic impact of COVID-19 (Strange 2020). Even highly isolated ones have felt its effects. At the other end, Sweden initially conducted an unorthodox experiment to build herd immunity, avoiding lockdowns. It still suffered significant economic losses compared with its locked-down neighbors, partly due to high levels of integration in GVCs. Many countries have deep linkages with the three global GVC hubs (the US, the PRC, and Germany) via trade and investment (Gao et al 2021). Once COVID-19 affects those hubs, the ripple effects are felt throughout all phases of production from materiel supplies to distribution (Baldwin and Freeman 2020; Kumagai et al. 2020). The impact of COVID-19 on a country or region depends not only on its economic size and ability to cope but also on its degree of participation and linkages with GVC centers (Maliszewska et al. 2020; Sforza and Steininger 2020). Guan et al. (2020) confirm propagation effects through GVCs via forward and backward linkages even to countries not directly affected by COVID-19. In a scenario where COVID-19 is strictly contained within the PRC, GDP losses for the PRC are still substantial (16.7% of the PRC's annual GDP), but propagation via GVCs—within and beyond the PRC—raise these losses to 21.5%. Another model-based analysis, by Inoue and Todo (2020), shows that had Tokyo been under lockdown for 1 month, the indirect economic effect via GVC propagation to other regions would be twice as large as the direct effect on Tokyo itself.

(iv) **Global value chain dynamics, uncertainty, and foreign direct investment.** GVCs operate in a context of highly dynamic market mechanisms, affecting investors' information and evolving decisions under uncertainty. Indeed, the World Uncertainty Index reached a record high at the onset of the COVID-19 pandemic in the first quarter of 2020. Global FDI flows fell by 42% in 2020 and a 5%–10% slide was projected for 2021, as foreign affiliates experienced difficult operational, market, and financial conditions, and plummeting profits (UNCTAD 2021). Resumed production helped turn the PRC into the largest FDI recipient in 2020, with inflows rising 4% from 2019. Because FDI is the most salient form of GVCs and a key driver of these chains, extreme uncertainty about the path, duration, magnitude, and impact of COVID-19 led to vicious cycles that dampened investor confidence, altered short-term investment decisions, and created spillovers along the entire GVC, leading to further declines in employment and investment. Over two-thirds of multinational investors in developing countries reported GVC disruptions, and lower revenue and production, within months of the outbreak (Saurav et al. 2020).

Effects of COVID-19 Risks: What's at Stake?

The COVID-19 pandemic is an unprecedented shock affecting all GVC dimensions in an uncertain environment. Broadly, three features of COVID-19 effects on GVCs distinguish the pandemic from past health or economic shocks. First, compared with the outbreak of severe acute respiratory syndrome (SARS) in 2003 and the global financial crisis, the impact of COVID-19 on GVCs is far more global, larger scale, and longer lasting (Yeyati and Filippini 2021). The global recession it unleashed was the deepest since the Great Depression. Kissler et al. (2020) argue that COVID-19 surveillance must be maintained because a resurgence in contagion is possible even as late as 2024.

Second, GVCs are mainly organized and controlled by MNCs, which account for about 50% of global trade, 33% of output and GDP, and 25% of employment (Cadestin et al. 2019). Qiang, Liu, and Steenbergen (2021) note that with the onset of COVID-19, 77% of surveyed MNC affiliates reported a fall in GVC reliability in middle- and low-income countries during the second quarter of 2020, declining to 41% in the third quarter. Small and medium-sized enterprises supplying MNCs were especially vulnerable to demand and supply shocks, forcing sharp reductions in hiring, travel, and other costs. The impact of COVID-19 on a firm depends on how dependent the intra- or inter-firm relation is between MNCs (lead firms) and domestic firms (suppliers) or between large firms and small and medium-sized enterprises, as well as on GVCs' governance type. For example, the most important feature of contemporary GVC arrangements is the factoryless phenomenon examined in Chapter 2. An increasing number of MNCs, especially from developed countries, have no production facilities but they own IP rights or product designs for goods manufactured or assembled by factoryless producers, typically located in developing countries. Developed countries thus have a strong comparative advantage in knowledge-intensive sectors at the high end of GVCs, while developing countries enjoy strong comparative advantage in labor-intensive sectors at the lower end (Meng, Ye, and Wei 2020; Meng and Ye forthcoming). This might partly explain why developed countries' services exports, developing countries' goods exports, and employment in smaller firms in developing countries have been more strongly affected by COVID-19 in the short run (Maliszewska et al. 2020; UNCTAD 2020).

Third, the spatial extent of COVID-19 is the most important driver of the global cost on GVCs. A landmark study by Guan et al. (2020) estimates the global costs of COVID-19 lockdowns on GVCs measured in value-added losses, which depend more on the number of affected countries and the duration rather than the strictness of lockdowns. In a scenario where the PRC alone was affected, COVID-19 lockdowns would have reduced global value added by only 3.5% of GDP. Instead, the spread to highly developed economies in Europe and the US would have decreased value added almost fourfold to 12.6%. The modelled impacts of COVID-19 lockdowns are even greater, decreasing global GDP by 26.8%. The global spread and relatively strict (60%) lockdowns for 4 and 6 months would decrease global value-added losses by about 4% over a higher level of strictness (80%) for 2 months. Hence, the bigger the spatial spread of COVID-19 and the longer the temporal duration of lockdowns, the

larger are the declines in global value added. It should be noted that even in scenarios where COVID-19 does not spread globally, sectors highly dependent on GVCs, such as the PRC's electronics and Germany's automotive industries, would be quite vulnerable.

The study also confirms propagation effects through GVCs via forward and backward linkages even to countries not directly affected by COVID-19. Importantly, low- and middle-income countries are far more vulnerable to indirect effects than developed countries. Propagation effects, in turn, will continue to inflict disruptions even after the pandemic has been controlled in the source countries. In a scenario where Europe and the US apply strict containment measures for 2 months, they would incur larger direct losses of 15%–20% of their GDP, but the costs of propagation to lower-income countries would be smaller than under lengthier lockdowns. COVID-19 containment has both substantial positive externalities (i.e., all countries benefit considerably when the PRC imposes strictest measures), and negative externalities (i.e., all countries suffer from containment in other countries via reduced demand). The positive externalities of containments dominate, however.

Even in scenarios where COVID-19 does not spread globally, sectors that are highly dependent on global GVCs would be quite vulnerable. The shortest and strictest containment in the PRC would result in a decrease of 27.3% in global value-added in electronics (20.0% direct PRC losses). In a scenario of global spread, the decline would be 40.0%. For Germany's automotive industry, the "PRC only" contained, strict, and brief lockdown would result in a modest value-added loss to German GDP of 1.8%. But the scenario of COVID-19 spreading to developed countries subject to 4-month lockdowns would raise German value-added losses to 28.8%, with significant upstream and downstream effects on its GVC partners.

Fourth, governments are facing considerable challenges in designing and conducting well-balanced policies to mitigate the impacts of COVID-19 on GVCs. These vary significantly across industries, regions, firm type, and income groups in both directions (positive or negative) and magnitude (Guan et al. 2020). So, policy responses designed to tackle one adverse impact may end up exacerbating another, placing policy decisions between a rock and a hard place. Pandemics also evolve dynamically when there is high uncertainty, posing formidable challenges for balancing resources across the short, medium, and long terms. As mentioned earlier, big synergies exist between efforts to stem the spread of the COVID-19 pandemic, an increasing risk of unilateralism, protectionism, and backlashes against economic globalization, all of which make balancing domestic and international considerations more difficult. The wildly uneven distribution of COVID-19 vaccines and other barriers to medical supplies, equipment, and materials imposed early in the pandemic fall under this rubric (Bown 2021). The section examining compounded risks elaborates on those synergies. Table 5.1 summarizes the discussion on the sources, mechanisms, and effects of each risk type on GVCs.

Table 5.1: Sources, Mechanisms, and Effects of Geopolitical, Environmental, and Pandemic Risks

Features	Risk Type		
	Geopolitical	Environmental	Pandemic (COVID-19)
Main sources	Rising inward-oriented political-economy strategies Emphasis on relative gains, asymmetries, negative externalities from global value chain (GVC) interdependence (especially in high-tech) Trade and GVCs	Natural hazards, climate change, and biodiversity loss Increased production, resource extraction, and GVC trade Higher exposure due to industrial clustering by GVCs	Onset and spread of COVID-19 reaching pandemic proportions Trade and GVCs
Common mechanisms	Supply or demand shocks or both Magnified generalized uncertainty Reduced trust in GVC integrity Exacerbated contagion (spillover) Diluted expected benefits from GVCs relative to political/economic costs Decreased movement of people, expertise, foreign direct investment across GVC nodes		
Unique mechanisms	Export and investment restrictions Technology denial Vertical contagion (retaliatory spirals) Spillovers undermine cooperation in other issue areas, including security, relevant to GVC operations	Direct impact on human casualties, capital, inventory, and infrastructure Higher demand for essential goods/services and decline in demand for others Large disruptions in trade infrastructure/routes	Restrained consumption Urban density, geographic agglomeration, transportation, poverty, inequality Diminished face-to-face communication Lockdowns affect production and consumption
Effects	Global scope, cascading effects Heterogeneous effects across locations, sectors, firm types, income levels, production concentration Decline in GVC participation rates Smaller GVC partners most affected Industrializing states most affected Increased unemployment Decreased individual income/consumption	Disaster risks diffuse upstream and downstream via GVCs Limited evidence of cross-border transmission of disaster shocks Exposure to natural hazards projected to increase Heterogeneous effects across locations and sectors	Global scope, long-lasting, marked by waves Significant changes in lifestyle and work patterns GVC hubs most affected, cascading effects Foreign-owned firms with higher reliance on GVCs are more likely to be affected Heterogeneous effects across locations, sectors, firm size, short/long term Challenges to firm/country risk management
Most affected sectors	Foundational high-tech sectors, especially "strategic" technologies (artificial intelligence, semiconductors, quantum computing, aerospace, robotics) Trade in intangibles across GVC types: research and development, product design, branding, marketing, retailing	Agriculture and tourism (due to rising temperatures and extreme weather) Transportation (susceptible to extreme weather) Effects on other sectors contingent on location and magnitude of shock	Negative: airlines, tourism, accommodation, restaurants, sports, plastics, chemicals, rubber Positive: pharmaceuticals, e-commerce, e-entertainment, live-stream conferencing, information and communication technology

Source: Authors.

Relative Global Value Chain Resilience and Adaptation to Risk

This chapter's working definition of GVC resilience entails the ability of these chains to anticipate and prepare for severe disruptions in a way that maximizes capacity to absorb shocks, adapt to new realities, and reestablish optimized operations in the shortest possible time. The degree of GVC resilience across risks depends on the nature and magnitude of shocks, whether shocks are sector- or region-specific, distinctive GVC features, industry and firm topographies, availability of substitutions, and degree of transactional stickiness in GVC partnerships. The following elaborates on how these different dimensions affect GVC resilience:

(i) **Nature and magnitude.** GVCs are more resilient to smaller shocks than larger, synchronized ones (Huneeus 2018). GVC relationships are often difficult and costly to form, leading to stickiness, such that only large shocks induce incentives to alter relations (Antràs, Fort, and Tintelnot 2017). Firms typically consider the fixed costs of multisourcing too large to bear, especially in the absence of large shocks.

(ii) **Sector- or region-specific.** Resilience also depends on whether a shock is specific to one region or country. GVCs can reduce their exposure to localized shocks via diversification of demand and supply or increase their exposure to shocks that are specific to sectors (or products) in which a country specializes. Caselli et al. (2020) find country-diversification effects to be eight times larger on average than sector-specialization effects. The net effect is that trade reduces volatility in most cases, especially when shocks are not correlated across countries. Industries that can relocate easily to other countries when facing "policy interventions" may be more resilient than those heavily constrained due to localized network and lock-in effects (Lund et al. 2020).

(iii) **Global value chain structure and choke points.** Shocks propagate more strongly when intersectoral linkages are asymmetric (Acemoglu et al. 2012). General-purpose suppliers—iron and steel mills, electric power generation and distribution, petroleum refineries, and real estate, for example—can act as potential choke points. MNCs, especially large ones, may be less resilient to particular shocks as are more complex, lengthier GVCs. GVC linkages have a significant association with increased international business-cycle co-movement between the individual firms and countries they trade with (di Giovanni, Levchenko, and Mejean 2018). Upstream sectors, especially those with higher specificity, are more likely to propagate GVC shocks. Supply-side shocks propagate downstream much more powerfully than upstream, whereas demand-side shocks have smaller effects on prices and propagate upstream via suppliers' adjustment-of-production levels and input demands (Acemoglu, Akcigit, and Kerr 2016). The more agglomerated sectors are, the more likely they are to transmit shocks across them.

(iv) **Availability of substitutions.** Critical GVC nodes can amplify shocks. With low substitutability, disruptions cascade and halt the entire production; with higher substitutability, sudden surges in domestic demand can be met via external supply. The time horizon is crucial: elasticity of substitution can be low in the short run whereas longer time horizons enable eventual substitution, which mitigates shocks (Yilmazkuday 2019). Complex GVCs are especially at risk, particularly in electronics.

The availability of substitutes is connected with the degree of transactional stickiness in GVC relationships. Solingen and Inomata (2021) propose a framework for estimating relative GVC resilience based on three criteria related to stickiness: scarcity of alternative suppliers, level of sunk costs (physical and intangibles), and volume of informational exchange between partners. Capital-intensive sectors are more likely to face fixed investments in physical production infrastructure, which may inhibit the relocation of production or sourcing from alternative suppliers, making them less resilient. Labor-intensive GVCs in apparel, textiles, and furniture, by contrast, can relocate more easily, making them more resilient. GVCs often rely on numerous specific investments, such as purchasing specialized equipment or customized products, which entail developing specific relationships and repeated interactions, especially when contract enforcement is weak (Antràs 2020b). Knowledge-intensive GVCs typically operating in specialized and localized ecosystems, with unique suppliers and expert pools, are harder to substitute. Fear of IP expropriation or imitation may prevent firms with intangible assets from engaging with too many suppliers, strengthening their incentives to choose vertical integration where they own or control suppliers (Antràs and Yeaple 2014). Specific GVC relationships lower resilience to exogenous shocks.

While GVCs may in some situations amplify the impact of shocks, they can also help mitigate their effects and enhance resilience (Baldwin and Freeman 2020; Miroudot 2020). Participating in GVCs may increase vulnerability to foreign shocks, but it can also reduce vulnerability to domestic shocks (Espitia et al. 2021). Diversified suppliers and cross-national production networks can adjust more easily to risks and shocks. Highly diversified inputs can mitigate the impact of shocks via two channels: first, each individual variety matters less in production, reducing volatility; second, the other varieties can become substitutes that offset the shock (Koren and Tenreyro 2013). In sum, the benefits of relying on diversified suppliers and clients outweigh the potential disruptions engendered by GVCs (Todo, Nakajima, and Matous 2015). Outward-oriented strategies are thus more likely to increase resilience, whereas inward-oriented ones can increase vulnerability, especially since across-the-board domestic substitution is typically unrealistic.

Global Value Chain Resilience to Specific Meta-Risks

Geopolitical risk. Anticipating relative GVC resilience to geopolitical risk is challenging, especially as coercive economic statecraft targets idiosyncratic sectors, industries, or firms based on sometimes unexpected, ad hoc, inconsistent, and dynamic political considerations. The generic correlates of resilience identified earlier may apply to

geopolitical risk. But unlike environmental and pandemic risks, geopolitically driven economic statecraft entails purposeful actors targeting especially vulnerable products, sectors, and industries due to their high input specificity and GVC hubs with a large potential for spreading disruption (e.g., rare earth derivatives or semiconductors). The conjunction of hubs with high input specificity makes for more vulnerable targets. Knowledge-intensive GVCs in specialized and localized ecosystems with unique suppliers and expert pools are harder to substitute.

Typical geopolitical targets include countries controlling concentrated levels of specific inputs, behaving as unreliable suppliers, and imposing illegal or arbitrary trade restrictions. When international economic exchange becomes subordinated to maximizing power in all its forms, IP-intensive and dual-use technologies with civilian and military applications become primary targets.[16] Contemporary examples include information and communication technology (ICT), artificial intelligence, quantum computing, semiconductors, aerospace, advanced robotics, and other frontier technologies identified as strategic. Complex GVCs may be tempting targets, but they can also be resilient. Economic statecraft also targets countries perceived to be violating international agreements or norms in environmental, labor, human rights, or security domains, including cybersecurity (Solingen 2012). Consumer boycotts—with or without government prodding affecting consumer incentives—target particular products, firms, or sectors (e.g., boycotts against products from Japan or the Republic of Korea in the PRC or boycotts against Japanese products in the Republic of Korea).

Empirical studies on resilience to geopolitical risk arrive at different conclusions even for similar cases. Li and Liu (2019) show different responses by PRC firms and consumers to a 2012 dispute with Japan. Electromechanical, transportation, and other consumer goods imports declined significantly because of the dispute, but less salient intermediate goods and food much less so. Intermediate inputs for firms may be arguably more resilient than inputs for consumers, especially those exposed to hypernationalist rhetoric. Li and Liu (2019) find a similar pattern in the PRC's boycott of goods from the Republic of Korea following the 2017 Terminal High Altitude Area Defence (THAAD) missile defense system crisis, where consumer-led measures were less restrained than firms importing Japanese intermediates, including ICT. They also find the effects of the 2012 dispute to have dissipated within a year. Luo and Zhou (2019) suggest the 2010 PRC boycott of Japanese goods dissipated within 6 months.

Barwick et al. (2019) argue that automobiles may be relatively resilient to boycotts in the PRC insofar as brand preferences are strong (sticky), cars are produced with over 50% local ownership, and foreign brands provide offsetting incentives to retain loyalty. Yet automobiles are especially vulnerable to politically inspired consumer boycotts because of their high visibility, high cost, high substitutability, and high susceptibility to

[16] For a primer on Nazi Germany's reliance on economic statecraft to maximize raw power, see Hirschman (2018).

vandalism. Japanese brands declined nearly 50% with the boycott and a slower decline persisted for several years. Since the 2012 boycott, Japanese firms in the PRC declined from 14,394 in that year to 13,685 in May 2019. The same dispute in 2010 and the growing tensions in 2012 also led to significant reductions in imported Japanese cameras (Li and Liu 2019). Geopolitically inspired consumer boycotts in the PRC, especially against European and US products, recrudesced in 2021 as GVC segments become targets.

Even when economic statecraft affects GVC resilience only marginally, and there is no guarantee this will be the case in the future, geopolitical risk is known for its potential for escalating beyond economic tensions, spilling over into militarized conflict even when all states prefer to avoid this outcome.[17] New frontier technologies exacerbate geopolitical risks and uncertainty even if some are intended to lower them both.

Environmental risk. A distinct feature of environmental risk is that disasters tend to be confined to a region and last for relatively short periods. Broader shocks, such as climate change, have heterogenous effects on different regions. This geographical and temporal dispersion means that, although GVCs can amplify environmental risks, especially in agglomerated industrial locations, they can also play a positive role in enhancing resilience via international diversification. Insurance, better infrastructure, and migration can also mitigate adverse effects.

There is some evidence of firms adjusting procurement and trade routes immediately after disasters. After 2011's floods in Thailand, firms were more likely to lower local procurement shares, increasing imports from Japan or PRC substitutes (Hayakawa, Matsuura, and Okubo 2015). After Japan's 2011 earthquake, at least 40% of exports went through alternative Japanese ports, especially technology-intensive products (Hamano and Vermeulen 2020). And ports affected by Hurricane Katrina in 2005 also experienced significant and lasting trade reductions, while shipments from adjacent ports experienced significant increases (Friedt 2021). In the medium term, GVCs often enhance resilience by anticipating environmental risks. Following Japan's 2011 earthquake, local firms diversified suppliers, including foreign sourcing, arguably to overcome domestic production and transportation disruptions (Zhu, Ito, and Tomiura 2016). Because of this disaster, Japan's automobile industry increased standardizing or modularizing car parts across car types to diversify GVC partners (Todo and Inoue 2021). The 2011 earthquake, however, did not lead countries dependent on Japanese suppliers to reshore, nearshore, or diversify in automobile and electronics, and trade in intermediates was disrupted less than trade in final goods (Freund et al. 2021).

17 The ability to adjudicate ex post facto whether armed conflict resulted from such spillovers, rational intentions, incomplete information, cognitive biases, or other variables remains elusive.

Domestic and foreign services, including weather forecasting, insurance, telecommunications, and logistics, also help mitigate damages from environmental risk, shifting the burden to GVCs. Insurance coverage in low- and middle-income countries remains low, however. Firms severely affected by the 2011 Thai floods were more likely to subscribe to property insurance before the floods and had weaker incentives to invest in recovery, providing evidence for adverse selection and moral hazard in corporate insurance markets (Adachi et al. 2016). Longer-term measures for coping with risks focus on preparedness and environmental policy, and these are discussed in the section on policy recommendations.

Pandemic risk. COVID-19 was a "foreseeable unexpected event," with repeated warnings of scientists on disastrous pandemics largely ignored (Walls 2020). A 2012 World Economic Forum survey on the risk of GVC disruptions included a "pandemic," assigning it a probability of 11% versus 19% for a global energy shortage and 17% for labor shortages (WEF 2021). Yet the GVC world finds itself in a perfect storm, forced to undergo swifter transformations (UNCTAD 2020). COVID-19 laid bare the fact that individual countries may account for overwhelming supplies of certain inputs exported across GVCs, creating potential bottlenecks (Bacchetta et al. 2021). India and the PRC, for example, account for about 80 % of the active pharmaceutical ingredients market. But bottlenecks can result even if inputs are produced across diverse geographies, particularly if there are severe capacity constraints. These remain evident from the continued disruptions affecting GVCs throughout 2021.

The longer the GVC, the more likely it is to be exposed to risks, for two main reasons. First, because firms operate across longer distances (geographic, economic, cultural, or institutional), bounded rationality and bounded reliability challenges increase (Verbeke 2020). And second, GVCs have lacked redundancy and risk-mitigation plans to cope with extraordinary shocks, such as COVID-19 (Silverthorne 2020). Concentrating on efficiency and productivity, and reducing production costs, made GVCs less resilient, leading to rising calls for diversification. Espitia et al. (2021) find GVCs to be more resilient to negative demand shocks in the absence of COVID-19.

Lund et al. (2020), examining firms' responses to various risks including the COVID-19 pandemic, estimate that "16 to 26 percent of exports, worth $2.9 trillion to $4.6 trillion in 2018, could be in play," possibly reverting to domestic production, nearshoring, or offshoring to new locations in the next 5 years. Others suggest that COVID-19 may propel GVCs to further "micro-modularize," reducing the risk of single micro-modules and enabling easier substitution (Verbeke 2020). Substantial GVC nationalization or regionalization risks reducing the diversification of suppliers and opportunities for some developing countries. Yet others, especially those closer to major markets, could capture growing opportunities from increased geographical diversification (UNIDO 2020; Qiang, Liu, and Steenbergen 2021). GVCs in medical supplies and devices have benefitted nontraditional exporters even more than traditional ones (Bamber, Fernandez-Stark, and Taglioni 2020).

Table 5.2 summarizes the discussion of generic correlates of GVC resilience and more specific conditions related to resilience in geopolitical, environmental, and COVID-19 risks.

Table 5.2: Relative Global Value Chain Resilience and Adaptation to Risks

Features	Risk Type		
	Geopolitical	Environmental	Pandemic (COVID-19)
Generic correlates of global value chain (GVC) resilience	**Variables affecting relative resilience** Nature and magnitude of shock, including size and sector/region specificity Distinctive GVC features, including symmetric versus hub and presence of choke points Industry and firm topographies, including upstream versus downstream and geographic dispersion Availability of substitutions (short, long term) Degree of transactional stickiness in GVC partnerships **Selected findings** GVCs can amplify the impact of shocks GVCs enable diversification that mitigate risks, reduce volatility, and enhance resilience Longer GVCs are more vulnerable Shocks propagate more strongly in GVCs featuring asymmetric intersectoral links and choke points (where a few hubs or lead firms connect the network) Supply-side shocks propagate downstream more powerfully than upstream Relative GVC resilience hinges on the availability of substitutions, short and long term, and on the stickiness of supply chain relationships Firms build resilience via automation, digitalization, diversification, "just in case" strategies, capacity buffers, regionalization, near shoring, and shorter GVCs Reshoring has hardly been the norm so far Digitalization increases vulnerability to cyberattacks		
Correlates of GVC resilience and vulnerability by specific risk type	Geopolitical shocks target knowledge-intensive, specialized, and localized ecosystems with unique suppliers and expert pools, often difficult to substitute (high input-specificity) and with high potential for propagating Lead firms with intangible assets limit range of suppliers for fear of intellectual property exploitation Typical targets: countries with highly concentrated levels of specific inputs, unreliable suppliers, countries erecting illegal/arbitrary restrictions or are perceived to violate international agreements or norms in environmental, human rights, or security	Extreme events often highly localized and temporally confined, hence GVCs enable adjustment (shock absorber) GVCs can amplify environmental risks in the short run, especially in agglomerated industry locations GVCs can enhance resilience by allowing diversification; some evidence of firms diversifying after disasters	Value chains with higher complexity, length, and more concentrated production or distribution are relatively more exposed to risk Substantial GVC nationalization or regionalization risks reducing diversification and opportunities for countries to benefit from GVCs The absence of robust coordination across countries exacerbates damages to GVCs
Firms' adaptation strategies by risk type	Geographic and supplier diversification, domestic and international Substituting away from concentrated or politically unreliable firms/country suppliers Developing alternatives to unique suppliers with high input specificity Moving production and sourcing away from firms/countries showing rising geopolitical risk, arbitrary restrictions, lack of transparency, treaty violations, nationalist backlash Enhancing protection from state and private cyberattacks	Short-term: adjust procurement share, substitute with alternative suppliers, customers, and trade routes Medium-term: adjust supply chain relationships to diversify exposure to environmental risks; insurance to protect against large losses Long-term strategies: changes in production patterns, trade, and migration policies to mitigate environmental damage	Localization of production of essential supplies; reduction in irreversible investments abroad Enhance diversity of trading partners (suppliers or buyers) in GVCs to allow easier substitution Accelerated adoption of digital technologies Improved balance of resource allocation between virtual and physical activities

Source: Authors.

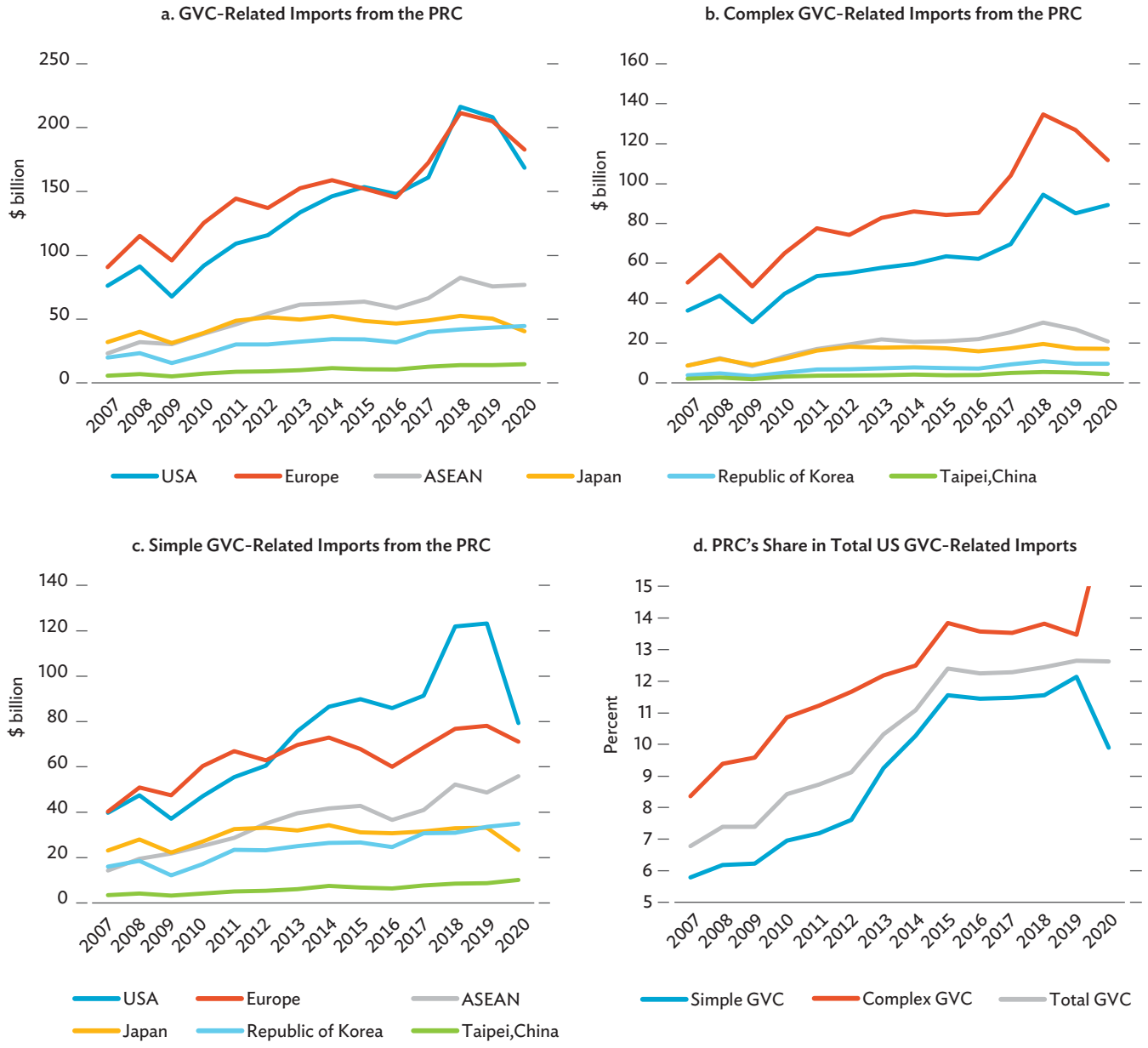
Compounding Risks

The previous sections examined the sources, mechanisms, and effects on GVCs of each risk type largely in isolation. Those risks, however, have become compounded. Environmental and pandemic risks have been long-standing concerns in the context of GVC resilience. Geopolitical shocks, for one, have become an even greater threat than at any time in recent decades not only for their potential to disrupt GVCs directly but also to lower the likelihood that states will cooperate in preventing environmental and pandemic shocks affecting GVCs. COVID-19 was superimposed on preexisting geopolitical risks, deepening concerns with GVC dependence in medical equipment, pharmaceuticals, and vaccines, especially as individual economies dominate markets in critical inputs. In turn, heated controversies over the exact path through which COVID-19 first jumped into humans aggravated geopolitical tensions between the US, the PRC, and other economies, making cooperation on GVC on matters related to COVID-19 even more difficult. The pandemic raised the uncertainty initially induced by geopolitical tensions to its highest level in early 2020, although the onset of vaccination in early 2021 reduced this significantly (Ahir, Bloom, and Furceri 2021). Meier (2020) finds that GVC disruptions lengthen "time to build" (the delivery lag of capital goods) by 1 month, depressing GDP by 1.0% and aggregate total factor productivity by 0.2%.

In another instance of compounding risk, studies show that deforestation and climate change have increased the incidence of infectious diseases (Lafferty 2009) and fueled regional conflicts (Gleick 2014). Carbon border-adjustment policies proposed by the European Union to offset carbon emissions embedded in imported inputs have raised concerns that these policies could arguably mask protectionism and increase tensions. Compounded risk effects are especially visible in semiconductor shortages, where geopolitical, environmental, and COVID-19 shocks that especially affect East Asia created bottlenecks throughout critical GVCs. Factory closures caused by COVID-19 triggered global semiconductor shortages in 2020 and 2021, and this was exacerbated by extreme weather hitting Japan; Texas; and Taipei,China; with effects felt by automobile factories across all major GVC hubs in Asia, Europe, and the US.

Compounding risks make any definitive assessment of the cumulative impact of geopolitical shocks on GVCs, or of the separate effects of COVID-19 on them, more difficult, as those effects are conflated. Figure 5.1 gives a preliminary snapshot of selected aggregate effects on GVC-related imports from the PRC by Association of Southeast Asian Nations members; Europe; Japan; the Republic of Korea; Taipei,China; and the US from 2007 and 2020. Total European and US GVC imports from the PRC (panel a) have grown significantly since 2016, but show a clear inflection point downward since 2018—under the trade and technology war—which exacerbated throughout 2020 by COVID-19.

Figure 5.1: Aggregate Effects on Global Value Chain-Related Imports from the People's Republic of China by Association of Southeast Asian Nations Members; Europe; Japan; Republic of Korea; Taipei,China; and the United States



ASEAN = Association of Southeast Asian Nations, GVC = global value chain, PRC = People's Republic of China, USA = United States.
Source: Authors' calculation based on Asian Development Bank's Multiregional Input–Output Database. https://mrio.adbx.online (accessed 31 July 2021); Asian Development Bank estimates.

Panels b and c disaggregate between complex and simple GVCs. Complex GVC-related imports from the PRC by European partners declined considerably since 2018—under the trade and technology war—whereas simple GVCs declined mildly and only in 2020, when COVID-19 was overlaid on geostrategic concerns. Interestingly, the decline in complex US GVC imports in 2018 and 2019, with the inception of the trade war, was reversed in 2020 despite combined geopolitical and pandemic uncertainty. Simple GVC-related US imports from the PRC declined dramatically in 2020, perhaps reflecting

more of a COVID-19 effect. They have grown slightly for the Republic of Korea and more noticeably for Association of Southeast Asian Nations members since 2016, but declined for Japan in 2020. Panel d shows a stable PRC share of total complex GVC-related imports into the US since 2015, declining slightly from 2018 to 2019 under rising geopolitical risk, but rising sharply in 2020 despite compounded geopolitical and COVID-19 risks. A stable PRC share in simple GVC-related imports increased slightly in 2019, but has declined significantly since then under compounded risks.

How have firms and GVCs adapted to compounded meta-risks? Automation, digitalization, diversification, multiple sourcing within and across economies, "just in case" inventories, redundancy, capacity buffers, nearshoring of production or suppliers, better GVC mapping, and transparency and visibility have emerged as the dominant responses for coping with compounded uncertainty. Reshoring has hardly been the standard GVC response as of mid-2021, arguably because GVCs reflect market mechanisms and efficiency more than nonmarket shocks (Meng and Ye forthcoming; Qiang, Liu, and Steenbergen 2020). Yet there is no guarantee this trend presages the future. Automation and digitalization have emerged as dominant GVC responses to uncertainty, but are also pregnant with implications for potential declines in employment, rising inequality and poverty in developing and developed economies, truncated technological upgrading in developing economies, and greater risk of cyberattacks.

Systematic data on ongoing relocation and reshoring is still fragmentary, although firm-level surveys provide a window into extant responses to the twin shocks (Solingen 2021). An October 2019 survey found that 90% of US firms were affected by US-PRC trade tensions, requiring diversification of suppliers, risk management, and cost control; 60% of respondents ranked those tensions as their top concern over the next 3 years (PwC and AmCham China 2020). A March 2020 subset of that survey (25 large US firms in the PRC) showed that only 44% of respondents thought US-PRC decoupling was "impossible," down from 66% in October 2019. About 94% of respondents put the PRC among the top five priorities in 2015, declining to 82% by 2019 with the onset of trade tensions (US-China Business Council 2019). Out of over 700 firms deployed globally, 96% of US-based firms and 100% of European ones listed the PRC among their top-three sourcing countries in 2019, declining to 77% and 80%, respectively, by March 2021 (Zhou 2021). US-PRC trade tensions were the most significant driver of GVC changes in 2019, including a loss in the PRC's global export market share (Baker McKenzie 2020). "Rising tensions in US-PRC relations" were not among the top five business challenges in surveys in 2017 and 2018, but rose to third highest in surveys in 2019 and 2020, and ranked top by late 2020, especially in the category of services (76%) and technology and R&D-intensive industries (65%) (AmCham China 2021b). In a 2021 survey of 900 GVC managers from Europe and the US, 51% of respondents reported disruptions from COVID-19, 51% from geopolitical events and the US-PRC trade dispute, and 25% from disasters (Interos 2021).

In 2019, most firms in an American Chamber of Commerce survey considered "in China for China" strategies suitable for mitigating the impact of trade and technology tensions, and 83% had no plans to relocate GVC production or operations (AmCham China 2020). By early 2020, however, 33% firms reported to have moved sourcing and manufacturing out of the PRC or were planning to do so, with US–PRC tensions featured in decisions to relocate to non-US destinations for 50% of those firms (John and Raman 2020). Tariffs, which according to this survey increased costs by up to 10% for about 40% of respondents (rising costs were even higher for another 10%), were the primary factor driving sourcing or production out of the PRC for 73% of respondents. Concerns over the technology and trade war accounted for 30% of incentives to diversify out of the PRC. A 2020 American Chamber of Commerce in Shanghai survey shows that whereas 81% of firms projected increases in PRC investments in 2016 (before the trade tensions), only 48% did so in 2019 (once tensions were in place), and this was down to 28% in 2020 from the compounded effects of the trade and technology war and COVID-19 (AmCham Shanghai 2020).

The outcome of the 2020 US elections restored some confidence, with nearly 63% of respondents in an American Chamber of Commerce in Shanghai survey reporting greater optimism about doing business in the PRC, 82% not planning relocation, 85% expecting no increases in trade restrictions or tariffs, and only 10% still planning to relocate over 20% of their production out of the PRC, citing uncertainty about US-PRC relations as a top concern (AmCham Shanghai 2020; AmCham China 2021a). Visa and travel restrictions related to the COVID-19 pandemic affected 75% of respondents and, by 2021, 92% of US and other foreign firms and 85% of PRC firms deemed an escalation of US-PRC trade tensions to be quite likely or very likely (AmCham [based in Guangdong, PRC] 2021). Most other surveys on US-PRC trade tensions did not envisage a massive or immediate GVC relocation out of the PRC, given the country's comparative advantage and domestic market size. However, significant diversification increased via "China+1" and "China + many" strategies, and it is possible that the longer-term incentives of firms to relocate may not be detectable at the time of writing. Lock-in effects raise the costs of relocation away from upstream and downstream partners in the short term (Qiang, Liu, and Steenbergen 2021).

The International Monetary Fund, in a mid-2021 economic outlook of Asia and the Pacific, notes little evidence of bifurcation into parallel structures aligned with the US or PRC sphere of influence, but warned against trade tensions morphing into technological decoupling that would inflict much larger costs on the global economy (IMF 2021b). Yet geopolitical tensions reinforced a preexisting trend driven by the PRC's rising labor costs pushing firms from Japan; the Republic of Korea; and Taipei,China to relocate production and final assembly to Southeast Asia and India. The 2021 American Chamber of Commerce in China Business Climate Survey reports that developing Asia captured 42% of favored destinations, developed Asia 7%, Canada and Mexico a combined 19%, the European Union 7%, and the US 14% (AmCham China 2021a). A Japan External Trade Organization April 2021 survey of 424 Japanese companies with affiliates in the PRC reported that 86% had no plans for relocation in the short term (Zhou 2020).

Japan disbursed nearly $3 billion by early 2021 to support 203 Japanese firms with incentives to reshore, especially in medical and semiconductor industries (Regalado 2021). Some firms reported that they had moved sensitive business activities out of the PRC to hedge against regional geopolitical risks. US and PRC export controls became the biggest concern for Japanese firms with subsidiaries in the PRC, replacing tariffs, in a survey in late 2020 of 2,700 of these firms (JETRO 2021). In 2021, LG Corporation announced plans to reduce global dependence on the PRC for materials and components for electric vehicle batteries on account of broader international concerns over lithium and cobalt supplies and prices.

The accelerated digitalization of GVCs has pushed firms to automate production, store key information online, and create an industrial Internet of Things, allowing computers built into factories, cars, and offices to communicate with each other. The COVID-19 pandemic accelerated this trend by several years (McKinsey & Company 2020). However, economies at different levels of digitalization and firms with different R&D endowments and GVC positions create digital divides. Furthermore, new technologies cannot mitigate all the adverse economic effects of COVID-19; GVCs still require face-to-face interaction to complement virtual interaction.

Digital technologies also have a dark side. Digitalization has increased vulnerability to cyber security risks to GVCs and associated infrastructure, compounding all three meta-risks. Jamilov, Rey, and Tahoun (2021) found that cyber risk has quadrupled since 2002 and more than tripled since 2013, with both the number of firms and intensity of the impact at record highs. Geopolitical and pandemic risks have, in turn, exacerbated cyber risks, targeting a widening range of global industries deployed along GVCs. In a typical vicious cycle, cyberattacks have aggravated geopolitical and pandemic risks, which in turn have fueled campaigns of misinformation and public deception. The 2021 Interos survey of 900 European and US GVC managers found that only 22% of respondents were not affected by cybersecurity breaches (Interos 2021). The World Economic Forum's *Global Risks Report 2021* cites cybersecurity among the top risks facing the world (WEF 2021). A combustible combination of geopolitical tensions and cyberattacks have intensified risks to GVCs at a time of diminished trust and weak multilateral cooperation.

In 2019 and 2020, a US federal grand jury indicted a group of Chinese nationals labeled "Apt41" for cyberattacks against 100 companies in the US and elsewhere, accusing them of theft of IP along with business and customer data (Department of Justice 2020). The charges mentioned targets including software developers, computer hardware manufacturers, and telecommunications providers, as well as universities, think tanks, and governments. Other charges included a hacking campaign over 7 years in relation to the aviation, defense, education, government, health care, and biopharmaceutical sectors worldwide (Kiran, Warrell, and Murphy 2021; White and Shepherd 2021). In 2020, the European Union imposed its first cyber sanctions against individuals and organizations from the Democratic People's Republic of Korea, the PRC, and the Russian Federation for alleged cyberattacks, including Operation Cloud Hopper against a lead GVC firm.

A cyberattack on Microsoft Exchange compromised over 100,000 servers worldwide, triggering the broadest condemnation of these attacks ever by Australia, the European Union, Japan, New Zealand, and 30 NATO countries. The outcry stopped short of imposing sanctions (Hudson and Nakashima 2021). In May 2021, a ransomware group based in the Russian Federation launched a cyberattack that shut down a pipeline supplying nearly half the oil to the US east coast for 5 days, causing major disruptions to supply chains.

In sum, risks compounding geopolitical and cyber tensions, natural hazards, and the COVID-19 pandemic have generated incentives for economies and firms to invest significantly in enhancing resilience to these risks. These measures have so far resulted in only a limited decline in the PRC's standing as the "factory of the world" and this does not look likely to change in the short term. But it could certainly buttress further GVC decoupling under more extreme inward-oriented geopolitics, fueled by rising protectionism, populism, and hypernationalism. Investments in resilience could also yield a modified but far from obsolescing GVC infrastructure that emerges nimbler and geographically diversified for coping with various types of risk.

Conclusions and Policy Recommendations

Writing at an inflection point in mid-2021 precludes a firm assessment of whether GVCs are becoming more or less resilient to the risks addressed in this chapter, but this section offers recommendations for reducing all three risk types. As many studies document, and this chapter echoes, GVCs can exacerbate each of those risks. The primary focus here, however, was the reverse causal arrow: why and how these risks affect GVCs. All three risks *from* GVCs are on the rise as are all three risks *to* GVCs. All three risks are becoming more predictable, to varying degrees, as the understanding of their sources and mechanisms improves. All three can be better contained domestically and internationally if handled well, especially because they all can have anthropogenic sources or mechanisms. All fuel unfortunate synergies across them and are increasingly compounded by cyberattacks. Unless appropriate policies are adopted for reducing those risks, the remarkable benefits that GVCs can bring, examined in other chapters of this report, will be at stake.

This chapter's overview of the sources, mechanisms, and effects underlying those risks leads to an overarching recommendation: the optimal strategy is confronting them at their source. Prevention can dramatically reduce the burden of coping with rising risks. Only international collaboration, reciprocity, and transparency will defeat uncontrolled climate change, pandemics, and the unconstrained, unilateral pursuit of relative gains in interstate relations. Geopolitical shocks inspired by extreme inward-oriented strategies generate both direct and indirect risks to GVCs by undermining cooperation geared to dampen environmental and pandemic risk. Further research will improve the ability to identify more specific synergies across the three risk types. The rest of this section distills seven more fine-grained complementary recommendations.

First, GVCs can indeed amplify and compound the effects of all three shocks. Geopolitical tensions enhance uncertainty, decrease investment, create bottlenecks, reduce productive economic exchange, and unleash contagion throughout GVCs. Extreme weather is stretching GVC capacities worldwide. COVID-19 affected trade primarily through GVCs. Notwithstanding those effects, research suggests that reshoring would reduce GDP further without significant increases in resilience. Calls for radical renationalization can overwhelm sober analysis of the net costs of dismantling GVCs, especially in the Beyond Production era. While GVCs may magnify shocks, they can also help mitigate them. Initial export restrictions under COVID-19 exposed the fragility of GVCs in essential goods, knowledge-intensive sectors, health care, and pharmaceutical goods, but subsequent relaxation proved that GVCs were quite resilient. Shortfalls and gridlock remain due to spikes in demand and lingering labor supply disruptions and lockdowns, as well as container shortages, transportation bottlenecks, outdated port and road infrastructure, and surging prices.

Second, enhancing GVC resilience is not equivalent to pursuing extreme self-reliance, a policy that is inefficient, costly, often ineffective, and counterproductive even for the largest countries. Most goods and services not tightly connected to national security do not justify complete self-reliance, subsidies, or import protection that increases consumer prices. Nor do risky shifts to self-reliance guarantee supply, especially when shocks affect domestic production. Limited global geographic diversification heightens vulnerability to shocks whereas dependable outward-oriented strategies foster GVCs with broader access to goods, services, specialization, and innovation. Outward-oriented strategies are also better poised than their alternatives to advance more environmentally sustainable and cooperative policies on a wide range of issues, including pandemic prevention and mitigation.

Third, surveys suggest that all three risk types are underpinning efforts to enhance the resilience of GVCs by adopting ICT, automation and digitalization, diversifying suppliers, expanding inventories, encouraging redundancies and "just in case" operations, regionalization, nearshoring, and striving to reduce dependency on any single economy for production or sourcing. GVCs are also increasing transparency and accurate mapping to facilitate timely substitution and geographic diversification. Automation has been a more typical response than reshoring so far, but increased pressure for accelerating reshoring cannot be discounted.

Fourth, efforts to restore confidence in GVC benefits require hard work at every level and awareness of synergies across those levels. Greater sensitivity to domestic distributional considerations from participating in GVCs can help reduce the impulse toward extreme inward-looking strategies premised on costly and elusive aspirations of self-sufficiency. MNCs capture massive returns from progressively more knowledge-intensive GVCs, deepening income disparities, and eroding public support for GVCs. Strengthening antitrust policies and competition helps minimize economic and political risk. Proper and fair tax reform for MNCs is vital for increasing equity and improving

labor and environmental protections. Agreement on a minimum global corporate tax could be followed by greater transparency in intra-firm income transfers and improved data collection on intangibles in GVCs. Eliminating poverty and reducing inequality also provides stronger foundations for technological upgrading.

Fifth, policies must prioritize renewable energy and decarbonization, making progress and improving on the Paris Agreement goals by combatting illegal deforestation linked to food-related GVCs, eliminating fossil fuel subsidies, adopting minimum carbon pricing and improved carbon emission standards, and other urgent measures toward net zero. UN Secretary-General António Guterres declared in March 2021: "Phasing out coal from the electricity sector is the single most important step to get in line with the 1.5-degree goal" (UN 2021). A more circular economy requires sustainability across all GVC stages. Sustainable, reusable packaging and zero waste are of growing importance to consumers and would help cushion GVCs from future shocks. Adjustments may be costly in the short term, but they are bound to yield a more sustainable environment for GVCs in the longer term.

Sixth, geopolitical tensions and coercive economic statecraft have introduced unprecedented risks to GVC operations, higher than at any time in recent decades. This has magnified generalized uncertainty, reduced trust in the integrity of GVCs, triggered retaliatory downward spirals, and undermined the global movement of people who lubricate GVC operations, especially in services and intangibles and more broadly in science, technology, and innovation. Global interdependence via GVCs entails complex compromises in terms of relative costs and gains that must be weighed against those risks. Inattention to their differential costs and benefits clouds a fitting recognition of GVCs' contributions to growth, welfare, innovation, productivity, ability to leapfrog, and peaceful international exchange over and beyond the benefits from non-GVC trade. The absence of reciprocity and transparency, and deficient compliance with multilateral commitments, undermine trust and fuel incentives to redress grievances unilaterally. Coercive economic statecraft, in turn, triggers counterproductive blowback and spillback effects, decreased investment, lower exports, rising unemployment, and Pyrrhic victories that hurt senders as much as targets and spill over into other domains in interstate relations. Further research must include not only the quantifiable but also reputational costs of coercive statecraft that can be harder to estimate before their application.

Seventh, strengthened multilateral institutions can help rebuild trust by, for instance, bolstering compliance with nondiscrimination, reciprocity, transparency, and IP rights, all of which are of huge relevance to knowledge-intensive GVC operations and trade in intangibles. A revitalized WTO can be empowered to play important new roles in reducing distortions, such as subsidies; reinforcing fair competition and market-oriented policies; strengthening information and cross-border digital flows and data privacy; and further liberalization of services. As WTO Director-General Ngozi Okonjo-Iweala has put it, the future of trade is services, digital, green, and inclusive (Harding 2021). Initial export restrictions on personal protective equipment hindered the collective ability to

cope with the most devastating pandemic in a century. WTO rules must be especially flexible for COVID-19 vaccine inputs. Much remains to be learned from failures of international policy coordination that might have otherwise improved supply chains and the timely delivery of vaccines worldwide (Bown and Bollyky 2021).

Other multilateral forums must urgently tackle cybersecurity because cyberattacks on GVCs and industrial and economic targets especially relevant to Beyond Production activities have soared to critical levels. Cyberattacks have brought the nontrivial potential that economic statecraft and technological competition spill over into the security realm to dangerous levels. A global compact reducing cyber risks to GVCs would be a stepping-stone toward a deeper and broader international regime curtailing the use of cyber space for nefarious aims. Countries must also converge around an upgraded multilateral early warning system for pandemics that guarantees effective transparency and the timely provision of data and all pertinent information, which WHO can help coordinate. A global blueprint for pandemic preparedness requires significant new funding from international financial institutions, including development banks and the International Monetary Fund, as well as scaled up, geographically diversified end-to-end GVCs for diagnostic tools, therapeutics, vaccines, and personal protective equipment (Group of 20 2021). Guan et al. (2020) provide a prescient insight on the lockdown effects on GVCs. Here, relaxing restrictions gradually (e.g., over 12 months) resulted in significantly lower declines in GVC value added (39.5%) than would have been the case with the quick lifting of restrictions, which would have resulted in recurrent future lockdowns (with declines of 49.5% and 61.5% in alternative scenarios). The study also suggests that a pattern where individual countries adopt disease control measures without consideration of their overall effects on GVCs leads to suboptimal outcomes. Developing a global cost-sharing instrument ahead of the next potential pandemic could enable a fairer distribution of the costs of monitoring, containing, and suppressing emerging diseases, while strengthening incentives for early action.

In the absence of these and other urgent adjustments, the alternatives have only compounded and reproduced perverse synergies across geopolitical, environmental, and pandemic risks. The recommended solutions make more viable the return to virtuous circles between interdependence via GVCs and broader international cooperation. Beyond their contributions to the global economy, the complexity of GVCs engenders novel mechanisms of global interdependence that could raise the costs of conflict, making international cooperation more resilient than 20th century forms of economic exchange. But political will is of the essence, especially because risks are rapidly compounding. Timely cooperation on climate change might not only help soften the rough edges of geopolitical and pandemic risks but also reinforce mutual commitments across all three risk types.

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6

Digital Platforms and Global Value Chains

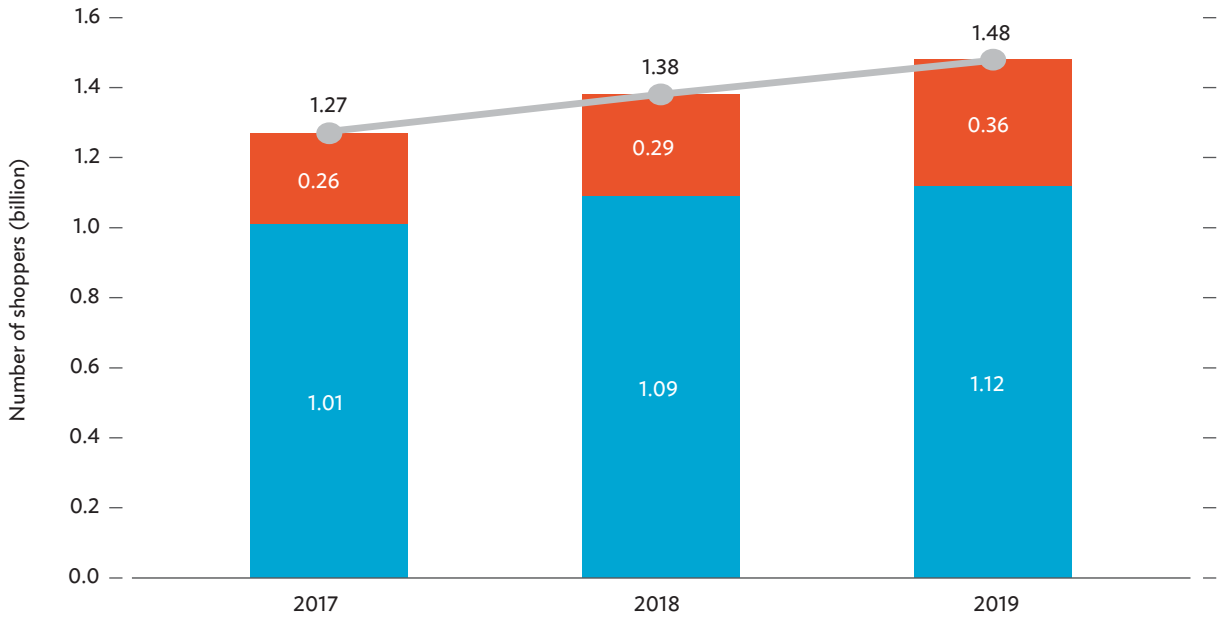
Kathryn Lundquist and Jong Woo Kang

The two largest changes that have affected international trade since the 1990s are the creation of the new digital economy and the development of global value chains (GVCs). Both are inherently connected to new information and communication technology (ICT), and both have seemingly increased trade inclusivity, benefitting the trade participation of micro, small, and medium-sized enterprises (MSMEs) and developing countries. The interaction between the digital economy and GVCs is not well explored, however. Although the growth of both may have been in parallel, is there evidence that the digital platforms at the core of the digital economy affect GVC participation? This chapter examines the role of digital platforms, especially e-commerce marketplaces in the modern economy; the ways these platforms can increase economic inclusivity; and the development of GVCs and their effect on trade participation. The chapter also reviews the evidence on the link between digital platforms and GVC participation.

The new digital economy is based around platforms—search systems such as Google, marketplaces such as Alibaba, and application platforms such as Android, among many others (ADB 2021; Evans 2011; Kenney and Zysman 2016; OECD 2019). These platforms have applications for all types of businesses, opening doors to new industries and players from micro firms to any digitally connected business in the world. Digital platforms not only bring supply- and demand-side players together to transact but also the platforms themselves are part of the ecosystem and they have become integral to value-creation processes, such as collecting data (Busch 2020; OECD 2019).

The COVID-19 pandemic has strengthened the digital economy and the role of digital platforms as the global economy became increasingly virtual because of physical distancing measures (ADB 2021; OECD 2021). For instance, the share of online retail sales increased markedly in 2019 and 2020 and now account for nearly a quarter of retail sales in the People's Republic of China (PRC), the Republic of Korea, and the United Kingdom (UNCTAD 2021). The value of online shopping, all of which is facilitated and conducted on some level by digital platforms, has also grown steadily in recent years, and is estimated at $26.7 trillion in 2019 or some 30% of global gross domestic product (UNCTAD 2021). More than 1.4 billion people made online purchases in 2019, a number that is sure to rise given the increase in online retail sales due to the COVID-19 pandemic (Figure 6.1).

Figure 6.1: Global Online Shoppers, 2017–2019



Source: United Nations Conference on Trade and Development. 2021. Estimates of Global E-Commerce 2019 and Preliminary Assessment of COVID-19 Impact on Online Retail 2020. *UNCTAD Technical Notes on ICT for Development*. No 18. Geneva.

The growing trend in e-commerce sales is global, but participation has not been equal and is concentrated in Asia, Europe, and North America (UNCTAD 2021). Indeed, the top 10 countries with e-commerce sales, comprising four-fifths of global e-commerce in 2019, were from these regions. Some of the reasons for this geographic concentration is due to digital infrastructure, since these regions are characterized by extensive mobile network coverage and internet access (ITU 2020), as well as digital skills being more prevalent in these regions (ADB 2021). The installation of global telecommunication equipment continues to grow but it, too, is not distributed equally around the world. Even so, the digital economy has created business opportunities through new digital services and methods of sale (OECD 2014). MSMEs have been able to capture some of the growth in e-commerce both domestically and internationally, particularly in

specialized manufacturing and services, which are areas of competitive advantage for smaller firms (Cusolito, Safadi, and Taglioni 2016). The internet also makes it easier to find and target niche demand opportunities, and has created the phenomenon of "born global" firms, with small enterprises able to export their products from initiation (Wong and Merrilees 2012). Phone applications are a good example of this. In 2009, the game Angry Birds and the messaging service WhatsApp were both created by small groups of developers. Both were immediately available for download to mobile phones around the world, making these small digital services firms instantly international. This aspect of global digital inclusion for businesses of any size is important from a development perspective since MSMEs make up more than 90% of firms in the world and account for more than 60% of global employment (WTO 2016).

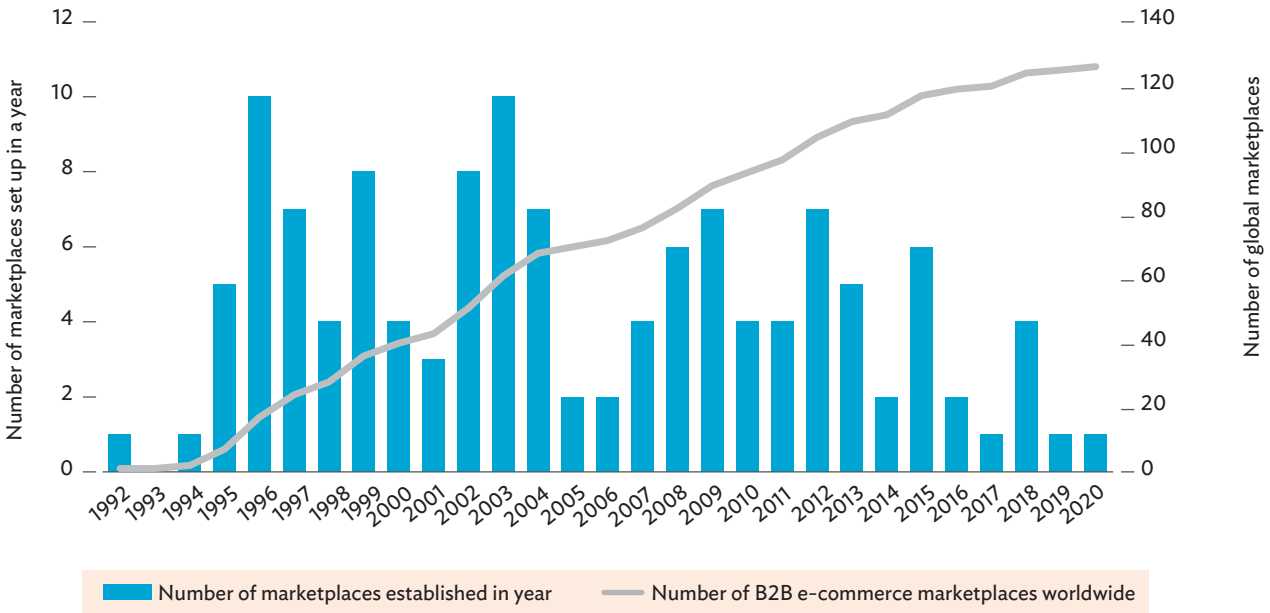
Digital Platforms

Platforms, digital or analogue, make it possible for two or more groups to interact directly with each other, and they tend to develop when there is both a benefit in connecting and connecting is easier through an intermediary (Evans 2011). Platforms also create "network effects," meaning the more users a platform has the more valuable those users find the platform (Evans 2016). Bazaars and marketplaces, where merchants and customers came to a specified place to interact, are the most obvious examples of analogue platforms from the past. Similarly, digital platforms are businesses aiming to provide digital space and tools for different parties to transact—and not just for buying goods but also for services or even just for social interaction. Examples of digital platforms range from e-payment services, such as PayPal Holdings Inc., that connect purchasers' credit information to vendors selling products or services; ride-sharing applications, such as Uber Technologies Inc. that connects drivers with riders; and social media services, such as Instagram, bringing individual content generators and advertisers together with viewers. Different digital platforms and users can also be linked to each other, creating a web of connected parts that is a digital ecosystem (OECD 2019). For example, Google and other search engines connect searchers and advertisers to transaction platforms, social networks, or whatever site is being searched; these sites then connect to their own buyers, sellers, or users creating a larger interaction beyond the search engines themselves.

The use and revenue of digital platforms have exploded in recent years. According to Cusumano (2020), the "most valuable publicly listed companies in the world today—Apple, Microsoft, Amazon, Alphabet-Google, Facebook, Tencent, and Alibaba—share a common trait. They are platform businesses—that is, they bring together different market actors in order to distribute or exchange products, services, or information." The trend is also transformational, bringing traditional retailers to the online marketplace. Walmart Inc. is now the second largest e-commerce retailer in the United States (US), with online sales up 79% for its fiscal year 2021 (ending 31 January 2021) compared with total company revenue growth of 6.7%. ADB (2021) estimates that revenue from global digital platforms in 2019 was $3.8 trillion, or 4.4% of global gross

domestic product. These figures are striking. Digital platforms have grown to a visible share of the global economy from essentially no presence before the 1990s. One example of the growth in digital platforms is the steady global increase of business-to-business (B2B) e-commerce marketplaces from the early 1990s (Figure 6.2).

Figure 6.2: Business-to-Business Marketplaces, 1992–2020

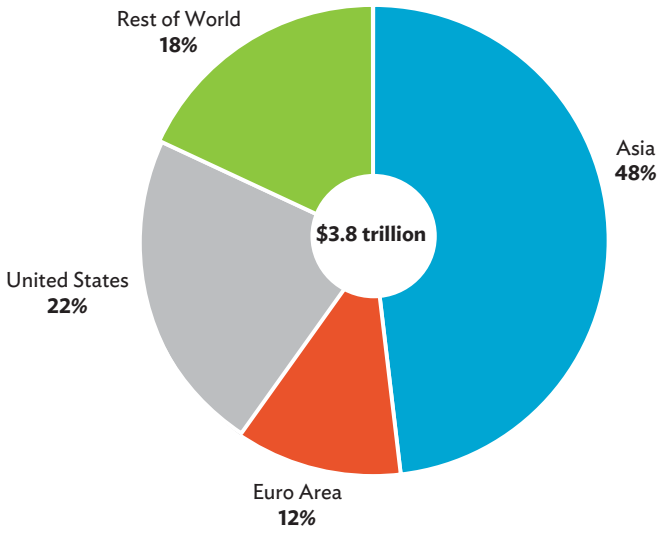


B2B = business-to-business.
Source: Maxime Ladrière, Kathryn Lundquist, and Qing Yi. 2020. B2B E-Commerce Marketplaces and Micro, Small, and Medium Enterprises: Evidence of Global Value Chain Facilitation? Unpublished. World Trade Organization; authors' calculations based on similarweb.com and web research.

Researchers have tried to apply various types of categories to distinguish types of digital platforms, such as by a platform's function, users, or type of data collected (OECD 2019). Examples of the first type, by function, are the often used "transactional" versus "innovation" platforms, such as Amazon Marketplace and Airbnb that connect users and transmit data, as opposed to Linux and Microsoft that allow users to develop products or services on their operating systems, which are sold to consumers. Although these examples appear to be distinct categories, some platforms, including Apple and Google, facilitate both transactional and innovation operations simultaneously by connecting buyers and sellers and creating an environment to develop content. Other methods, such as categorizing by user or type of data collected, face similar difficulties. To overcome the problem of platforms straddling categorization definitions, the Organisation for Economic Co-operation and Development broadly defines an online platform as a "digital service that facilitates interactions between two or more distinct but interdependent sets of users (whether firms or individuals) who interact through the service via the internet" (OECD 2019). This is how digital platforms are viewed in this chapter.

As with e-commerce generally, digital platforms are not distributed or used equally throughout the world. Asia is at the forefront of the digital platform economy, which generated $1.8 trillion in 2019, nearly half of the $3.8 trillion in global revenue from these businesses (ADB 2021) (Figure 6.3). A survey of the headquarter locations of B2B e-commerce marketplaces by Ladrière, Lundquist, and Yi (2020) similarly found that most of these specific platforms are in Asia, followed by North America and Europe.

Figure 6.3: Digital Platform Revenue by Region, 2019



Source: Asian Development Bank. *Asian Economic Integration Report 2020/2021: Making Digital Platforms Work for Asia and the Pacific.* Manila.

Digital Platforms and Micro, Small, and Medium-Sized Enterprises

Digital platforms provide many benefits and additional capabilities for their users, which can be especially beneficial for smaller businesses. Digital platforms through their services, such as market research, e-payment, and online advertising, can lower barriers to enter markets, making economic participation more inclusive (OECD 2021). Digital platform firms may even provide these services free or at a loss so they can increase participation and their network effect. This allows MSMEs to access services that might otherwise have been prohibitively expensive and can help them overcome skills gaps. Table 6.1 shows some MSME business functions performed through online digital platforms.

Table 6.1: Business Functions Performed for Micro, Small, and Medium-Sized Enterprises through Online Platforms

SME Business Functions	Matchmaking		Main Benefits for SMEs	Examples
	SME End-User	Other End Users		
Marketing, advertising, branding, customer services, external communication	All SMEs	Potential clients, business partners	Positive indirect network effects, access to markets (incl. global), advanced analytics/AI (e.g., for targeting/market segmentation, impact analysis)	Facebook, Google, YouTube
E-commerce (online marketplaces)	SMEs (e.g., manufacturing, retail)	Companies (B2B), individual customers (B2C)	Positive indirect network effects, access to markets (incl. global), advanced analytics/AI (e.g., for targeting/market segmentation, impact analysis), lower transaction costs (e.g., payment, shipping, logistics), enhanced client trust (i.e., reviews system, platform insurance)	Amazon, E-bay
Service delivery (aggregators of incumbents[a])	SMEs in food services, media and entertainment, accommodation, among other areas	Individual customers	Positive direct and indirect network effects, access to global markets, lower transaction costs (e.g., payment, shipping, logistics, customer care), enhanced client trust (i.e., review systems, platform insurance)	Booking, Deliveroo, DoorDash, Netflix, Sony PlayStation, Spotify, Uber Eats
Service delivery (disruptors for new entrants into the market[a])	Self-employed, entrepreneurs	Individual customers	Positive indirect network effects, standardization of offer, standardization of contracts, reduced asymmetry of information, access to markets (incl. global), enhanced client trust (i.e., review systems, platform insurance)	Airbnb, TaskRabbit
Financing	SMEs looking for financing sources and financial products	Financial institutions, banks, retail investors	Positive direct network effects, access to global markets, reduced financing costs, reduced asymmetry of information (e.g., collaterals)	Campeon, Funding Circle, GoFundMe, Kickstarter, Lending Club, Revolut,
Payment	Selling SMEs (merchants)	Individual customers	Positive direct and indirect network effects, lower cashing delays, reduced asymmetry of information (funders)	PayPal, Square, we.trade
Communication, remote working, teleconferencing	All SMEs	Individual customers, suppliers, workers	Positive direct and indirect network effects, lower-to-zero costs for implementation (incentives or benefits)	Google Meet, Microsoft Teams, WhatsApp, Zoom
Research and development, design, exploration	SMEs (application developers)	Other programmers, individual users	Positive direct network effects, lower production and diffusion costs (e.g., common standards, open-source code)	App Store, GitHub, Google Play

AI = artificial intelligence, B2B = business to business, B2C = business to customer, SMEs = small and medium-sized enterprises.

Note: The SME end-user column is used to highlight the different types of SMEs using different online platforms. It is by no means exclusive since large firms, nonprofits, and so on can (and generally do) use the same platform.

[a] The distinction between aggregators and disruptors is a qualitative assessment of the business model of platforms proposed in Alberto Bailin Rivares, Peter Gal, Valentine Millot, and Stéphane Sorbe. 2019. Like It or Not? The Impact of Online Platforms on the Productivity of Incumbent Service Providers. *OECD Economics Department Working Papers.* No. 1548. Paris: Organisation for Economic Co-operation and Development. The paper distinguishes between online platforms focused on allowing incumbent services providers to reach their customers more effectively (aggregators such as Booking and Deliveroo) and online platforms opening markets to previously almost nonexistent competitors, usually self-entrepreneurs (disruptors such as Airbnb and Uber).

Source: Organisation for Economic Co-operation and Development. 2021. *The Digital Transformation of SMEs.* OECD Studies on SMEs and Entrepreneurship. Paris.

Digital platforms can provide valuable network effects for MSMEs that help them increase their access to more consumers and provide more sourcing options. These platforms are also one of the primary ways for MSMEs to get into international markets since they can reduce trade barriers and lower costs (Morais and Ferreira 2020; OECD 2018). Evidence shows that digital platforms can increase productivity, with stronger effects seen in smaller firms (OECD 2021). These productivity gains occur by reducing information asymmetries through ratings and review systems and by increasing competition between service providers, which can lead to cheaper and better options available to firms (OECD 2021;

Rivares et al. 2019). E-commerce marketplaces, which connect buyers and sellers directly, are a particularly good example of these benefits, especially for MSMEs. E-commerce marketplaces, for instance, offer services such as credit card processing, storage facilities, and shipping that are especially helpful for smaller players (Wu and Gereffi 2019). Evidence shows that although smaller firms are less likely to have online sales, those that do sell online are more likely to use e-commerce marketplaces (Ladrière, Lundquist, and Yi 2020; OECD 2021) (Table 6.2).

Table 6.2: European Union Enterprises with Website or App Sales—Share of these Sales via E-Commerce Marketplaces (%)

Size (number of employed)	2017	2018	2019
Small enterprises (10–49)	40	42	41
Medium enterprises (50–249)	35	36	37
Average all enterprises	39	40	40

Note: For 28 countries in the European Union.
Source: Eurostat. https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do (accessed 20 May 2020).

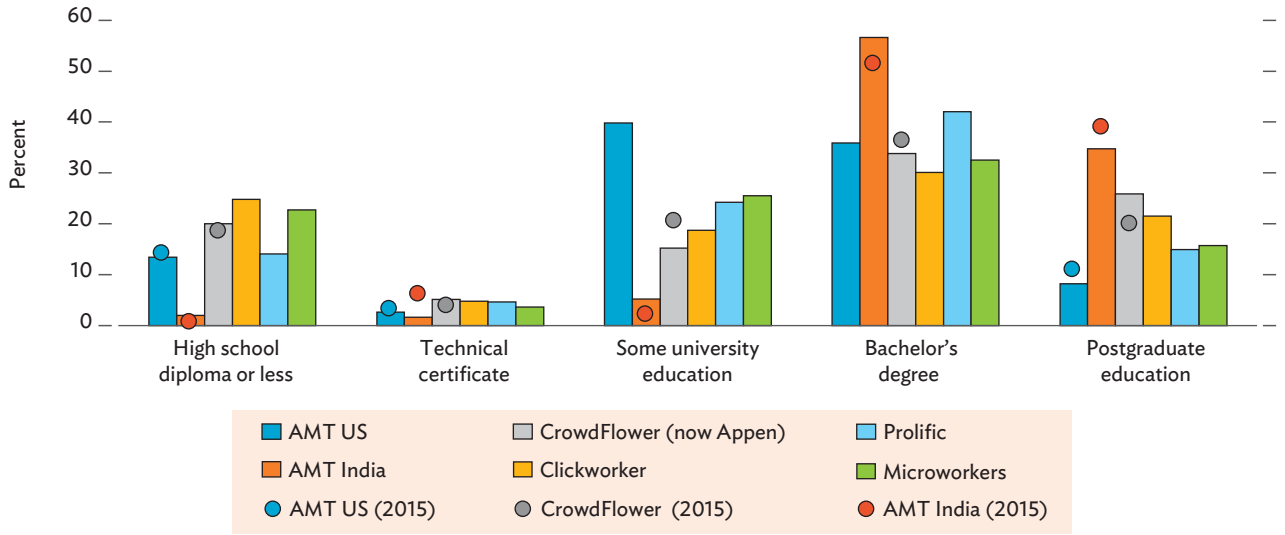
Many opportunities exist for MSMEs that can access digital platforms, including cost reductions to reach more and broader markets, which can promote economic development (Koskinen, Bonina, and Eaton 2019). Take the PRC's *Taobao* villages, defined by Alibaba Group Holding Ltd.'s research arm, AliResearch, as a village with more than CNY10 million in e-commerce sales annually or with at least 100 active online shops on Taobao, a PRC online shopping platform. These were essentially created by rural entrepreneurs and grew dramatically due to e-commerce. The success of these villages attracted more industries and businesses to them, increased average income, reduced the incentive to migrate, and improved the environment (ADB-ESCAP 2018).

Challenges of Digital Platforms

Digital platforms, despite their large number of benefits, can be challenging for MSMEs. Smaller firms can be constrained by a lack of training in new digital tools, which may prevent ICT from being used and so limiting their access to digital platforms (Martin and Vasilciuc 2011). Although digital platforms may provide complementary training modules, such as Amazon's e-book *The Beginner's Guide to Selling on Amazon*, firms may not be willing or able to devote time and resources for this (OECD 2021). Human capital constraints are also significant in the digital platform economy. For example, International Labour Organization surveys of crowdworkers in 2015 and 2017 find that more educated people are more likely to participate in digital contract work, such as the jobs posted on Amazon Mechanical Turk, Appen, and Clickworker (ILO 2018) (Figure 6.4). Digital platforms may also use algorithms that unfairly promote their own products or obscure smaller sellers (Khan 2017; OECD 2021). Even more fundamentally, digital platforms require a minimum level of internet connectivity and digital

infrastructure that no amount of technology leap-frogging can overcome. And as discussed later, the tendency for digital-platform consolidation can adversely affect smaller players with limited market power.

Figure 6.4: Educational Level of Crowdworkers by Platform



AMT = Amazon Mechanical Turk.
Source: International Labour Organization. 2018. *Digital Labor Platforms and the Future of Work*. Geneva.

An important challenge for digital platforms is their tendency for market consolidation, determined by the relative level of switching costs between digital platforms (Busch 2020). This is because the aggregation of users can be self-reinforcing, with network effects increasing as a platform gets new users that in turn encourages even more new users to join that platform, which weakens potential competition. This has implications for the productivity gains offered by digital platforms, which were found to be lower when a single platform is dominant in a given market (Rivares et al. 2019). E-commerce marketplaces are an example of digital-platform consolidation. Amazon Inc., among the most valuable publicly listed companies in the e-commerce marketplace, accounted for nearly 20% of the gross merchandise value of the top 13 business-to-consumer (B2C) e-commerce companies in 2019, and Alibaba Group Holding Ltd., JD.com Inc., and Pinduoduo Inc. accounted for more than 60% of the value of global B2C gross merchandise and 80% of the PRC's retail e-commerce (Ma 2021; UNCTAD 2021). These dominant market shares mean firms looking to sell on digital platforms are almost obliged to consider these e-commerce marketplaces—at the very least for the inherent network effects of these marketplaces, because if firms were to post their products elsewhere there would be far fewer potential "eyeballs" for their offerings.

Evans and Schmalensee (2007) find there are five factors that can either lead to, or discourage, the consolidation of digital platforms: network effects, scale economies,

congestion, platform differentiation, and multi-homing (where customers use more than one digital platform for similar purposes because they offer different features). The first two, network effects and scale economies, lead to more consolidation.[1] The last three, congestion, platform differentiation, and multi-homing, can reduce this type of consolidation (Evans 2011).

Digital platforms also have many direct and indirect costs for their use, including costs to join a platform and data-sharing requirements by platform users (OECD 2021). E-commerce marketplaces, for example, can be gatekeepers, especially to MSME participation, either through expensive membership fees, strict return and shipping policies, and rating systems that favor large companies.

Although digital platforms have many inherent benefits and can increase economic inclusivity, the potential, and even tendency, toward market consolidation is an important concern. Policymakers need to consider this, along with requirements for digital access and skills, and the potential direct and indirect costs of using a digital platform.

Global Value Chains

The phenomenal growth in GVC trade since the 1990s has been driven by falling trade barriers and lower transport costs. This rise is closely tied to ICT, which allows production to be partitioned while keeping communication among dispersed production segments intact (Rodrik 2018). The rise in GVC trade has promoted greater economic inclusion, resulting in Richard Baldwin's often-cited "Great Convergence" as the Group of Seven's share of world income began to decline in the 1990s and the manufacturing share of key industrializing economies increased (Baldwin 2016).

During this period, GVC participation also grew steadily, declining only during the global financial crisis of 2008–2009 (Figure 1.1). More recently, the GVC participation rate, as measured by the share of GVC exports to total exports, has levelled off and even begun to decline. This has been attributed to the slowdown in trade liberalization and a parallel decline in the rate of fragmentation of traditional GVC industries, such as machinery, electronics, and transportation, as they reached a new equilibrium with industrializing economies sourcing more domestically rather than cross-border (World Bank 2020).

Geographic differences in value-chain participation are present in regional versus global participation. Since 2000, North America has had the highest ratio of regional to global value-chain participation rates, although this has weakened slightly (Figure 6.5).

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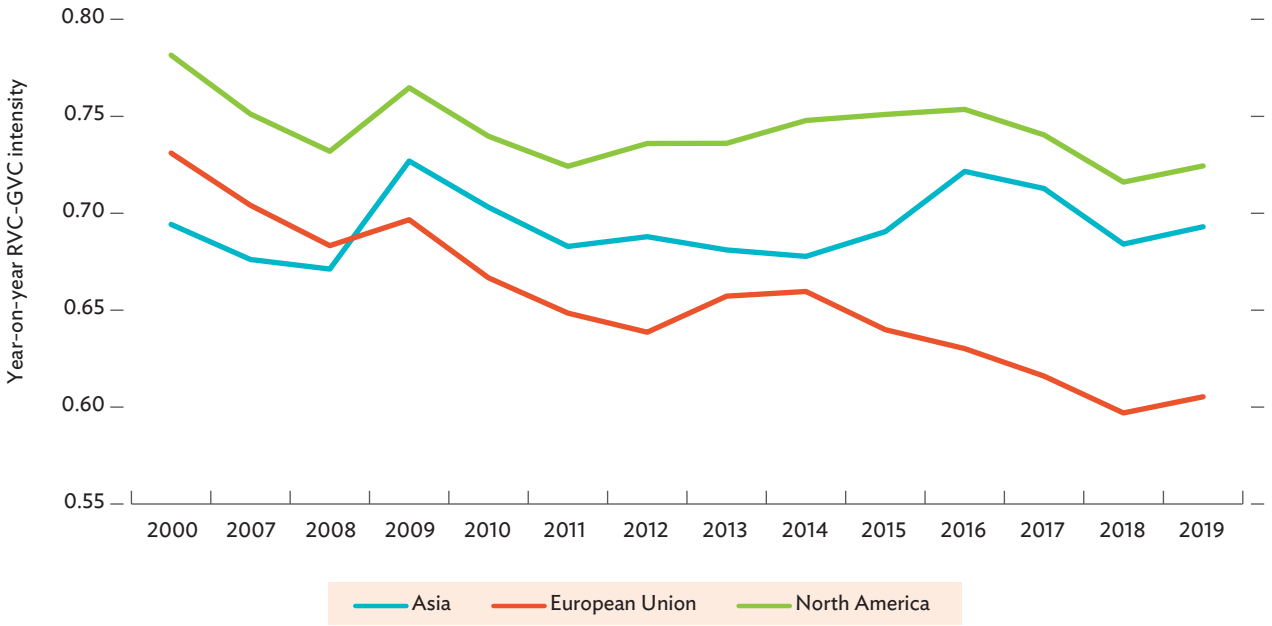
1 Here, digital platform users benefit from a larger pool of other users on the same platform, such as e-commerce marketplaces, or the digital platform itself has high fixed operating costs.

The European Union's regional value-chain intensity has declined considerably since 2000 as countries in the bloc sourced more globally. This can be seen in the sharp downward trend in the ratio of regional to global value chain participation rates. Asia's regional value-chain intensity has increased substantially since 2000 (ADB 2021).

Figure 6.5: Ratio of Regional and Global Value Chain Participation Rates in Asia, European Union, and North America, 2000–2019



EU = European Union, GVC = global value chain, RVC = regional value chain.
Note: RVC–GVC intensity is the ratio of RVC and GVC participation rates. North America comprises Canada, Mexico, and the United States.
Source: Figure 2.11 in Asian Development Bank. 2021. *Asian Economic Integration Report 2020/2021: Making Digital Platforms Work for Asia and the Pacific.* Manila.

Countries within regions also have different GVC participation levels and may be more prevalent at certain positions along GVCs. For example, Indonesia, Mexico, Poland, the PRC, the Republic of Korea, and Turkey participate in downstream manufacturing. Australia and Brazil are among countries that provide upstream commodities. And India is still focused on the services sector (Kang, Bacate, and Ramizo 2020; World Bank 2020). Overall, three GVC hubs have emerged—Germany, the PRC, and the US—one in each of the three main regions examined (Ferrantino and Taglioni 2014).

Global Value Chains and Micro, Small, and Medium-Sized Enterprises

Although a large part of the GVC story can be told in terms of multinational corporations, these chains have created new opportunities for MSME suppliers. One of the ways that GVCs have been able to bring in players from developing countries is by fragmenting

the production process into different, self-contained parts that require different skills and abilities. This fragmentation, or modularization, which has only been possible with advances in communication technology, allows for entrants with capacities in only part of the production of a finished product to join a value chain (Fort 2017). This can also help MSMEs whose businesses focus on only one specialized input of a larger product.

GVCs use services much more than other forms of international trade. Although an estimated one-fifth of gross exports globally are services, nearly half (46%) of value-added inputs within exports come from services (UNCTAD 2013). This has important implications for increasing the participation of MSMEs in GVCs since exporting MSMEs are more prevalent in services sectors (Cusolito, Safadi, and Taglioni 2016).

Although GVCs have many potential benefits, including increasing the competitiveness and innovation of participating firms, they have asymmetries that can work against MSMEs (Das and Hussain 2017). To begin with, the number of lead firms is limited and they are mostly in developed countries. This can mean that opportunities for suppliers are very competitive and lead firms make the terms, leaving smaller suppliers with the choice of either accepting these terms or not participating (Sturgeon 2009). The types of activities that lead firms outsource, especially to developing countries, often generate lower revenue than those performed in other regions, particularly for manufacturing, and the employment and profit associated with these activities can significantly differ (Gereffi and Frederick 2010). Suppliers, especially MSMEs or firms in developing countries, may be locked into lower-revenue industries either because of poor access to resources, including skills and infrastructure, or because of the governance structure of the value chain itself (Antràs 2020; Das and Hussain 2017). This is discussed in more detail later in the chapter. Because of the prominent role that multinational corporations play in promoting GVC networks through their market-seeking or efficiency-seeking foreign investments, the absorptive capacity of host countries in nurturing networks of local suppliers with foreign-invested enterprises becomes crucial.

Although MSMEs and participants from developing counties face hurdles for participating in GVCs, considerable GVC openness still exists. However, the extent of that openness depends on GVC governance structures (Kano, Tsang, and Yeung 2020). Gereffi, Humphrey, and Sturgeon (2005) categorize value-chain governance—that is, who participates in a chain and what their role is—into five main groups, which are important in the consideration of digital platforms. The first group are market value chains, or market linkages, where two parties interact with each other regularly, but without formal contracts. As a result, switching from one supplier to another is easily done. The second group includes modular value chains where buyers request custom inputs from a seller. It is, however, possible to make these inputs on standard machinery available to other providers and therefore suppliers have only limited market power. The third group includes relational value chains that are highly integrated. Here, two parties may be dependent on one another and the relationship can be long lasting. The fourth group contains captive value chains in which smaller suppliers depend

on larger buyers. They face significant hurdles or costs to switch, however. The fifth group is hierarchical, with vertically integrated GVCs and top-down management from headquarters to subsidiaries. Each of these five governance structures holds both opportunities and barriers for more inclusion. Modular value chains, for example, open opportunities for MSMEs to enter GVCs, but upgrading or differentiating a product can be challenging for these firms, and the value added from modular value chains can be low because of asymmetries and the bargaining power of lead firms (Antràs 2019).

Digital Platforms, International Trade, and Global Value Chains

Digital platforms are reshaping economies by enabling new international transactions and playing an increasing role in trade (OECD 2021). This can be seen in the increased number of small commercial packages crossing international borders (facilitated by digital platforms either directly as e-commerce marketplace transactions or via other online commerce) and services exports by contractors through labor platforms, such as Amazon Mechanical Turk or Clickworker, that enable anyone who is digitally connected around the world to perform requested virtual tasks (OECD 2020). The digital economy and digital platforms are making it easier for new entrants to trade via a substantial reduction in search and communication costs, and the development of e-payment systems allows for easier and more secure money transfers (ADB 2021). Digital platforms can also be exported, with Google and other familiar search engines available across borders or online store platforms, such as Shopify, available to businesses in many countries. Cross-border B2C e-commerce totaled an estimated $440 billion in 2019, up 9% from 2018 (UNCTAD 2021).

These cross-border trade effects can be realized by firms of all sizes, including MSMEs, and have implications for developing countries. Although MSMEs are still less likely to trade internationally, digital platforms can help them enter international markets (Jin and Hurd 2018). And MSMEs that use digital platforms, especially e-commerce marketplaces with their many built-in services, are more likely to export (ICC 2016; OECD 2021). The e-commerce marketplace companies themselves have also published research on ways their tools facilitate exports, especially for MSMEs. Amazon reported $3.1 billion in US export sales for 2019 specifically by MSMEs, up nearly 30% from 2018 (Amazon 2020). Digital platforms often start as small businesses and may continue as relatively small operations given the well-known “scale without mass” effect of digital businesses (Brynjolfsson et al. 2008).

The digital economy has undoubtedly expanded trade opportunities, but how has it affected GVCs? E-commerce is primarily conducted between businesses, executed sometimes through digital platforms, such as e-commerce marketplaces and direct purchases through business websites, or by other means, such as electronic data interchange and the digital platform technologies behind them. B2B e-commerce is estimated to make up about 90% of global e-commerce (Ferrantino and Koten 2019).

Unfortunately, statistics on cross-border e-commerce are scarce, especially for B2B transactions (UNCTAD 2016). But given the substantial share of B2B e-commerce, which is undoubtedly related to value-chain transactions, it can be surmised that at least some share of this is cross-border and therefore part of GVCs if broadly defined.

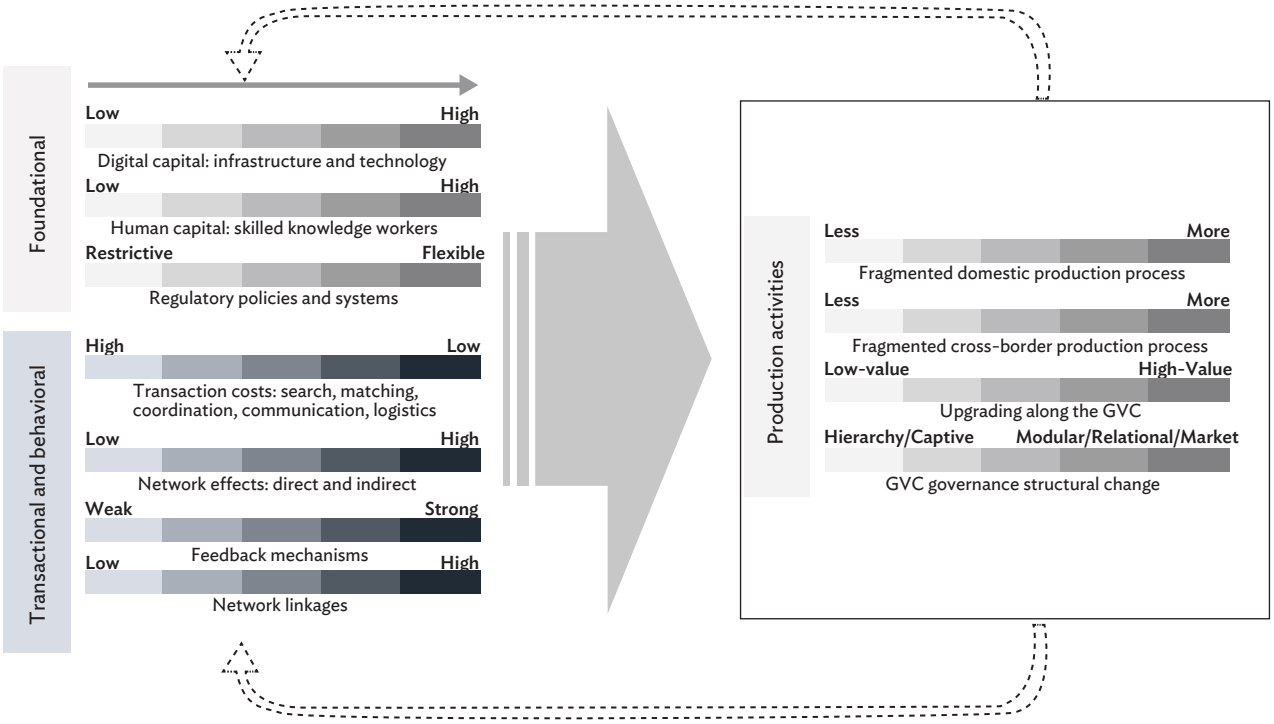
Despite the measurement challenges, research shows a link between trade facilitated by digital platforms, especially for e-commerce marketplaces, and GVCs. On a surface level, Ladrière, Lundquist, and Yi (2020) find that about one-third of e-commerce marketplace listings are intermediate inputs for downstream production, some share of which may cross borders as trade. Kang, Bacate, and Ramizo (2020), using Euromonitor International's dataset on B2C online commerce sales, find statistically significant effects for the impact of both internet and mobile internet retail sales on GVC exports within an economy. Similarly, Baldwin, Chiarotti, and Taglioni (forthcoming) link the entrance of an e-commerce marketplace in an economy with an increase in GVC trade. Some new value chains have also developed in tandem with these e-commerce transactions; these are "infomediary" value chains related to the data generated from a transaction conducted over a digital platform (Kang, Bacate, and Ramizo 2020). Data collected about a user, whether for accessing a website to view, say, a research paper or someone's shopping habits in an online store, allow firms to generate new value from the data either by selling it to other firms or using it for their own marketing.

Two readiness pillars need to be in place for digital platforms to enable firms, especially MSMEs, to participate in GVCs. The first pillar, foundational readiness, is the structural basis that needs to be present in an economy, such as physical infrastructure for internet access, human capital or know-how within the population, and national regulations that enable e-commerce transactions. The second pillar, transactional and behavioral readiness, focuses on the digital platforms themselves and whether they enable more market transactions by reducing search and coordination costs, leveraging and capitalizing on network effects, and using effective feedback mechanisms to enhance transactions (Kang, Bacate, and Ramizo 2020) (Figure 6.6). Once these two pillars are in place, GVC participation will be determined by level of fragmentation, with more fragmented value chains creating more opportunities for external parties, such as MSMEs and developing country participants. This last point on governance structure and the way digital platforms enable GVC participation has implications for the benefits of digital platform economies and innovation within GVCs.

Importantly, when it comes to e-commerce marketplaces and certain other types of GVC trade facilitated by digital platforms, the governance structure tends to be less hierarchical or captive, even less relational, and more modular or market-oriented (Ding and Hioki 2018). This has three main implications, especially for MSMEs and developing countries. First, the modular architecture of digital platforms themselves can contribute to innovation within firms and GVCs and help bring participants from developing countries into GVCs by allowing technologically constrained players to enter into a less demanding part of the value chain (Gawer 2014). Second, just as for MSMEs, an already

developed digital platform enables participants to skip investing their own resources to create something similar from the ground up (OECD 2021). And third, platforms can reduce coordination costs between different players—for example, by using standard software, such as Microsoft Office Suite that can be used for both communication and other business functions that are easily transferable.

Figure 6.6: Mechanisms through Which Digital Platform Economies Enable Firms to Engage in Global Value Chains



GVC = global value chain.
Source: J. W. Kang, M. L. Bacate, and D. Ramizo. 2020. *Digital Platforms and Global Value Chains.* Unpublished. Asian Development Bank.

For developing countries, these benefits are, however, contingent on a type of GVC governance that is platform-driven and on whether that governance requires direct integration and cooperation by firms within a GVC. Here, relational GVCs are characterized by close connections between firms and the intra-firm trade of intangible goods, such as production technology and business practices that can lead to upgrading by participating firms through learning and innovation (Gereffi, Humphrey, and Sturgeon 2005). Because these governance structures are primarily modular or market-based, some trade facilitated by digital platforms will fall into the broader definition of trade in intermediate inputs without the additional exchange of intangible value-added that accompanies relational GVC trade that can be so valuable for MSMEs and businesses in developing countries (Antràs 2020). Goods sold on e-commerce marketplaces are self-contained and interchangeable. At an even more basic level, many e-commerce marketplace transactions are one-off interactions with no expectation

of future purchases or commitments. In other words, if firms are only producing finished products, information exchange between industries is scant and the exchange of intangible value is decreased (Kang, Bacate, and Ramizo 2020). Unfortunately, buyer-driven GVCs, such as those facilitated by e-commerce marketplaces, do not necessarily want to share proprietary information with their developing country and MSME partners (Schmitz and Knorringa 2000; Bazan and Navas-Aleman 2004; Morrison, Pietrobelli, and Rabellotti 2008). High competition based on low costs and large volume for certain modular inputs could also limit mutual learning (Brandt and Thun 2011; Yasumoto and Shiu 2007). This contributed to the idea that digital platforms may actually be substituting for traditional GVCs on some level; for example, through their information-sharing capabilities and verification technologies that might make the contracted relationships of formal GVCs less necessary—and so contributing to the declining rate of GVC participation (van Alstyne, Parker, and Choudary 2016).

Digital technologies have also created a whole new GVC governance structure—internet-driven GVCs—that bring in the digital platform itself as an intermediary actor along with sellers or providers (supply side) and buyers or clients (demand side) (Gereffi 2001a and 2001b; ADB 2021). Internet-driven GVCs are diminishing the importance of physical stores and retailers, a trend that has been magnified by the COVID-19 pandemic. Internet-driven value chains have also added important new dimensions, including the two-sided market where customers can directly contribute their feedback to sellers or manufacturers, thereby influencing future product development and output (Evans 2011). This has significant implications for the labor-market space. Internet-based virtual intermediaries replacing physical intermediaries, such as brick and mortar stores, the displacement of clerks, and other face-to-face service providers, is accelerating—and entailing a remarkable shift within the spectrum of demand for services jobs. Internet-based virtual intermediaries have developed whole new value chains, such as the data-driven value chain for the generation, processing, and sale of data products (Curry et al. 2014).

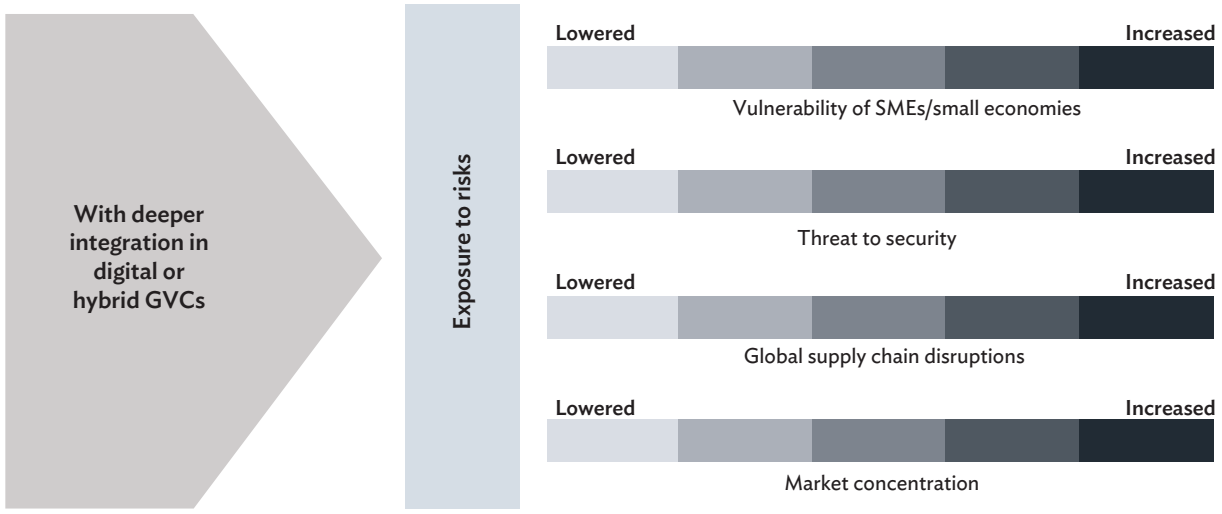
Challenges for Inclusion and Policymaker Considerations

Although digital or hybrid GVCs present many opportunities for inclusiveness, especially given their modular architecture, they also pose increased risks, as illustrated in Figure 6.7. These include increased threats posed by cyberattacks, a greater risk of global supply chain disruptions, and less market power when using monopolistic digital platforms because of consolidation (Kang, Bacate, and Ramizo 2020). “Winner-take-all” or “winner-take-most” scenarios for digital platforms also raise concerns for the inclusive participation in GVCs by MSMEs and firms in developing countries, although this is not a foregone conclusion (Evans 2011; OECD 2020).

For the digital economy more generally, policymakers face issues that need tackling to make access and use more inclusive. Besides access to digital infrastructure and improved connectivity, ADB (2021) highlights the need to lower barriers to entry and

promote interoperability across digital platforms to increase competition and reduce market consolidation. Policymakers need to consider the market power that arises from digital platforms, including the private data these platforms collect and the special case of integrated platforms, such as Amazon, that not only facilitate sales but also sell the firm's own products (ADB 2021; Faherty, Huang, and Land 2017). Government scrutiny is expected to become stronger because of the rapidly growing market shares of mega-platform firms and the potential anticompetitive influences from their gatekeeping advantage. Data access, privacy, and security are also important for data value chains. Ensuring that data are securely available for use and for the generators to have portable access to their own information is important for innovation and competition (Tucker 2019). Related to policymaker considerations for bringing digital platforms to an economy, an important finding in Kang, Bacate, and Ramizo (2020) is the need for secure servers and access to formal banking. Both of these variables have positive and significant effects on B2C online sales.

Figure 6.7: Risks Created from Digital Platforms



GVC = global value chain, SMEs = small and medium-sized enterprises.
Source: J. W. Kang, M. L. Bacate, and D. Ramizo. 2020. *Digital Platforms and Global Value Chains.* Unpublished. Asian Development Bank.

Because of the growing cross-border presence of commercial platforms, international tax cooperation is gaining considerable attention. The Inclusive Framework on Base Erosion and Profit Shifting, led by the Organisation for Economic Co-operation and Development, proposes the creation of a new right to taxation that is independent from physical presence (pillar 1) and a global minimum corporate tax (pillar 2). Both are expected to help resolve the controversy over fair taxation of digital services across borders. Although this initiative could lead to some reallocation in corporate income tax revenue among sovereign authorities, it may not act as a disincentive for digital platforms to curtail their global businesses.

Digital platforms can increase competition within markets and help lower prices by reducing search costs and enhancing efficiency gains in supply chain management and sourcing and outsourcing engagements. But these platforms can also pose anticompetitive challenges due to the advantages for incumbents stemming from economies of scale and scope, and due to their exclusive access to sources and information. Increasing the market power of digital platforms is likely to prompt growing attention in the sphere of competition policies (ADB-ESCAP 2018).

Increasing calls for regulatory vigilance notwithstanding, striking the right balance between anti-trade regulations and fostering scale economies driven by market innovation, and between regulations on data flows for privacy and security purposes and facilitating freer data transmissions for business efficiency, remains a challenge for policymakers.

Conclusions

Digital platforms and the new digital economy are inherently connected with GVCs. These new evolutions are also providing opportunities for MSMEs and firms from developing countries to participate in GVCs by allowing them to get around obstacles, such as poor access to information and segmented capabilities, that previously prevented them from joining (Antràs 2020). E-commerce marketplaces and similar platforms can help reduce fixed transaction costs, such as finding products or customers, facilitating payments, and reducing information asymmetries. But although digital platforms can make GVC participation accessible for more players, poor infrastructure and limited digital capacities still leave many excluded.

The digital platform economy also poses regulatory challenges. For one, unnecessary consolidation among digital platforms needs to be avoided given the importance of competition between digital platforms to provide more equitable access to users and lower barriers to entry. An increasing concern besides the potential gatekeeper effects posed by monopolistic digital platforms is the amount of user data and information collected by them that potentially "lock in" buyers and sellers, which feeds into the lack of competition (Antràs 2020). Price discrimination enabled by effective advertising and product customization by utilizing user data can also reduce consumer surplus.

There is a strong need to ensure access to ICT infrastructure and upgrade education to bring all players into the digital platform economy (ADB 2021). Kang, Bacate, and Ramizo (2020) note the importance of financial readiness, including access to digital payment systems, consumer protection, and secure servers. Good governance in general is needed to bring in and foster the types of businesses that will lead to GVC upgrading and high-value segments in supply chains.

Just as the emergence of digital platforms disrupted the international economy, new technologies on the horizon signal future changes. Antràs (2020) posits that digital ledger technology will have a significant effect on GVCs, making tracking and tracing easier and allowing for better verification. Other scholars, including Strange and Zucchella (2017), note the new digital economy is still developing. Rehnberg and Ponte (2016) note the Internet of Things and 3D printing have considerable potential to change GVCs and their players. And the COVID-19 pandemic has both expanded e-commerce and underscored the fragility of some supply chains. This has revealed the need for diversity to accelerate resilience, which may prompt the reconfiguration of the GVC landscape, including near-shoring, regionalization, and reshoring. The role of digital platforms due to their inherent interplay with sourcing, production, marketing, distribution, and service networks will likely continue to be crucial for shaping GVCs in the future.

The potential for new technologies and the continuing trend of changing GVC participation and participants means there is ample room for further research. More study is needed on whether the nonrelational governance of GVC transactions fostered by some digital platforms carries equal benefits to other relational GVCs since these transactions lack trade in intangibles, like intellectual property transfer and know-how. GVCs and digital platforms have undoubtedly brought more players into the international economy, but better data and further investigation are needed to understand the role these platforms have for MSMEs and international trade.

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APPENDIX

First Workshop and Chapter Authors' Workshop for the Global Value Chain Development Report 2021

First Authors' Workshop for the Global Value Chain Development Report 2021

8–9 October 2020, ZOOM Conference

ADB | UIBE 1951 | World Trade Organization | IDE-JETRO | CDRF 中国发展研究基金会 China Development Research Foundation

Day One

8 October 2020, Thursday, 9:30 Philippine Standard Time

Opening Remarks

Chairperson: **Elisabetta Gentile**, Asian Development Bank and Global Labor Organization

9:30–9:40	**Yasuyuki Sawada**, Asian Development Bank
9:40–9:45	**Yuqing Xing**, National Graduate Institute for Policy Studies and University of International Business and Economics

Session 1: Measuring GVC Participation/Contribution Beyond Production

Chairperson: **Elisabetta Gentile**, Asian Development Bank and Global Labor Organization

9:45–10:15	Mahinthan Joseph Mariasingham, Angelo Jose Lumba, Krizia Ann Garay, Kristina Baris, Patricia Georgina Gonzales, and **Kenneth S. Reyes**, Asian Development Bank *Measuring Global Value Chains: Beyond Production* Discussant: **Zhi Wang**, University of International Business and Economics Q&A
10:15–10:45	**Bo Meng**, Institute of Developing Economies, Japan External Trade Organization; Yuning Gao, Tsinghua University; Jiabai Ye, Hunan University; Meichen Zhang, Tsinghua University *Trade in Value-Added vs. Trade in Income* Discussant: **Mahinthan Joseph Mariasingham**, Asian Development Bank Q&A
10:45–11:15	Bo Meng, Institute of Developing Economies, Japan External Trade Organization; **Yuning Gao**, Tsinghua University; Jiabai Ye, Hunan University

Network Topology and Comparative Advantage in GVCs: Multinationals vs Domestic Firms

Discussant: **Matthias Helble**, Asian Development Bank
Q&A

11:15–11:30 Coffee Break

Session 2: Beyond Production: The Role of Brand, Technology, and Retail Networks

Chairperson: **Bo Meng**, Institute of Developing Economies, Japan External Trade Organization

11:30–12:00 Zhi Wang and **Kunfu Zhu**, University of International Business and Economics

Multinational Enterprises and Value-Added Trade in Global Value Chains

Discussant: **Ming Ye**, Nanjing University
Q&A

12:00–12:30 Bo Meng, Institute of Developing Economies, Japan External Trade Organization; **Ming Ye**, Nanjing University

Smile Curves in Global Value Chains: Multinationals vs Domestic Firms

Discussant: **Wei Xiang**, Yale University
Q&A

12:30–13:00 Valerie Mercer-Blackman, World Bank; **Wei Xiang**, Yale University; Fahad Khan, Asian Development Bank

Understanding FDI Spillovers in the Presence of Global Value Chains

Discussant: **Jules Hugot**, Asian Development Bank
Q&A

13:00–14:30 Lunch Break

14:30–15:00 **Masahiro Kuroda**, National Graduate Institute for Policy Studies

Evaluation of Knowledge Stocks of R&D Expenditures as Intangible Assets on Static/Dynamic TFP Measures by Input–Output Framework

Discussant: **Donald Jay Bertulfo**, Asian Development Bank
Q&A

15:00–15:30	**Keiko Ito**, Chuo University *The Changing Structure of Global Value Chains and Technological Change: Evidence from Japanese Firm-Level Patent Data* Discussant: **Zhongzhong Hu**, University of International Business and Economics Q&A
15:30–16:00	Coffee Break

Session 3: GVCs Beyond Production: Implications for Advanced Economies

Chairperson: **Victor Stolzenburg**, World Trade Organization

16:00–16:30	Roberta Piermartini and **Stela Rubínová**, World Trade Organization *Knowledge Spillovers through International Supply Chains* Discussant: **Fahad Khan**, Asian Development Bank Q&A
16:30–17:00	**Yuqing Xing**, National Graduate Institute for Policy Studies and University of International Business and Economics *Factoryless Manufactures and International Trade in the Age of GVCs* Discussant: **Stela Rubínová**, World Trade Organization Q&A
17:00–17:30	**Katharina Längle**, World Trade Organization; Ruijie Tian, University of Gothenburg; Ankai Xu, World Trade Organization *The Weakest Link: Assessing the Supply Chain Effect of Natural Disasters* Discussant: **Shantong Li**, Development Research Center of the State Council Q&A

----------End of Day One----------

Day Two

9 October 2020, Friday, 9:00 Philippine Standard Time

Session 4: Coping with the Risks of GVC Participation

Chairperson: **Zhi Wang**, University of International Business and Economics

9:00–9:30	**Marie-France Paquet**, **David Boileau**, and Aaron Sydor, Global Affairs Canada *Vulnerability of Canadian Industries to Disruptions in Global Supply Chains* Discussant: **Valerie Mercer-Blackman**, World Bank Q&A
9:30–10:00	**Etel Solingen**, University of California, Irvine; Satoshi Inomata, Institute of Developing Economies, Japan External Trade Organization *GVC Interdependence and Geopolitics: What Is at Risk?* Discussant: **Yuqing Xing**, National Graduate Institute for Policy Studies and University of International Business and Economics Q&A
10:00–10:30	**Shantong Li** and Jianwu He, Development Research Center of the State Council *Regional Impacts of PRC-US Trade Conflicts in the PRC* Discussant: **Jiwei Qian**, National University of Singapore Q&A

Session 5: GVCs of Service Industries: Opportunity for Developing Countries

Chairperson: **Shantong Li**, Development Research Center of the State Council

10:30–11:00	Yuqing Xing, National Graduate Institute for Policy Studies and University of International Business and Economics; **Shaopeng Huang**, University of International Business and Economics *Value Captured by the PRC in the Smartphone GVC: A Tale of Three Smartphone Handsets* Discussant: **Elisabetta Gentile**, Asian Development Bank and Global Labor Organization Q&A

11:00–11:15	Coffee Break
11:15–11:45	Yuning Gao and **Meng Li**, Tsinghua University; Bo Meng, Institute of Developing Economies, Japan External Trade Organization *Understanding the Routes and Determinants of the Creation, Absorption, and Transfer of Job Opportunities in Global Value Chains* Discussant: **Yothin Jinjarak**, Asian Development Bank Q&A
11:45–12:15	**Laura B. Fermo**, Bangko Sentral ng Pilipinas; Yuqing Xing, National Graduate Institute for Policy Studies and University of International Business and Economics *Plugging into Global Value Chains of the Services Industry: The Experiences of the Philippines* Discussant: **Jiantuo Yu**, China Development Research Foundation Q&A
12:15–12:45	Shaopeng Huang, University of International Business and Economics; **Jai Asundi**, Center for Study of Science, Technology, and Policy; Yuqing Xing, National Graduate Institute for Policy Studies and University of International Business and Economics *Plugging into Global Value Chains of the Software Service Industry: The Experiences of India* Discussant: **Yuning Gao**, Tsinghua University Q&A
12:45–14:00	Lunch Break
14:00–14:30	**Jiantuo Yu** and Lu Wang, China Development Research Foundation *AI and Restructuring the Call Center Service Industry: A Global Value Chain Perspective* Discussant: **Laura B. Fermo**, Bangko Sentral ng Pilipinas Q&A
14:30–15:00	**Ben Shepherd**, Developing Trade Consultants; Matthias Helble, Asian Development Bank *GVC Trade Growth and Development: Evidence from CPTPP and RCEP*

Discussant: **Ashish Narain**, Asian Development Bank
Q&A

15:00–15:30 Coffee Break

15:30–16:00 Enrico Nano, Stela Rubínová, and **Victor Stolzenburg**, World Trade Organization

The Impact of Services Exports on Developing Country Labor Markets: Evidence from India

Discussant: **Jai Asundi**, Center for Study of Science, Technology, and Policy
Q&A

Session 6: Platform Revolution and Innovation along GVCs

Chairperson: **Nadim Ahmad**, Organisation for Economic Co-operation and Development

16:00–16:30 **Wenyin Cheng**, Tsinghua University; Bo Meng, Institute of Developing Economies, Japan External Trade Organization; Yuning Gao, Tsinghua University

The PRC's Innovation Boom: Miracle or Mirage?

Discussant: **Shaopeng Huang**, University of International Business and Economics
Q&A

16:30–17:00 **Elisabetta Gentile**, Asian Development Bank and Global Labor Organization; Gaaitzen de Vries, University of Groningen

What Is Driving Income Convergence among Developing Countries in Asia?

Discussant: **Victor Stolzenburg**, World Trade Organization
Q&A

17:00–17:30 **Hongsheng Zhang**, Zhejiang University; Bo Meng, Institute of Developing Economies, Japan External Trade Organization; Robert Koopman, World Trade Organization

Digital Technologies and Global Value Chains

Discussant: **Kathryn Lundquist**, World Trade Organization
Q&A

17:30–18:00	**Kathryn Lundquist**, Qing Ye, and Maxime Ladrière, World Trade Organization *B2B E-Commerce Marketplaces and Micro, Small, and Medium-Sized Enterprises: Evidence of GVC Facilitation?* Discussant: **Hongsheng Zhang**, Zhejiang University Q&A
18:00–18:30	**Jong Woo Kang**, Marife Lou Bacate, and Dorothea Ramizo, Asian Development Bank *Digital Platforms and Global Value Chains* Discussant: **Jiwei Qian**, National University of Singapore Q&A

Closing Remarks

Chairperson: **Yuqing Xing**, National Graduate Institute for Policy Studies and University of International Business and Economics

18:30–18:45	**Robert Koopman**, World Trade Organization
18:45–19:00	**David Dollar**, Brookings Institution

Chapter Authors' Workshop for the Global Value Chain Development Report 2021

26–28 May 2021, ZOOM Conference

Day One

26 May 2021, Wednesday, 20:00 Philippine Standard Time

Chapter 4: The Role of Global Services Value Chains in Services-Led Development

Moderator: **Elisabetta Gentile**, Asian Development Bank and Global Labor Organization

20:00–20:45	Presenter: **Enrico Nano**, World Trade Organization
20:45–21:00	Discussant: **Ben Shepherd**, Developing Trade Consultants
21:00–21:15	Discussant: **Mohammed Faiz Bin Shaul Hamid**, Islamic Development Bank
21:15–21:30	Q&A
21:30–21:45	Coffee Break

Chapter 5: Coping with Risks

Moderator: **Yuqing Xing**, National Graduate Institute for Policy Studies and University of International Business and Economics

21:45–22:30	Presenter: **Etel Solingen**, University of California, Irvine
22:30–22:45	Discussant: **Robert Koopman**, World Trade Organization
22:45–23:00	Discussant: **Yasuyuki Sawada**, Asian Development Bank
23:00–23:15	Q&A

----------End of Day One----------

Day Two

27 May 2021, Thursday, 20:00 Philippine Standard Time

Chapter 3: Productivity Growth, Innovation, and Upgrading along Global Value Chains

Moderator: **Mustafa Yagci**, Islamic Development Bank

20:00–20:45	Presenter: **Elisabetta Gentile**, Asian Development Bank and Global Labor Organization
20:45–21:00	Discussant: **Neil Foster-McGregor**, United Nations University, Maastricht Economic and Social Research Institute on Innovation and Technology
21:00–21:15	Discussant: **Roberta Piermartini**, World Trade Organization
21:15–21:30	Q&A
21:30–21:45	Coffee Break

Chapter 1: Recent Trends in Global Value Chains

Moderator: **Bo Meng**, Institute of Developing Economies, Japan External Trade Organization

21:45–22:30	Presenter: **Kenneth S. Reyes**, Asian Development Bank
22:30–22:45	Discussant: **Zhi Wang**, University of International Business and Economics
22:45–23:00	Discussant: **Satoshi Inomata**, Institute of Developing Economies, Japan External Trade Organization
23:00–23:15	Q&A

----------End of Day Two----------

Day Three

28 May 2021, Friday, 20:00 Philippine Standard Time

Chapter 2: Trade in Intangible Assets along Global Value Chains and Intellectual Property Protection

Moderator: **Victor Stolzenburg**, World Trade Organization

20:00–20:45	Presenter: **Yuqing Xing**, National Graduate Institute for Policy Studies and University of International Business and Economics
20:45–21:00	Discussant: **Xiaolan Fu**, University of Oxford
21:00–21:15	Discussant: **Sébastien Miroudot**, Organisation for Economic Co-operation and Development
21:15–21:30	Q&A
21:30–21:45	Coffee Break

Chapter 6: The Digital Platform Revolution and Global Value Chains

Moderator: **Jiantuo Yu**, China Development Research Foundation

21:45–22:30	Presenter: **Kathryn Lundquist**, World Trade Organization
22:30–22:45	Discussant: **Daria Taglioni**, World Bank
22:45–23:00	Discussant: **Joonkoo Lee**, Hanyang University
23:00–23:15	Q&A

----------End of Workshop----------

Global Value Chain Development Report 2021
Beyond Production

A radical shift is underway in global value chains as they increasingly move beyond traditional manufacturing processes to services and other intangible assets. Digitization is a leading factor in this transformation, which is being accelerated by the coronavirus disease (COVID-19) pandemic. The *Global Value Chain Development Report 2021*, the third of a biennial series, explores this shift Beyond Production. This report shows how the rise of services value chains offers a new path to development and how protectionism and geopolitical tensions, environmental risks, and pandemics are undermining the stability of global value chains and forcing their reorganization geographically.

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