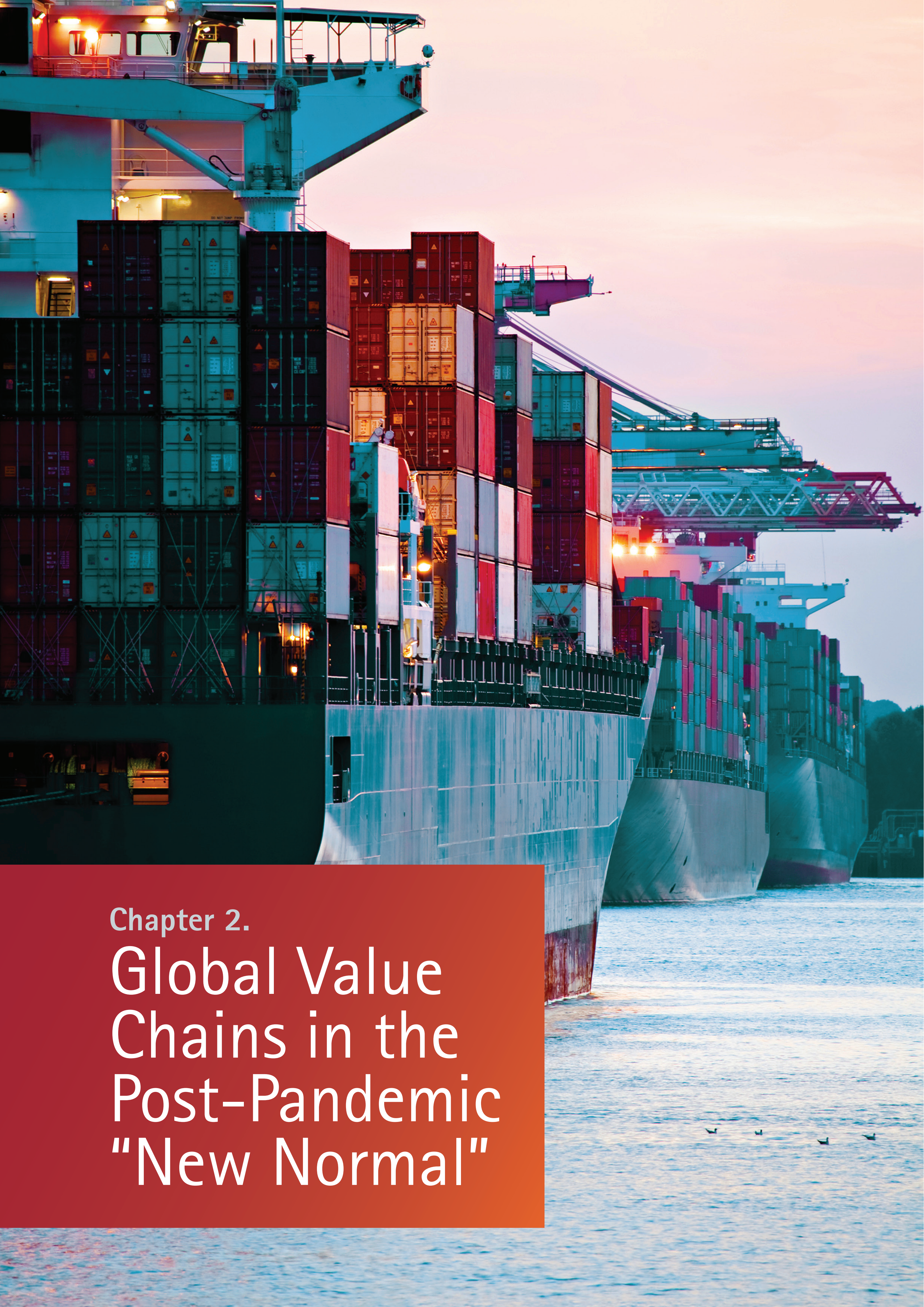

Chapter 2.

Global Value Chains in the Post-Pandemic "New Normal"

Highlights

- Natural disasters, trade tensions, and the COVID-19 pandemic have spurred greater emphasis on supply chain resilience. This trend has raised concerns that globalization is in retreat and global value chains (GVCs) would be reconfigured. Although some cross-border relocation movements have been observed globally, no evidence has as yet emerged of wholesale GVC restructuring or transfer away from China and from the ASEAN+3 region.

- Multinational enterprises (MNEs) are critical to a potential GVC reconfiguration, especially their decisions as to (re)organizing their network of suppliers. MNEs' relationships with their suppliers, the costs of switching location and partners, as well as other economic factors—including labor costs, soft and hard infrastructures, domestic market growth, and government incentives—influence their decision to locate in specific regions: to stay, or transfer to other locations.

- The ASEAN+3 region remains a highly attractive location for MNEs, given its rapidly growing middle-class consumers and dynamic growth prospects. Attractive labor costs aside, the region also fares relatively well in terms of infrastructure quality, skilled labor availability, and technological absorption, when compared to alternative locations such as in Africa, Latin America, or Eastern Europe.

- GVC reconfiguration, if it emerges, is likely to occur in particular stages of the global supply chain. In particular, stages that are labor-intensive or cost-sensitive and do not require highly technical skills, such as assembly operations, are more likely to be moved. Factories that have neither large exit costs nor require tacit knowledge exchange are also strong candidates for relocation if downside risks escalate.

- The pandemic accelerated the “flight to digital” for businesses and consumers, and this behavior is unlikely to be reversed in the future. The outlook for digital consumption thus remains highly positive, including in the ASEAN+3 region. But full deployment of new technologies will require the region to develop and install the necessary hard and soft infrastructures, especially for information and communication technology (ICT).

- Technology bifurcation could result from the ongoing tech competition between China and the United States, although history also shows that such bifurcation is likely to be resolved by interface technology over time. Advances in technology—and its adoption—can also be stymied by other challenging hurdles, such as data regulations and transfer restrictions, security issues, and geopolitics.

- The quality of institutions, human capital, and infrastructure will continue to remain relevant for the ASEAN+3 to attract future GVC investments. Nonetheless, in the post-pandemic world, the region should focus on (1) building infrastructures geared toward the Fourth Industrial Revolution (4IR); (2) developing stronger crisis management within their policy response frameworks; and (3) securing sustainable funding, considering the region’s weaker fiscal positions now compared to its pre-pandemic conditions.

I. Global Value Chains in the Post-COVID-19 Environment: A New Trade Paradigm

COVID-19 has spurred a wave of globalization obituaries. Some have argued that post-pandemic, life, instead of returning to the old normal, will herald a global economic and trade reset. In particular, global value chains (GVCs), which have become the backbone of world trade, may be on course for a major reconfiguration. While some changes in trade patterns are afoot, the magnitude of the shift is still uncertain. How much of GVCs will be reconfigured? What will be the impact on current GVCs, especially in the ASEAN+3 region, from the greater emphasis on supply chain resilience rather than cost and efficiency?

US–China tensions have compounded the impact of the pandemic on the global economy. Although economic competition is healthy, manufacturing nationalism, spawned by the tensions between the United States and China, has lent further support to the argument for a major reconfiguration of GVCs. Indeed, there is concern that the US–China technology rivalry could lead to a technology bifurcation with far worse ramifications than the tariff escalation. Technology is an important enabler of global supply chains; it is also deeply embedded in many goods and services. Thanks to technology, the world has shrunk as distances have collapsed with the ease of transportation, travel, and telecommunications, and myriad devices are able to interconnect and communicate with each other almost anywhere. Globalization of standards and open architecture are some of the factors that have helped achieve this outcome. But more recently, concerns have emerged that the trends of globalization and integration have reversed and technology fragmentation, or "splinternet," is supplanting the Internet. How concerned should we be about the trend toward technology bifurcation and what will be its impact, particularly for the ASEAN+3 region?

This chapter deals with the twin issues of GVC reconfiguration and technology bifurcation. In a way, it is a continuation of the thematic chapters of past editions of the AREO, which have dealt with structural challenges facing the region: the "manufacturing for export" growth strategy (AMRO 2018), leveraging digital technology for growth (AMRO 2019), and major global trends affecting globalization and the rise of the "new economy" in Asia (AMRO 2020). This year's thematic chapter continues the discussion with the above questions on globalization and technology.

This chapter is organized as follows. Section II examines the factors that drove the development of the GVCs in the ASEAN+3 region, along with the forces that are reshaping its configuration in the period ahead. It highlights the role that multinational enterprises (MNEs) and lead firms play in forming the nodes of the global supply chains and the factors underlying their alternative GVC strategies. In particular, it discusses the factors that determine MNEs' decisions to organize their network of suppliers in particular ways, which can provide an indication of the ease or difficulty in reconfiguring GVCs. The section closes with what economies in the region can do to take advantage of this potential reconfiguration of the GVCs.

Section III follows with a discussion on the new digital technologies that will transform the production process and reshape global supply chains, beginning with how the pandemic has accelerated digital transformation across businesses, before diving into a discussion of the US–China technology tensions. While the section discusses how techno-nationalism can result in the development of a dual universe of US-led or China-led technologies, it also recalls what had transpired when similar technology bifurcation and standards had occurred in the past. It argues that, ultimately, as in the past, technology itself would solve the problem of bifurcation, as interface technology and other innovations would render switching costs between technologies irrelevant and immaterial in business decisions. However, it could also be that, at least in the short term, one of the two types of technology might eventually emerge as dominant and reap the benefits from network and monopoly effects. The final section summarizes the chapter and provides some policy considerations for ASEAN+3 economies.

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II. Will Global Value Chains be Reconfigured?

GVCs have played a critical role in driving Asia's industrialization and economic development since the 1960–70s when developing countries in the region opened up their economies to attract foreign direct investments (FDIs), pursuing a "manufacturing for exports" strategy of development. The regional supply chain was given a boost in the 1980–90s when Japanese MNEs decided to move the labor-intensive parts of their manufacturing production to lower-cost ASEAN economies to mitigate the loss of competitiveness resulting from the sharp yen appreciation in the wake of the Plaza Accord. This trend was further boosted in the 2000s with the accession of China into the World Trade Organization (WTO), which led global MNEs to restructure their supply chains by shifting production to China to take advantage of its cheap and abundant labor.

The development of the regional production network, as noted in our earlier thematic studies, led to the industrialization of the regional economies as wave after wave of developing economies entered the production network and moved up the value chain. This process of industrialization of the region is vividly captured by the flying geese theory of development propounded by Ozawa (2005). Each group or wave of economies pursued slightly different strategies to develop, but all leveraged their growth on export-oriented strategies. Japan, followed by Korea and Taiwan Province of China, grew by promoting and supporting domestic manufacturing enterprises, which built vertically integrated domestic supply chains that eventually became global. Hong Kong and Singapore, followed by the other ASEAN economies and China, industrialized by attracting FDIs and specializing in some stages of production or tasks, progressively upgrading their participation in the global supply chains, until they achieved higher levels of development and income. Hong Kong and Singapore also diversified into finance and business services and have become major financial and business hubs in the region.[1/] China has industrialized and moved up the GVCs so rapidly that it is now a global manufacturing powerhouse and at the cutting edge of technology in many industries.

The fragmentation of the vertically integrated production process into global supply chains was premised on the virtues of globalization such as comparative advantage, allocative efficiency, and cost minimization, and was enabled by technological advances that led to a sharp drop in cost of transportation and telecommunication. Indeed, the efficiency of the global supply chains led to lower prices of consumer goods and services that benefited households in every country, especially the United States and Europe. However, the relocation of production also led to job losses in the manufacturing sector in advanced economies and widening income disparity, which have led to anti-globalization sentiments and the rise of populist movements. In particular, voices calling on governments in advanced economies to bring back jobs that have been offshored and protect the domestic market from foreign competition are getting louder. The question therefore is whether globalization has run its course and how GVCs will be affected going forward. How will GVCs be reconfigured? What will be the role of the ASEAN+3 region in changed or reconfigured GVCs, if this occurs?

This section begins with a discussion on the importance of GVCs for the ASEAN+3 region, before delving into the role of MNEs and FDI in the growth and expansion of GVCs. Next, it discusses the different GVC governance structures, with MNEs usually at the helm as lead firms; this is necessary as the governance arrangements provide hints on the ease or difficulties of reconfiguring GVCs. The third subsection describes a range of factors that affect the location choices of MNEs, which will significantly impact the likelihood of a global reconfiguration. Some emerging evidence is then presented on planned investments into the region. The section concludes with the challenges facing developing ASEAN+3 economies as preferred investment locations.

[1/] AMRO (2020) has an in-depth discussion of China's "leapfrog within" the flying geese formation. In particular, China's progression from low-cost manufacturing to skills- and technology-intensive industries have challenged the traditional "linear" evolution of comparative advantage. Thus, while China continues to retain comparative advantage in traditional manufacturing, it has also achieved a rank close to leadership in some high-tech industries. For example, some provinces and cities such as Shenzhen and Hangzhou, have moved up value chains to the production frontier of certain industries while other provinces, especially the inland ones, follow behind as in the flying geese formation.

Global Value Chains in ASEAN+3

GVCs are an integral part of ASEAN+3 economies, comprising about half of their regional and global trade (Figure 2.1). A huge proportion of international trade of regional economies are from GVCs, which explains their high participation rates. In 2019, GVC participation rates in the ASEAN+3 range from about 30 percent of total exports for China to at least 60 percent for Singapore.[2/] China's relatively low GVC participation rate is in line with other continental size economies with large domestic markets, such as the United States and India.[3/]

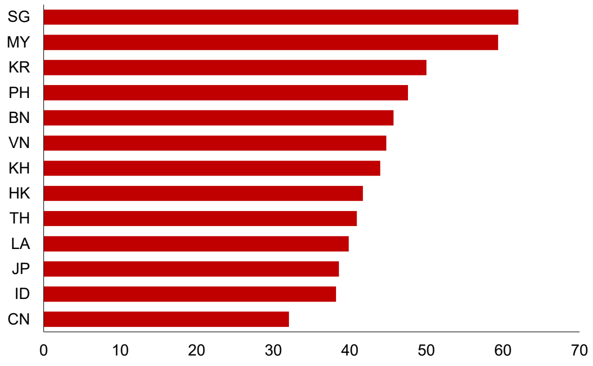
Close to a quarter of global GVC activities come from ASEAN+3 (Figure 2.2), while nearly half are accounted for by Europe.[4/] China, despite its low GVC participation rate, accounts for a larger share of global GVC activities than any other economy in the ASEAN+3. In 2019, China accounted for nearly 7 percent of global GVC activities during the year, close to one-third of the ASEAN+3's global GVC share, up from its 2.9 percent share in 2000 (Figure 2.2). This trend shows how China has become more deeply embedded in manufacturing GVCs over time.

Following the 2008–09 global financial crisis (GFC), which marked the beginning of the decline in GVCs' share of global trade, the region's GVC participation rates likewise dropped (Figure 2.3). From a high of 42.8 percent before the GFC, the ASEAN+3 participation rate decreased to about 40 percent in 2019. This is attributable mostly to the decline in China's participation rate, followed by a slight decrease for ASEAN. The participation rates of Japan and Korea (Plus-2 economies), on the other hand, increased slightly during the period.

A significant weakening in backward GVC participation since 2007, which was not offset by the relatively small increase in forward participation, accounts for the overall decline in the ASEAN+3 participation rate (Figure 2.4). In particular, China's backward participation rate decreased significantly by nearly 10 percentage points between 2007 and 2019, even though it recorded the largest increase in forward participation. This suggests that China needed fewer intermediate components imports and instead exported more of them. In contrast, the Plus-2 economies' forward participation rate fell, while their backward participation increased—likely a result of their offshoring strategies. Imports of intermediate goods produced by Plus-2 MNEs' subsidiaries in lower-cost economies such as China or the ASEAN could account for the increase in the Plus-2 economies' backward participation rates.

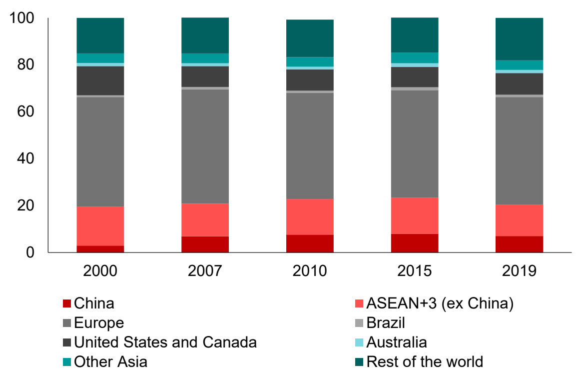
Is the ASEAN+3's value chain trade global in scope, or is it more regional?[5/] The low regional value chain (RVC) participation rates for both ASEAN and ASEAN+3 suggest that value chain trade in the region is more

Figure 2.1. ASEAN+3: GVC Participation Rates, 2019
(Percent share of total exports)



Sources: Asian Development Bank; and AMRO staff calculations.

Figure 2.2. ASEAN+3 and World Regions: Share in Global GVC Activity
(Percent share of world GVCs)



Sources: Asian Development Bank; and AMRO staff calculations.

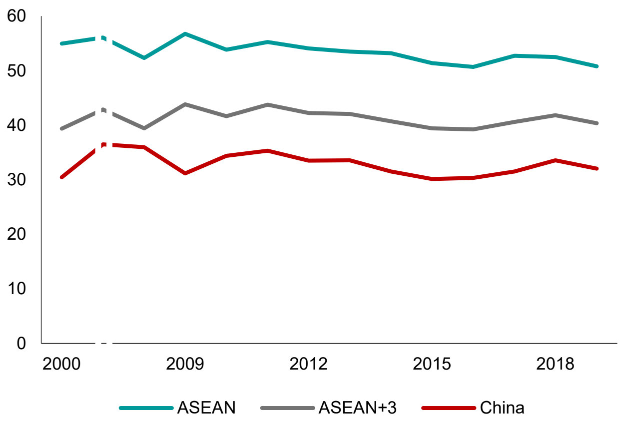
2/ GVC participation is the sum of the foreign value-added of imported foreign inputs used in the production of exports of goods and services (backward participation), and the value-added of domestically produced inputs exported to partners in charge of downstream production stages (forward participation), or the domestic value-added that goes to third economies for their exports (WTO 2020). The data in this section, including boxes, use the Asian Development Bank Multiregional Input-Output Tables downloaded in December 2020.

3/ Large economies such as the United States or China have a huge value of exports, not all of which are GVC-related. Since GVC participation is a ratio over exports, it partly explains why GVC participation rates of China or the United States are low.

4/ This is computed as the sum of each individual economy's export DVA_INTrex (domestic value-added exports used by the importer economy to produce exports for a third economy) and FVA (foreign value-added), divided by all economies' DVA_INTrex and FVA, as indicated in the Asian Development Bank's Multiregional Input-Output Tables. In the case of Europe, individual economies' shares were first calculated, then added together, which explains the large share of Europe as a whole in global GVC activities. In other words, all the intermediate goods trade among EU member countries are captured in the GVC activity calculations for Europe in Figure 2.2.

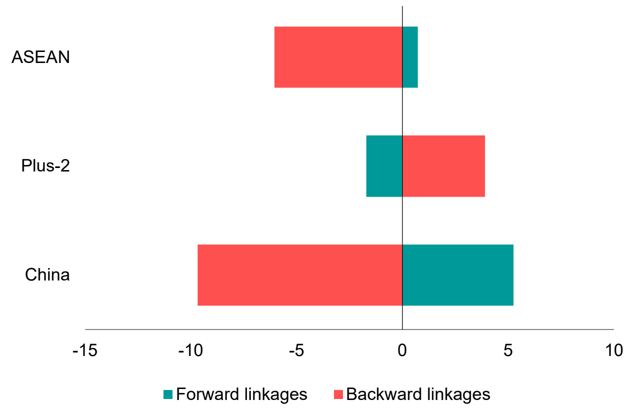
5/ Regional value chain trade involves only regional production partners (both as source of components and as export destination of components for further export processing). GVC trade, on the other hand, involves extra-regional partner economies.

Figure 2.3. ASEAN+3: Aggregate GVC Participation Rates
(Percent share of total exports)



Sources: Asian Development Bank; and AMRO staff calculations.
Note: White lines represent a break in the data, from 2001 to 2006.

Figure 2.4. ASEAN+3: Change in GVC Linkages, 2007 versus 2019
(Percentage point change in share of total exports)



Sources: Asian Development Bank; and AMRO staff calculations.

global than regional (Figure 2.5). In particular, the low RVC participation ratio for the ASEAN economies of about 7 percent suggests that regionalization of manufacturing supply chains among only ASEAN member economies is not strong. Most of ASEAN's imported components used in production supply chains (captured in foreign value-added, or FVA) come from outside ASEAN and more of its domestic value-added exports for further processing (or DVA_INTrex) are used outside the region (Appendix Figure 2.1.1. for a detailed illustration). For the ASEAN+3, on the other hand, a relatively larger share of imported components come from within the region, and a larger share of DVA_INTrex are likewise used within the region (Figure 2.5). This reflects the stronger linkage between the ASEAN and the Plus-3 economies: (1) the importation by the Plus-3 economies, especially Japan and Korea, of manufacturing components that have been outsourced to the ASEAN economies and China; and (2) the importation by ASEAN economies of intermediate components from the Plus-3 economies for processing before being exported. This is in contrast to the relatively weaker linkage among ASEAN members alone.

ASEAN+3's low RVC participation rate of 12–13 percent compared with its GVC participation rate of 40–50 percent shows the strong external orientation of the regional supply chains. While the ASEAN+3 RVC participation rate is higher than ASEAN's, it merely reflects the fact that bigger size of the regional grouping will naturally lead to more trade of intermediate goods within the group. In particular, MNEs in the Plus-3 economies are able to leverage on the lower cost in ASEAN economies for outsourcing of their supply chains, while ASEAN exports benefit from the intermediate goods demand from the Plus-3 economies (Figure 2.5). The entire region as a whole, however, imports a large share of intermediate goods and services from extra-regional partners (for example, auto design by Ford in the United States, sent to its manufacturing plant in Thailand); as well as exports to them (for example, Ford auto parts from Thailand exported to its assembly plant in Mexico). Simply put, the ASEAN and ASEAN+3 region are more tightly embedded in global than in regional trade.

ASEAN+3's manufacturing industries, more than services, are the most connected to global and regional value chains, but certain industries have stronger regional links than others. In particular, compared to other industries, the manufacturing of electrical and optical equipment, basic and fabricated metals, chemical products, as well as for coke and refined petroleum, have stronger value chain contributions from regional economies (Figures 2.6–2.7).

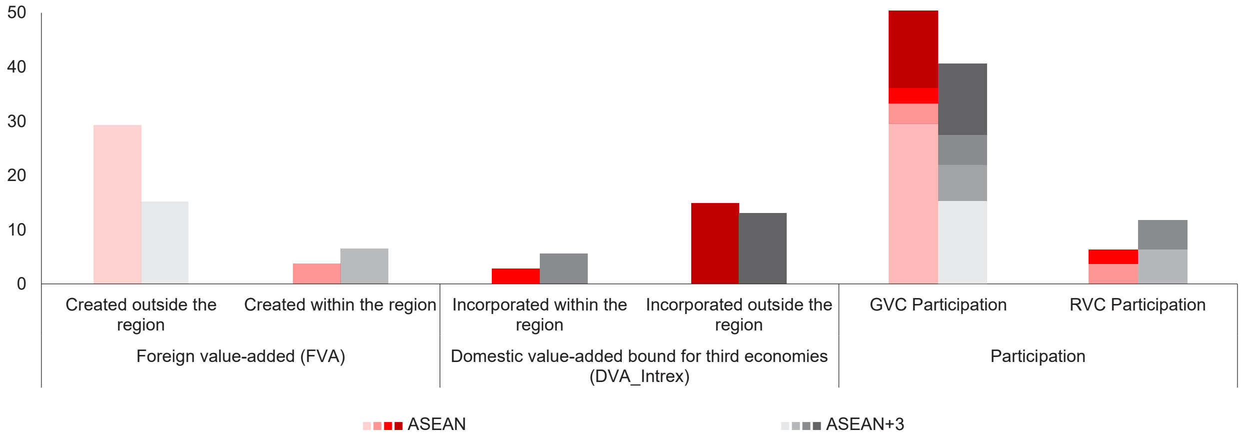
Particularly in the manufacture of electrical and optical equipment sector—where the region has progressively upgraded its GVC participation by doing the higher value-added stages like design and fabrication—the strong RVC contribution is not surprising. In other manufacturing industries like transport equipment and textiles, ASEAN+3 economies have a strong GVC presence, but a relatively smaller RVC contribution, because of the larger size of the transport and garment industries and markets in the United States and Europe (Figure 2.7). The auto industry, in particular, operates supply chains more on a global than regional scale, where a majority of parts and components, as well as high-value services like design or research and development (R&D), are outsourced and imported from abroad, including the ASEAN+3 region.[6/]

The bulk of the value-added in ASEAN+3 economies' exports are contributed by the domestic economy (Figure 2.8). For ASEAN economies, the domestic value-added (DVA) share has risen from 60 percent in 2000 to about 65 percent in 2019, with another 9 percent from other ASEAN economies. Between 2000 and 2019, China's

6/ Electrical/ optical and transport sectors are among the GVCs that are considered to have long supply chains (Miroudot and Nordström 2020) because the parts and components travel long distances and cross borders multiple times before they reach the final product.

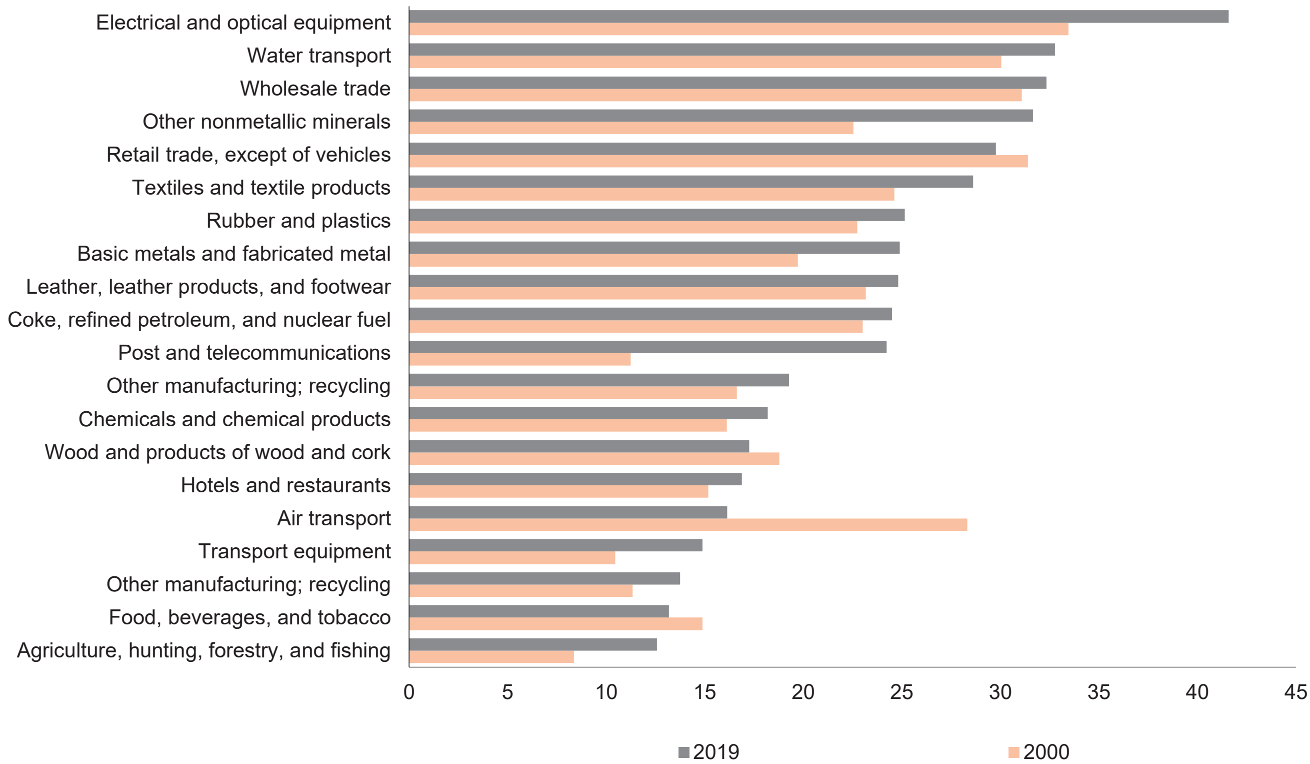
DVA in exports increased by about 5 percentage points to nearly 90 percent while the foreign value-added share has decreased (Figure 2.8). This shows that, despite the huge and necessary import components in GVC activities, most of the exported value-added still come from the domestic economy. Undoubtedly, as the next section discusses, established subsidiaries and affiliates of MNEs in the local economy contribute to the large exports of DVA.

Figure 2.5. ASEAN+3: Global and Regional Value Chain Participation, 2019
(Percent of total exports)



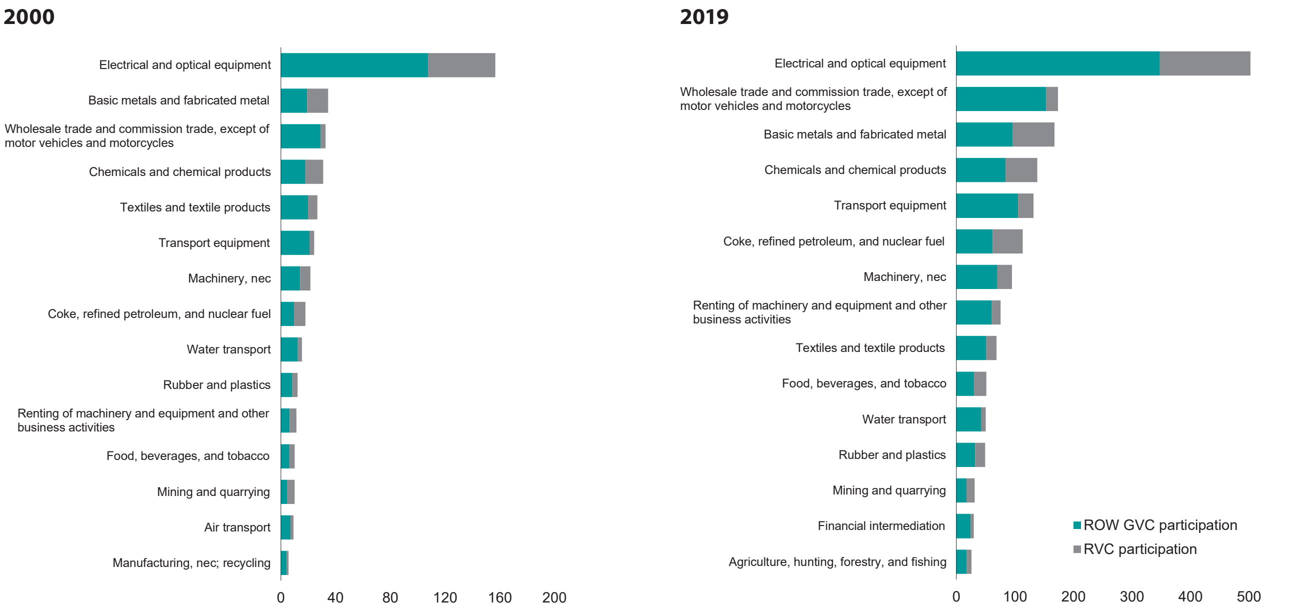
Sources: Asian Development Bank; and AMRO staff calculations.
Note: The methodology used is based on Organisation for Economic Co-operation and Development (2019). DVA_INTrex = Domestic Value Added (DVA) in intermediate exports used by direct importers to produce intermediate or final exports for a third economy's final consumption or use for its own exports. DVA_INTrex incorporated within the region means the DVA from an economy belonging to a region, either ASEAN or ASEAN+3, say from Thailand, is being used by another economy in the same region, say to Malaysia (in the case of ASEAN) or Japan (for ASEAN+3) to export to a third economy. Incorporated outside the region means that the DVA from an economy in a region, for example, ASEAN+3, is being used by extra-regional economy, say Mexico, to produce its exports to another destination. The same concept holds for FVA or foreign value-added. FVA created within the region reflects the intra-ASEAN imports (or intra-ASEAN+3 imports); while FVA created outside the region is from extra-regional GVC trade partners, for example, the European Union or United States. GVC Participation is the sum of FVA and DVA_INTrex (both within and outside the region); while RVC is the sum of FVA and DVA_INTrex within the region. See Appendix Figure 2.1.1. for a schematic illustration.

Figure 2.6. ASEAN+3: Top 20 Sectors with the Highest Share to GVCs, 2000 and 2019
(Percent of world GVC activity of sector)



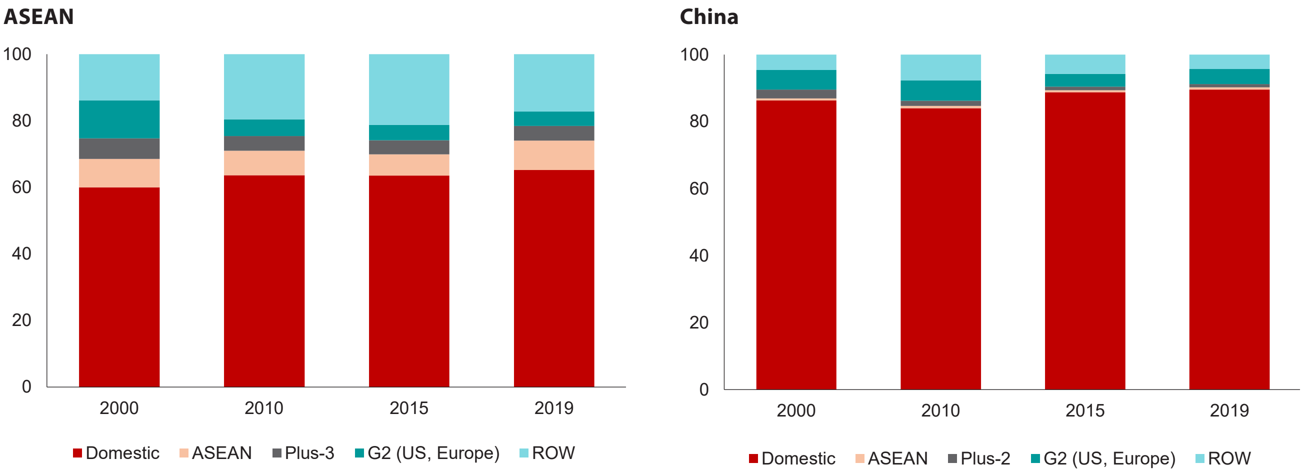
Sources: Asian Development Bank; and AMRO staff calculations.

Figure 2.7. ASEAN+3: Top 15 Sectors with the Highest GVC Participation, 2000 and 2019
(Billions of US dollars)



Sources: Asian Development Bank; and AMRO staff calculations.
Note: nec = not elsewhere classified; ROW = rest of the economies included for that year in the Asian Development Bank Multiregional Input-Output tables; RVC = regional value chain. The low sector share of regional VC to global GVC of sectors such as Transport Equipment, despite the fact that some high-value added components are already sourced within the region, for example, Japan and Korea, reflects the fact that other regions too, like the European Union, undertake large GVC activities in the sector. These low shares are consistent with GVC shares in Figure 2.2.

Figure 2.8. ASEAN and China: Sources of Value-Added in Exports
(Percent of total value-added exports)



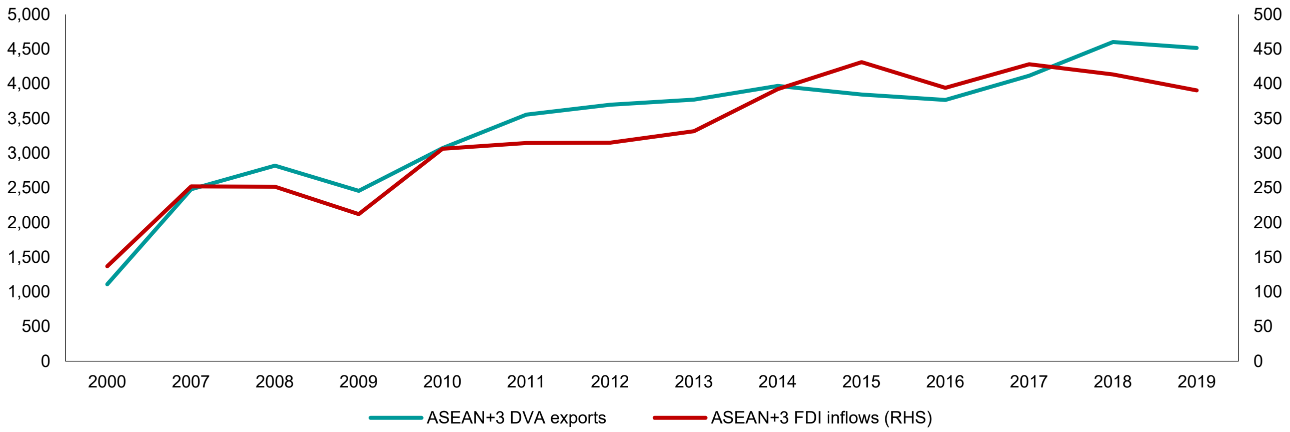
Sources: Asian Development Bank; and AMRO staff calculations.
Note: ROW = rest of the world.

Global Value Chains and the Role of Foreign Investment

FDI has been key to the growth of DVA in ASEAN+3 exports (Figure 2.9) because the activities of the subsidiaries and affiliates of MNEs are part of the domestic economy and thus counted in DVA. Even if MNEs do not have direct investments in the economy, their contractual relationships with local suppliers would likewise stimulate domestic economic activities. Hence, while the correlation between aggregate FDI inflows and DVA exports is positive, a similar correlation can likewise be observed in specific sector investments; for example, DVA exports of automobiles or garments have shown increases over time as a result of GVC-related investments (Boxes 2.1 and 2.2).

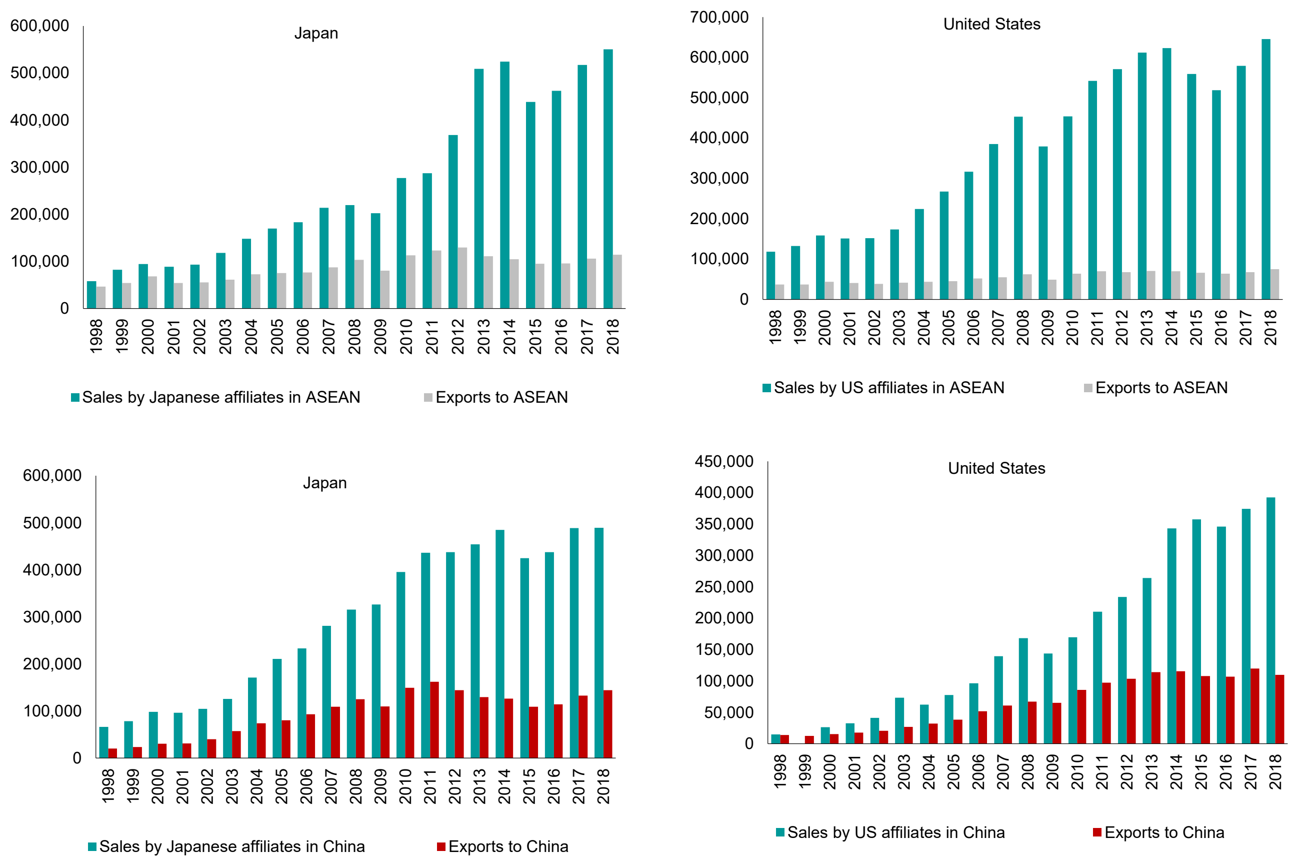
Additional evidence of the important role of FDI and foreign affiliates in domestic GVC activities (and thus growth in DVA) can be observed from comparing the growth of affiliates' sales in the domestic economy with direct exports. For example, the direct exports of the United States and Japan to China and ASEAN pale in comparison to the domestic sales of their subsidiaries and affiliates (Figure 2.10). This is particularly true for China where affiliates' sales are classified as local procurement, thus contributing to China's DVA exports (Figure 2.8), while in ASEAN, some of the sales of US and Japanese affiliates may be part of intra-ASEAN exports. Foreign subsidiaries may be exporting to their parent firms or affiliate companies as part of the GVC activity of the lead firm, supplying other MNEs abroad or in the host economy, or catering to the domestic market. In any case, sales of US foreign affiliates in China and in ASEAN have been on an upward trend since 1998, increasing seven– or eightfold respectively from 1998 to 2014–18, in contrast to the much slower growth of US exports. Likewise, the sales of Japanese affiliates, which grew fivefold, mirrored a similar trend (Figure 2.10).

Figure 2.9. ASEAN+3: Domestic Value-Added Exports and FDI Inflows
(Billions of US dollars)



Sources: Asian Development Bank; United Nations Conference on Trade and Development; and AMRO staff calculations.
Note: DVA = domestic value-added; FDI = foreign direct investment.

Figure 2.10. Japan and United States: Exports to versus Sales of MNE Affiliates to ASEAN and China, 1998–2018
(Millions of US dollars)



Sources: Japan's Ministry of International Trade and Industry; US Bureau of Economic Analysis; World Bank's World Integrated Trade Solution; and AMRO staff calculations.
Note: MNE = multinational enterprises; US = United States.

Box 2.1:

Growth in Domestic Value-Added in GVCs: Automotive Industry and Machinery, Electrical, and Optical Equipment

The embedding of foreign affiliates' activities into the domestic value chain ecosystems in the ASEAN+3 region helps increase domestic activities and the region's value-added exports. This is especially true at the aggregate export level and in the exports of specific sectors like the automotive industry, as well as the machinery, electrical and optical equipment industries.

In the auto industry, while Japan has maintained its hub position, China has upgraded and increased its role in the sector's supply chain. The domestic value-added (DVA) content from Japan, Germany, and the United States were already among the biggest in the network in 2000, but China's DVA global share has evolved from a tiny node in 2000 to a conspicuously bigger one in 2019 (Figure 2.1.1), outperforming Korea, France, and the United Kingdom. In value terms, China's DVA in its auto exports increased from USD 4.5 billion in 2000 to nearly USD 105 billion in 2019. The DVA shares of the Big Three—the United States, Germany, Japan—remain large because high-value activities like design or research and development, and more recently, software and IT components of cars, are mostly carried out in the home economies of the MNEs.

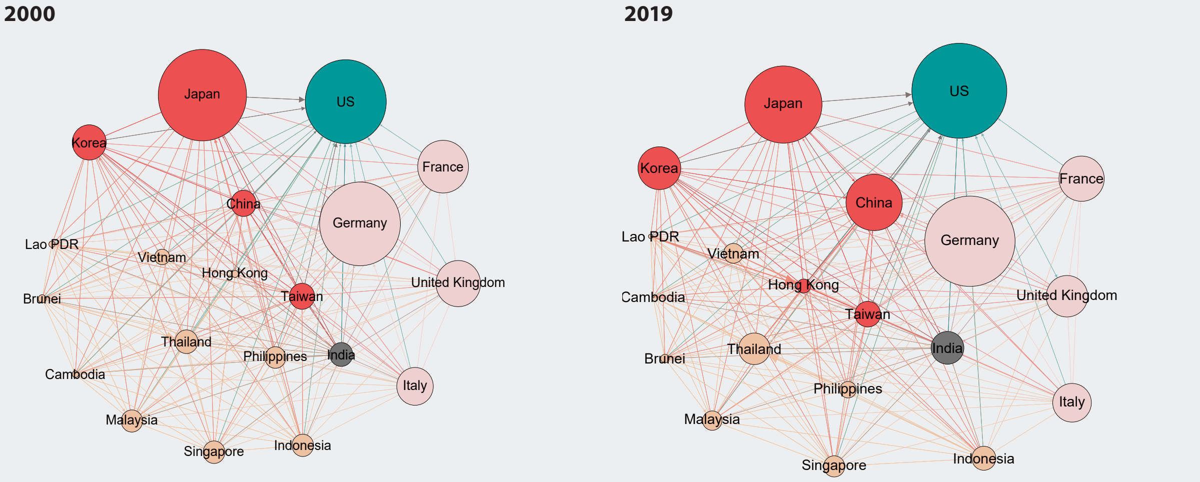
A similar story can be observed for exports of the machinery, electrical, and optical equipment sectors, where the increase in China's DVA share is even more impressive—from 5 percent of the global share in 2000 to 30 percent in 2019 (Figure 2.1.2). As evidence of its move up the value chain, China has become the industry's biggest hub in 2019, in contrast to 2000 when these hubs were Japan and the United States. Japan has switched from being a net exporter to, into being a net importer from, China. Korea remains the biggest high-tech supplier to China. On the other hand, the ASEAN-6 economies have become a significant net importer of these high-tech goods from China.

In the auto industry, Japan and Korea's DVA shares have declined while their FVA shares have increased, reflecting higher imports of components and parts from either their suppliers in the region or offshore affiliates of their MNEs (Figure 2.1.3). In ASEAN, Indonesia and Thailand are the major beneficiaries of the offshoring activities of Japan's and Korea's automobile industries. They increased their DVA shares in automotive exports over the last two decades, coinciding with the offshoring activities of auto MNEs. Vietnam is also participating more in the automotive GVCs as evidenced by its high share of PDC (pure double counted terms) and FVA, which indicates that there is multiple back and forth trade in automotive parts between Vietnam and other economies.[1/] If Vietnam continues to upgrade its participation in GVCs, its DVA share will likely increase, similar to what has happened with China's DVA exports of machinery, electrical, and optical goods.

ASEAN members take up different positions in the automotive value chains. For example, Indonesia and Thailand have similar shares of DVA in their automotive gross exports, but the two countries participate in the production chain in different ways (Figures 2.1.3–2.1.4). For Thailand, DVA embodied in its final exports (DVA_FIN) has remained stable at nearly 70 percent between 2000 and 2019, while DVA embodied in its intermediate exports (DVA_INT) and DVA sent to third countries (DVA_INTrex) have been about 30 percent. Thailand's DVA structure suggests that Thailand's position is more toward the downstream part of the value chain: by producing and exporting fully or close-to-fully assembled cars. On the other hand, for Indonesia, the DVA_INT and DVA_INTrex contribute more than 50 percent of its automotive exports, suggesting that Indonesia is concentrating more on the upstream segment, for example, on intermediate parts and components, of the value chain.

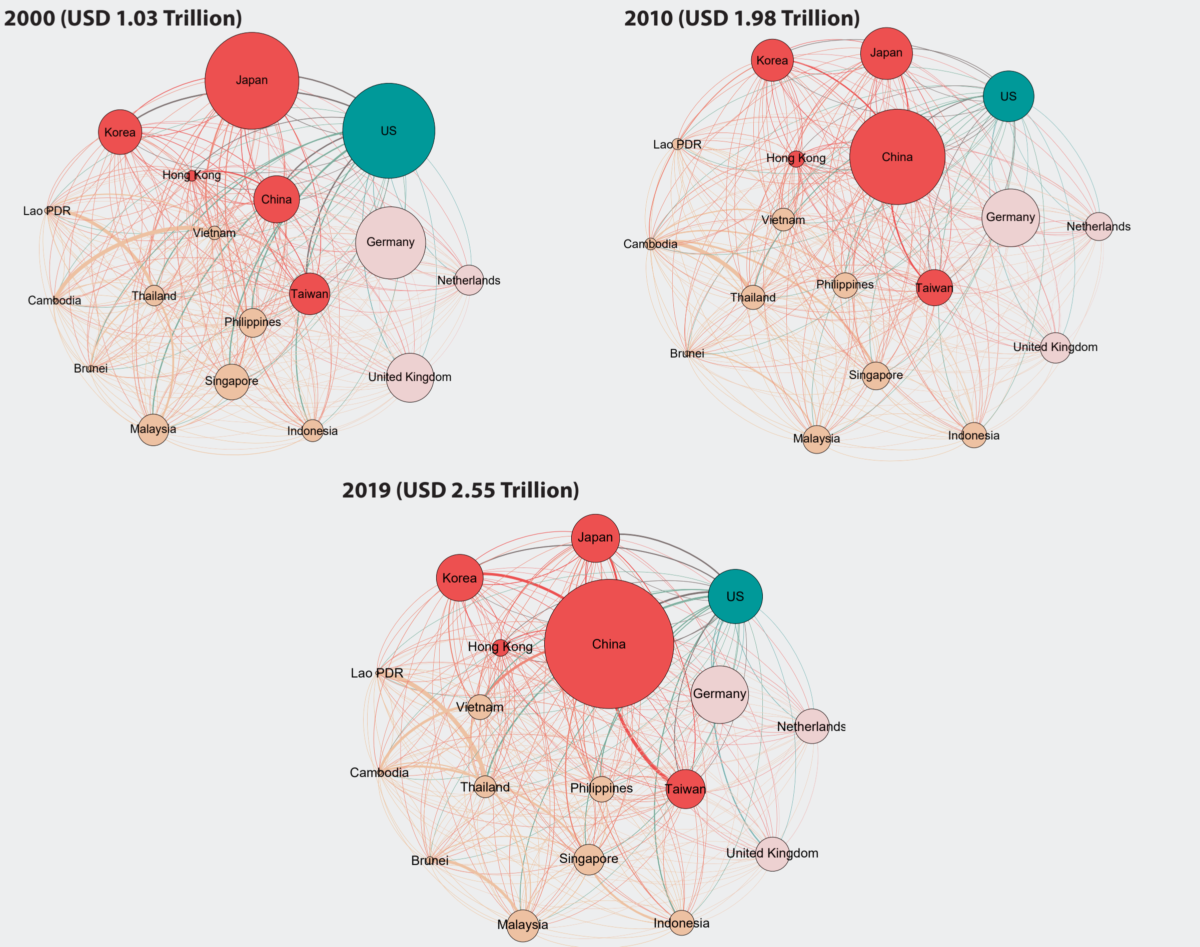
[1/] Pure double-counted (PDC) terms in an economy's exports occur when there is back-and-forth trade of intermediate products. An increasing share of PDCs could indicate the deepening of cross-country production sharing, for example, intermediate goods have to cross national borders multiple times before they are used in final goods production. The methodology of Wang, Wei, and Zhu (2018) provides a way to separate the domestic and foreign value-added terms from the purely double-counted values (Appendix Figure 2.1.1).

Figure 2.1.1. Global Value Networks of Automotive Production



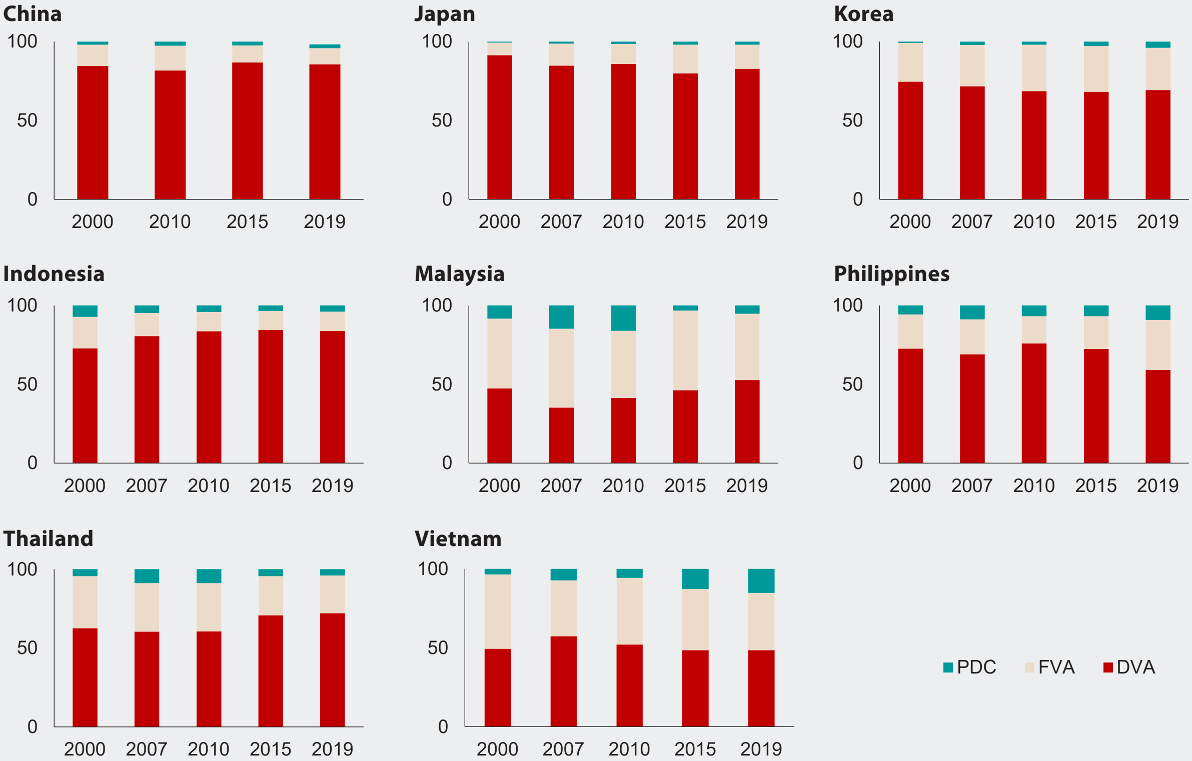
Sources: Asian Development Bank; and AMRO staff calculations.
Note: Underlying data are domestic value-added (DVA) embedded in an economy's gross exports, based on the methodology of Wang, Wei, and Zhu (2018).The size of each node represents the share of an economy's DVA exports to total global DVA exports in the auto industry. The thickness of the edge linking economy *i* to its corresponding trading partner represents the percentage share of value-added exports from economy *i* to its corresponding trading partner with regard to economy *i*'s total value-added exports. The color of the nodes represents the region that economies belong to. Automotive Production refers to Sector 15 (Transport Equipment) in the Asian Development Bank Multiregional Input-Output Tables' Sector Aggregation.

Figure 2.1.2. Global Value Networks of Machinery, Electrical, and Optical Equipment Sector



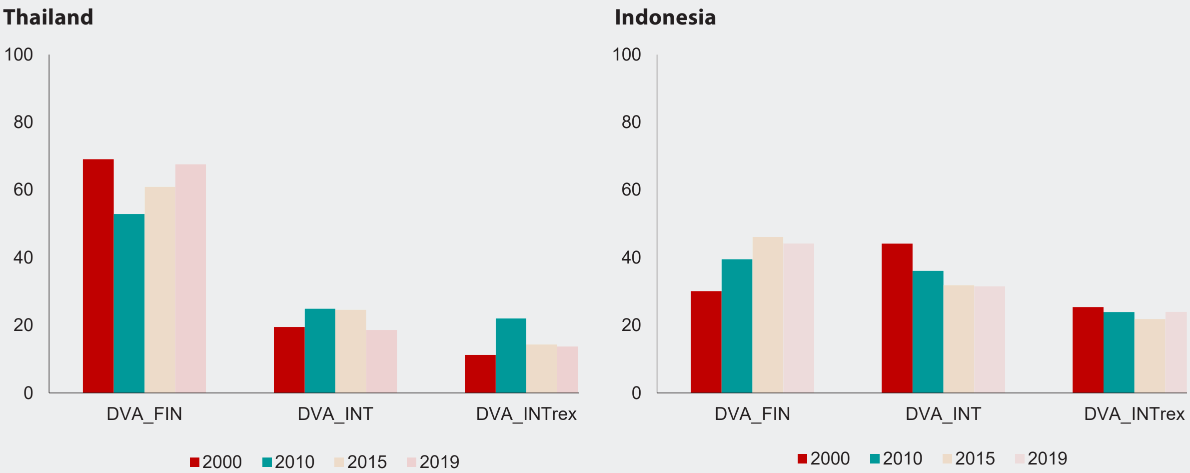
Sources: Asian Development Bank; and AMRO staff calculations.
Note: Underlying data are domestic value-added (DVA) embedded in an economy's gross exports which are ultimately absorbed abroad, based on the methodology of Wang, Wei, and Zhu (2018). The size of each node represents the share of an economy's DVA exports to total global DVA exports in machinery and electrical and optical equipment. The thickness of the edge linking economy *i* to its corresponding trading partner represents the percentage share of value-added exports from economy *i* to its corresponding trading partner with regard to economy *i*'s total value-added exports. The color of the nodes represents the region to which the economies belong. Machinery, electrical and optical equipment Industry refers to Sectors 13–14 in the Asian Development Bank Multiregional Input-Output Tables' Sector Aggregation.

Figure 2.1.3. ASEAN+3: Value-Added Components in Automotive Gross Exports
(Percent of gross exports)



Sources: Asian Development Bank; and AMRO staff calculations.
Note: DVA = domestic value-added; FVA = foreign value-added; PDC = pure double-counted terms. Automotive Production refers to Sector 15 (Transport Equipment) in the Asian Development Bank Multiregional Input-Output Tables' Sector Aggregation.

Figure 2.1.4. Indonesia and Thailand: Structure of Domestic Value-Added in Gross Exports of Automotive Industry, 2000, 2010, 2015, and 2019
(Percent of gross exports)



Sources: Asian Development Bank; and AMRO staff calculation.
Note: DVA_FIN = DVA exports in final goods exports; DVA_INT = DVA in intermediate exports to direct importers and is absorbed there; DVA_INTrex = DVA in intermediate exports used by importing economy to produce exports bound to a third economy. Automotive Production refers to Sector 15 (Transport Equipment) in the ADB Multiregional Input-Output Tables' Sector Aggregation.

The author of this box is Trung Thanh Vu.

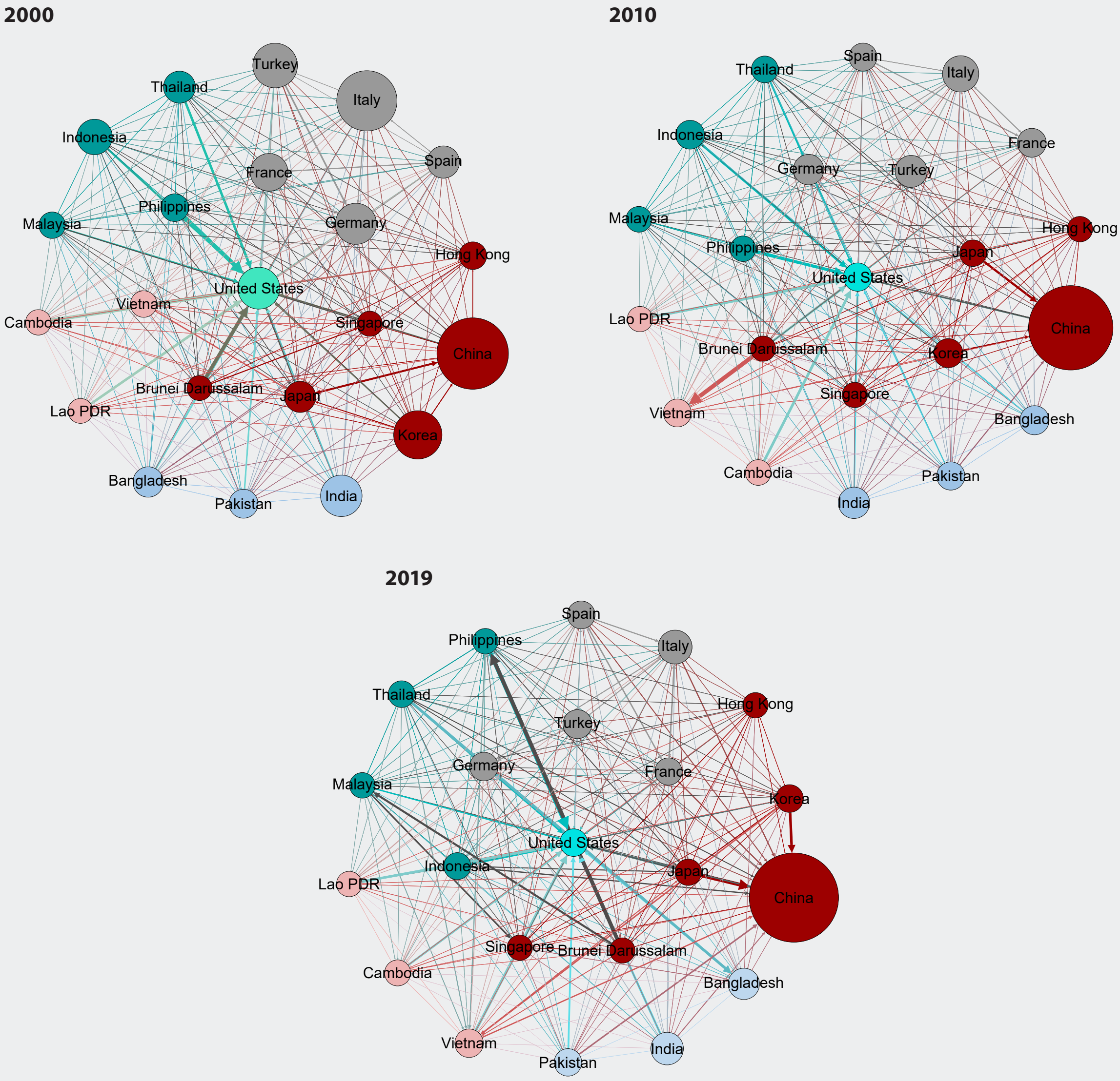
Box 2.2:

Growth in Domestic Value-Added in GVCs: Garment Products

While the Plus-3 economies appear to participate more in the automotive and high-tech goods GVCs, some ASEAN economies have increased their roles in the global supply chains for garment products. China continues to lead the sector's GVCs; however, the CLMV (Cambodia, Lao PDR, Myanmar, and Vietnam) economies have increased their roles in the value chain, even as the rest of the ASEAN (ASEAN-4) economies have decreased their roles in the network. Other nodes, such as Italy, Turkey, and the United States, have also seen diminishing shares of their domestic value-added (DVA) from 2000 to 2019 (Figure 2.2.1). China's DVA exports of garments increased sevenfold from USD 42.7 billion (14.4 percent of the world's DVA exports of garments) in 2000 to USD 284.4 billion (40.1 percent) in 2019.

The participation in garment GVCs varies among ASEAN+3 economies. Not only is China the largest supplier of garment materials in the world, it is also a

Figure 2.2.1. Global Value Networks of Garment Production



Sources: Asian Development Bank; and AMRO staff calculations.
Note: Underlying data are domestic value-added (DVA) embedded in an economy's gross exports which are ultimately absorbed abroad based on the methodology of Wang, Wei, and Zhu (2018). The size of each node represents the share of an economy's DVA exports to total global DVA exports in garment. The thickness of the edge linking economy *i* to its corresponding trading partner represents the percentage share of value-added exports from economy *i* to its corresponding trading partner with regard to economy *i*'s total value-added exports. The color of the nodes represents the region to which the economies belong (CLMV in rose, ASEAN+3 high income in red, ASEAN-4 in dark teal, the United States in teal, the European Union in grey, and others in light blue). Garment sector refers to the combination of sectors 4 (Textiles and textile products) and 5 (Leather, leather products, and footwear) in the Asian Development Bank Multiregional Input-Output Tables' Sector Aggregation.

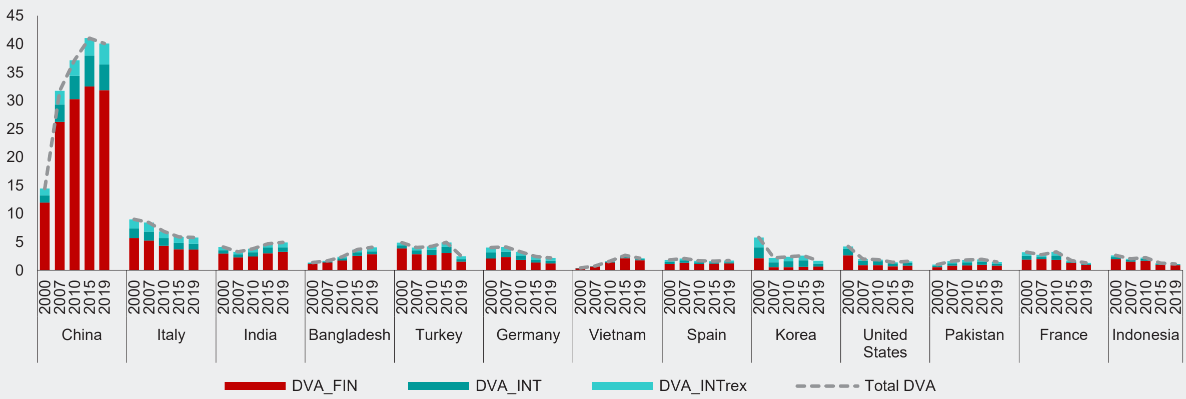
top final product exporter (Figure 2.2.2). Its key role in garment intermediates trade explains why the COVID-19 pandemic disruptions in China caused widespread stoppage in the garment global supply chains, affecting major garment exporters like Bangladesh, Cambodia, and Vietnam. In Cambodia and Vietnam, for example, garment manufacturers were forced to temporarily shut down due to the shortage of garment materials from China, leading to a delay in their production (Onishi 2020). Cambodia, in particular, imports about 60 percent of total garment materials from China.

Albeit remaining large, the share of China's DVA garment exports to the world has seen a slight decrease over the past 5 years, partly reflecting a relocation of its garment production to other countries. In 2015, China's share of world's DVA in garment exports accounted for roughly 41 percent, while in 2019, the share declined slightly to 40 percent (Figure 2.2.2). At the same time, other major garment producers such as Bangladesh and India—economies with abundance of labor and relatively low labor costs—have seen a rise in their share of DVA in garment exports. Other economies receiving preferential trade treatments like Cambodia and Vietnam have also benefited from the relocation of production. China has been putting more effort into moving up its manufacturing value chain to produce more sophisticated goods, which is well aligned with its economic strategy of "Made in China 2025."

In the CLMV economies, Vietnam has become less dependent on garment manufacturing and gradually moved up the value chain to higher value-added industries—such as electrical and optical equipment, as well as transport equipment—over the past two decades, whereas Cambodia continues to largely depend on garment exports, making up 87.4 percent of its total DVA manufacturing exports and 91 percent of its total FVA manufacturing exports (Figures 2.2.3–2.2.4). Cambodia's lack of skilled labor, unfavorable business environment, weak infrastructure and logistics, among others, have hindered the country's capacity to move up the value chain and increase its participation in the higher value-added segments of the GVC.

Years before the pandemic erupted, garment manufacturers had begun moving from China to other lower labor-cost locations such as the CLMV economies, Bangladesh, and India. Notwithstanding the increase in investments, much of the contribution of the CLMV economies in GVCs are still at the processing stage of production—cut, make, and trim (CMT) (Figure 2.2.5). In Vietnam, for instance, the garment exports based on CMT account for 65 percent of its total garment exports, while 35 percent come from the more advanced stages, for example, original design manufacturing (ODM) (Nguyen 2020). Likewise, Cambodia's garment exports industry is based on the CMT model, where the inputs, for example, raw materials, machinery, and the design of garments, come from outside Cambodia, while product assembly is conducted in the economy (Nguyen 2020). In addition to their status as low-cost locations, CLMV economies enjoy preferential trade treatment from the European Union, such as the "Everything But Arms" trade policy,[1/] and the United States under the Generalized System of Preferences (GSP), which could partly explain the relocation decisions of some garment manufacturing companies in their favor.

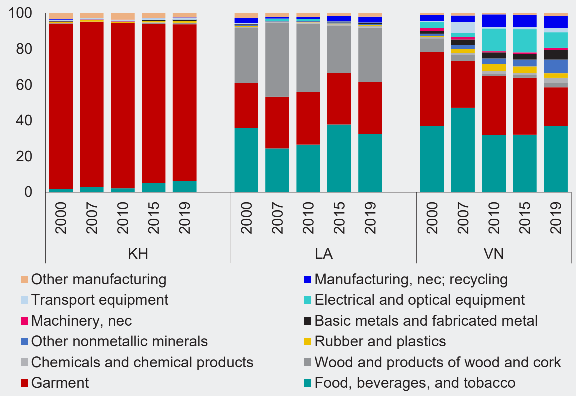
Figure 2.2.2. Top Garment Exporters: Garment DVA Exports by Component
(Percent of world's total DVA garment exports)



Sources: Asian Development Bank; and AMRO staff calculations.
Note: DVA = domestic value-added; DVA_FIN = DVA exports in final goods exports; DVA_INT = DVA in intermediate exports to direct importers and is absorbed there; DVA_INTrex = DVA in intermediate exports used by importing economy to produce exports bound to a third economy. Total DVA refers to the sum of all three components.

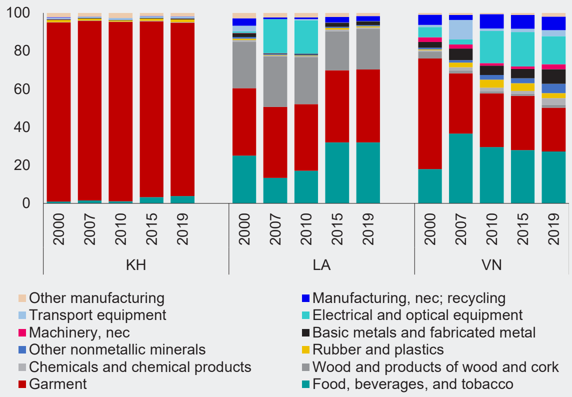
[1/] Cambodia lost duty-free access to 20 percent of its goods exports to the European Union because of human rights issues in August 2020.

Figure 2.2.3. CLV: Manufacturing DVA Exports
(Percent of each country's total DVA manufacturing exports)



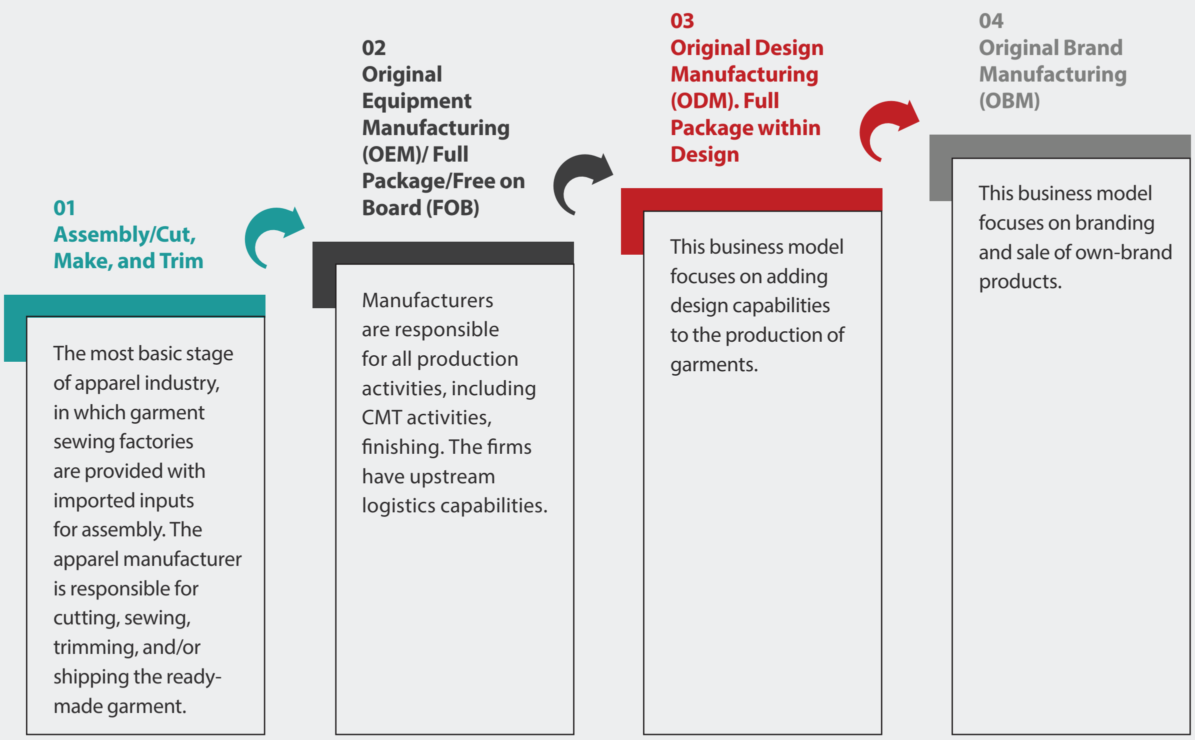
Sources: Asian Development Bank; and AMRO staff calculations.
Note: DVA = domestic value-added; FVA = foreign value-added; KH = Cambodia; LA = Lao PDR; nec = not elsewhere classified; VN = Vietnam.

Figure 2.2.4. CLV: Manufacturing FVA Exports
(Percent of each country's total FVA manufacturing exports)



Sources: Asian Development Bank; and AMRO staff calculations.
Note: DVA = domestic value-added; FVA = foreign value-added; KH = Cambodia; LA = Lao PDR; nec = not elsewhere classified; VN = Vietnam.

Figure 2.2.5. Garment Sector's Value Chain



Source: Fernandez-Stark, Frederick, and Gereffi (2011).
Note: CMT = cut, make, and trim.

The author of this box is Vanne Khut.

Non-Equity Investments, Value Chain Upgrading, and Growth in Domestic Value-Added

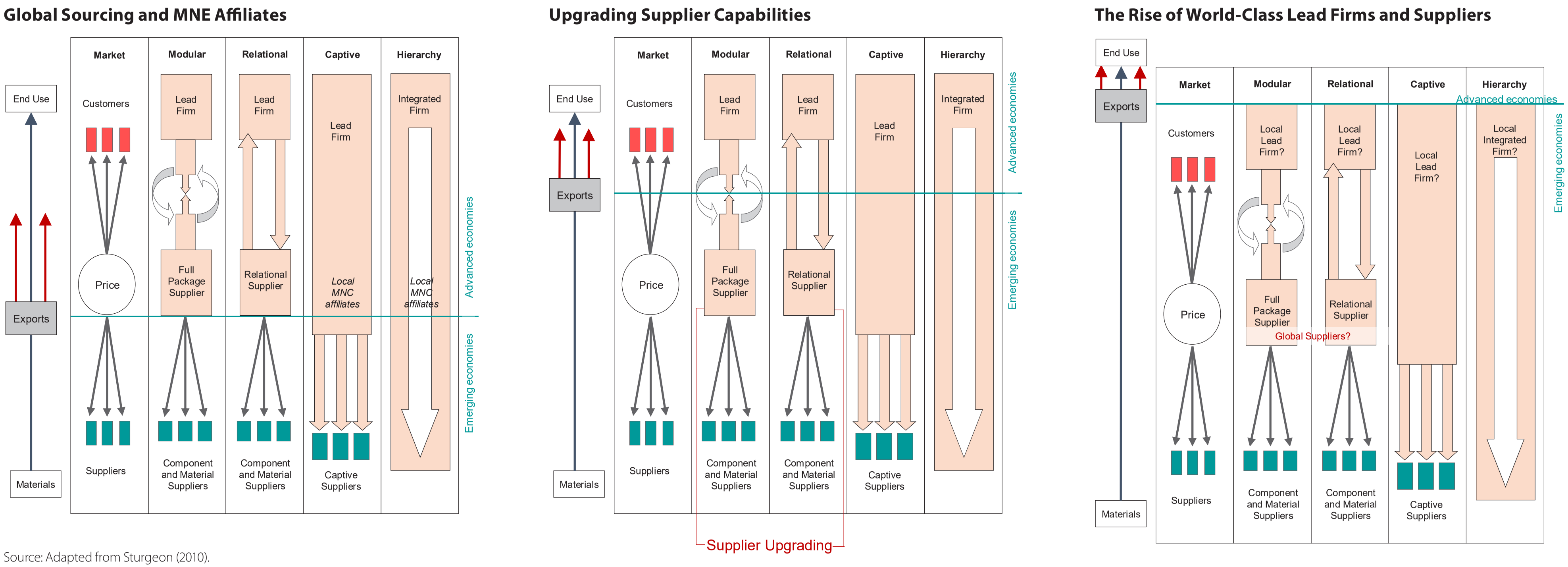
In addition to direct investments via establishment of foreign affiliates or subsidiaries, GVC activities take place through other forms of non-equity modes of investments (NEMs) such as contracting, leasing, franchising, or licensing, all of which entail a different set of governance challenges (Box 2.3). In fact, many GVC activities take place between unrelated companies rather than within an integrated intra-firm production supply chain. Unrelated firms' GVC trade transactions entail risks such as intellectual property leakage or lack of control over quality and timeliness of delivery, among others. NEMs require tight but "incomplete contracts"[7/] between suppliers and lead firms, often for highly customized products (Box 2.3). Despite these risks, NEM contracts somehow get to be enforced and observed because GVC transactions take place in the context of "repeated games" (Antras 2020), that is, transactions take place multiple times and last for as long as the relationship of trust continues.

Different industries usually use different NEM arrangements. Inter-firm contract manufacturing is common in technology and capital-intensive industries such as automotive components, electronics, and pharmaceuticals, as well as in labor-intensive industries like garments, footwear, or toys. Over time, large intermediaries arose that coordinate both upstream suppliers and large downstream buyers, especially in labor-intensive industries where many suppliers are small and medium-sized enterprises (SMEs). On the other hand, franchising arrangements are more typical in service industries like retail, food services, or in hotels and accommodation. Management contracts are used for hotels, where well-established hotel chains take over the management of the hotel infrastructure and facilities. Licensing, as part of the GVC relationship, tends to happen across industries (UNCTAD 2011).

Even in NEMs, the host economy's DVA can increase over time as local suppliers expand, upgrade, and capture more value in GVCs (Box 2.3). Indeed, a significant part of the growth in DVA in exports of ASEAN+3 economies have come from these NEM arrangements. For example, a possible evolution of value chains is where initially, exports take place only at the level of unorganized small components and parts suppliers, before upgrading takes place (Figure 2.11). As firms expand their production capacity, a few domestic firms become bigger as full package suppliers and relational suppliers with specific competencies that are desired by the lead firm. Foxconn is an example of a company that has become a global supplier, with multiple customers that are lead firms, such as Apple, Huawei, Xiaomi, or Samsung. With upgrading, the DVA of exports tends to increase, because the economy is able to capture more value in the GVCs. Lastly, some domestic firms grow to become lead firms themselves—examples of these are the new MNEs that have emerged in China such as Huawei, or Haier.

7/ Incomplete contracts in economics occur because all possible contingencies are hard to anticipate and write into a contract. Certain states of nature (like quality of a good) or actions cannot be verified by third parties after they arise and thus cannot be written into an enforceable contract (Aghion and Holden 2011).

Figure 2.11. Upgrading Strategy and Increase in Domestic Value



Source: Adapted from Sturgeon (2010).

Box 2.3:

GVC Organization, Governance, and Switching Costs

Although some GVC trade takes the form of intra-company transactions, for example, among affiliates or with parent companies, an increasing proportion takes place with unrelated firms (Lakatos and Ohnsorge 2017). The GVC relationships between suppliers and leaders are organized through non-equity modes, instead of (foreign) direct investments.

GVCs are usually organized by a lead firm that assumes the fixed costs of setting up the network of suppliers. Usually, these are firms that have established brands and market power, for example, Walmart, Apple, or Toyota. Still, other GVCs are more decentralized or supplier-centric, with individual producers setting up links both upstream and downstream from them. An example is Hong Kong's Li and Fung trading company, which links up with famous fashion design companies (upstream) and clothing department stores (downstream) and organizes a coterie of upstream suppliers—some their own, others independent producers or SMEs—in various parts of Asia to whom they farm out customized product orders.

Depending on various factors, lead firms adopt different GVC governance mechanisms. Factors that affect GVC governance are (1) the complexity of information and knowledge (either with respect to the product or process) that need to be shared with suppliers, (2) whether the information or knowledge can be codified and thus transmitted efficiently, and (3) whether the suppliers have the capacity to deliver according to the lead firm's specifications. Based on the combination of these different factors, Gereffi, Humphrey, and Sturgeon (2005) have identified five different governance arrangements: market, modular, relational, captive, and hierarchical (Table 2.3.1). Each entails a different degree of control by the lead firm.

The hierarchical governance is essentially an intra-firm arrangement with the MNE lead firm doing business with its own subsidiaries or affiliates. This arrangement suits transactions where some sensitive proprietary information, like critical intellectual property, needs to be exchanged but have very high risk of leakage, and/or quality management cannot be entrusted to unrelated suppliers. The captive and relational GVC governance modes, like the hierarchical arrangement, also need strong coordination by the lead firm but for different reasons. For the captive arrangement, it is because of the low capabilities and resources of the supplier firms. Examples would be in the toy or garment manufacturing industry wherein small manufacturers need the materials and (sometimes) equipment from the lead firm.

For relational GVC governance, a high-quality supplier may have complementary capabilities that the lead firm needs, but the information exchange is sensitive. An example of relational governance is perhaps between Foxconn and Apple, where highly classified information on upcoming models of mobile phones from Apple need to be transmitted for chip manufacturing by Foxconn. Despite the low codifiability[1/] of the information, the contract and trust between buyer and seller are enforced and regulated through mutual dependency, reputation, social or spatial proximity, or other ties (Gereffi, Humphrey, and Sturgeon 2005). The need for spatial proximity explains why certain processes cannot be offshored easily. The relational arrangement can also be enforced through legal mechanisms that make the cost of breaking the contract commitment extremely high (Antras 2020). In the example of Foxconn and Apple, the repeated game aspect of the business relationship ensures that each has an interest in keeping the other partner satisfied and in maintaining the trust between them.

The modular and market GVC governance modes both require little coordination from the lead firms. In the market arrangement, the transaction is relatively simple: the suppliers' capacity is high, and information is easy to codify. On the other hand, in the modular GVC arrangement, the transaction may be complex but it is similarly simple to codify, for example through established international standards. An example of modular GVC governance is in auto parts and components manufacturing.

1/ Codifiability means that production instructions or information can be transferred to an external partner without jeopardizing company secrets or intellectual property rights.

The switching costs also differ depending on the type of governance arrangement, which is important to keep in mind in any potential GVC reconfiguration. Modular and market governance arrangements impose relatively low switching costs for changing partners. On the other hand, the relational arrangements have high switching costs because of the relationship and trust invested in the partnerships, as well as the flows of tacit knowledge that have taken place. Captive governance may also be costly to switch because of the investments made in organizing the suppliers' network and ecosystem. However, even if the garments industry is an example of a captive GVC governance, other considerations for switching, such as labor costs, also come into play.

Table 2.3.1. Types of GVC Governance

Governance type	Complexity of inter-firm transactions	Degree to which complexity can be mitigated through codification	Capabilities of suppliers to meet requirements	Degree of explicit coordination and control
Market	low	high	high	low coordination and switching cost examples: garments intermediate goods: thread, zipper, etc.
Modular	high	high	high	low coordination; low switching cost to new partners examples: components manufacturing
Relational	high	low; tacit knowledge needs to be exchanged, often by frequent face-to-face interaction	high	high explicit coordination; high switching cost; examples: electronics manufacturing
Captive	high	high	low	high level of support by large buyer or lead firm; captive suppliers frequently confined to narrow range of tasks, for example, assembly; high dependence on lead firm who provides resources and market access; switching cost may be high because of cost of organizing the network but labor cost needs to be factored in example: garments industry
Hierarchy	high	low; control intellectual property	low	high; usually between affiliate companies; intra-firm example: automotive industry

Source: Adapted from Gereffi, Humphrey, and Sturgeon (2005).

The author of this box is Gloria O. Pasadilla.

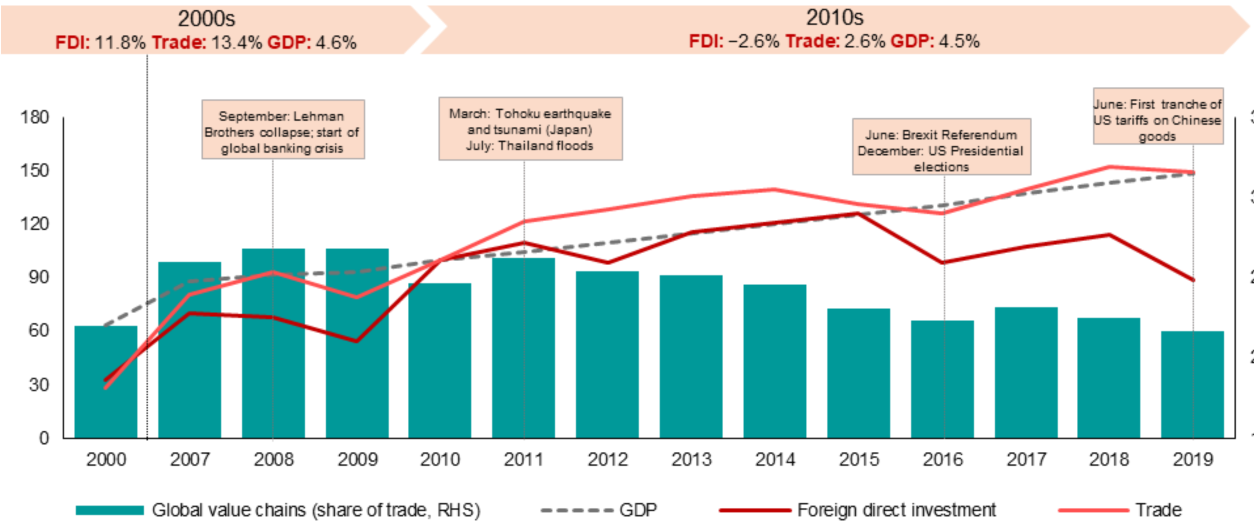
Drumbeats of Potential GVC Reconfiguration

The offshoring decisions by MNEs are known to have been made primarily out of efficiency and cost considerations, underpinned by several economic factors. These factors include (1) cheap labor and low logistics costs of moving products across borders; (2) advances in technology that act as enablers for global operations, easing the coordination costs of managing widely dispersed sources of supply; as well as (3) trade liberalization and open policies that have been, until recently, the prevailing consensus. Encouraged by the rapid growth of exporting economies in Asia, economies have sought more economic and trade integration. After the establishment of the WTO and the conclusion of the Uruguay Round in 1990s, many countries negotiated with other partner economies and signed a slew of regional and bilateral free trade agreements (FTAs) to promote exports, with favorable outcomes for FTA partners, of which is Vietnam is a good example (Box 2.4). Binding commitments, whether from multilateral or regional agreements, support the development of GVCs because they minimize tariffs and other trade transactions costs among partners and, therefore, attract more FDIs.

However, the global trading environment has changed after the GFC and the European sovereign debt crisis. Especially after 2010, the globalization trend and GVC participation declined, along with slowing global trade and FDI (UNCTAD 2020). Two reasons could explain the slowdown in FDI flows. First, non-equity modes of investments (NEMs) became increasingly the method for GVC outsourcing more than direct investments. Second, while manufacturing investments declined globally, technology MNEs increased their investments abroad. Unlike manufacturing industries, however, these new MNEs could reach the global market while being asset-light, for example, without the need to establish significant physical presence in developing economies (UNCTAD 2020) and expend huge capital abroad. Companies such as Uber or Airbnb, for example, can enter foreign markets without owning a transportation fleet or hotels, respectively. Despite the global downtrend in FDI, direct investment flows to the ASEAN+3 have remained strong (Figure 2.12) and continued to increase in the first quarter of 2020, albeit at a slower pace than in the previous decade, until the pandemic caused these to plunge in the second quarter of 2020 (Figure 2.13).

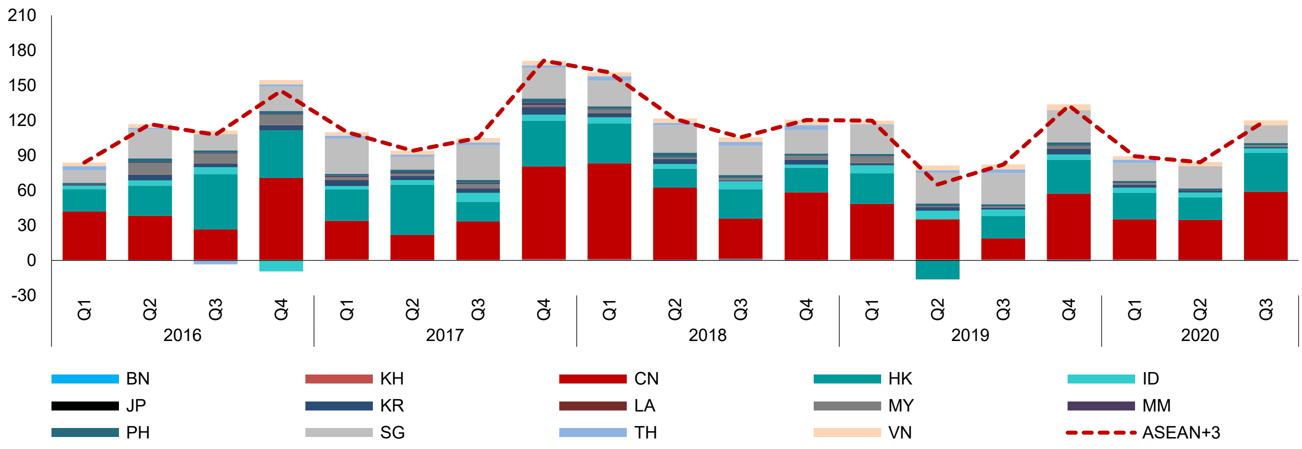
However, the factors that encouraged and propelled the growth of GVC offshoring, namely, open trade policies, low labor and logistics costs, and technology, have started to move in the opposite direction (UNCTAD 2020). In particular, anti-globalization sentiments and protectionism are on the rise, albeit under a different guise. In goods trade, this trend is evident in the rise of non-tariff trade measures such as technical barriers to trade (TBT) or sanitary and phytosanitary (SPS) measures that often seek to compensate for the diminished market protection brought about by years of tariff decline (Figures 2.14–2.16). In general, more protectionist government measures have been observed globally in recent years (Global Trade Alert 2020).

Figure 2.12. ASEAN+3: FDI, Trade, GDP, and GVC Trends, 2000–19
(2010 = 100; Percent of total exports)



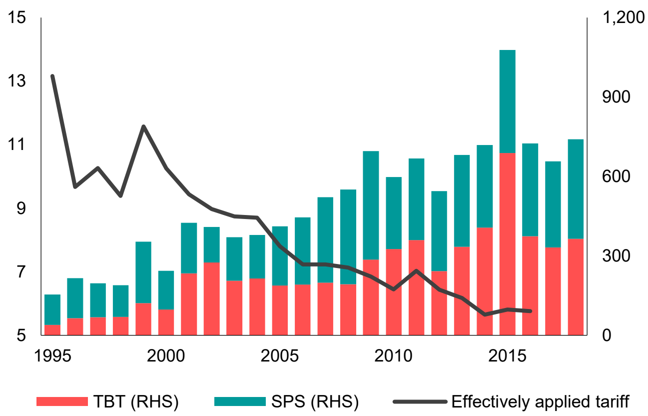
Sources: National authorities via Haver Analytics; and AMRO staff calculations.
Note: Trade refers to total trade of exports and services, while the GVC share of trade is proxied by the share of foreign value-added in exports, as in UNCTAD (2020).

Figure 2.13. ASEAN+3: Inward Foreign Direct Investment Flows
(Billions of US dollars)



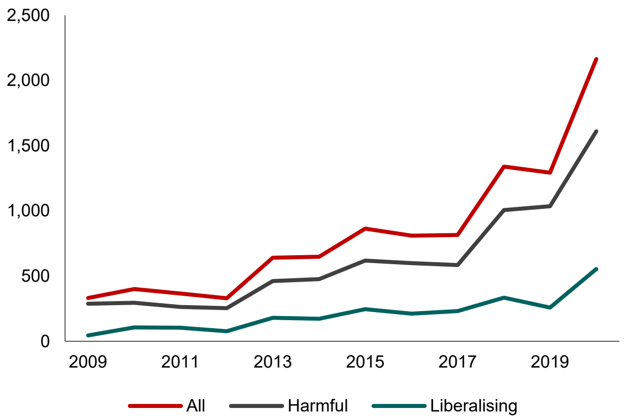
Sources: International Monetary Fund; national authorities via Haver Analytics; and AMRO staff calculations.
Note: BN = Brunei Darussalam; CN = China; HK = Hong Kong; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; LA = Lao PDR; MM = Myanmar; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; VN = Vietnam. Foreign direct investment inflows data refer to direct investment (liabilities) extracted from each economy's balance of payment (BPM6) sourced from the IMF, except for Malaysia whose data are from the national authority. Latest data for Brunei Darussalam are as of Q4 2019; data for Lao PDR and Myanmar are as of Q2 2020.

Figure 2.14. World Trade Organization: TBT and SPS Notifications and Effectively Applied Tariff Rates
(Percent; number of notifications)



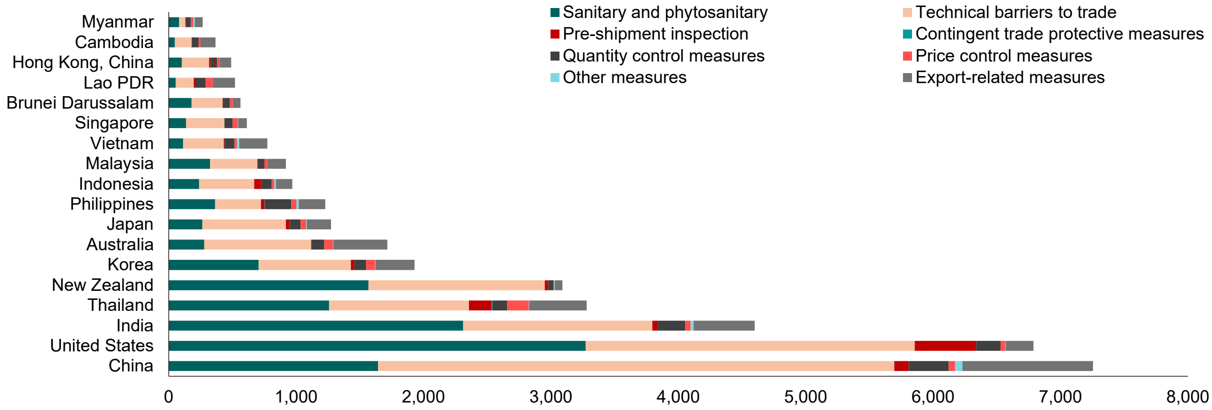
Source: United Nations Economic and Social Commission for Asia and the Pacific (2019).
Note: SPS = sanitary and phytosanitary measures; TBT = technical barriers to trade.

Figure 2.15. World: New Global Interventions
(Cumulative number)



Sources: Global Trade Alert; and AMRO staff calculations.

Figure 2.16. Selected Economies: Non-Tariff Measures
(Number of measures)



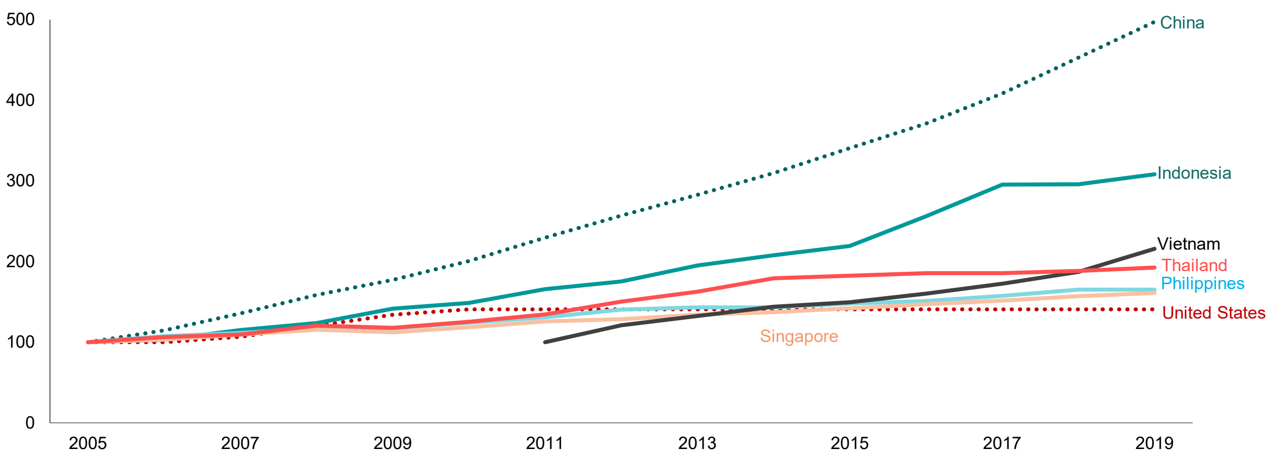
Sources: United Nations Economic and Social Commission for Asia and the Pacific (2019); and UNCTAD TRAINS database (2020).

Second, labor costs in Asia, especially in China, have also risen faster than in other economies, diminishing a major attraction for offshoring (Figure 2.17). Even technology that initially spurred firms' decisions to offshore has developed in such a way that some products can be produced more cheaply in the source countries, such as in the United States and Europe, despite the higher labor cost. Some of the advanced technologies also require skilled manpower which is in relatively greater abundance in developed economies. Outsourcing and advances in technology have also led to job losses and rising income inequality (Box 2.5), adding to the political and popular pressure to onshore jobs and bring GVCs back home. Technology is a major trade issue that affects MNEs and GVCs and it is discussed in greater detail in Section III. Most importantly, the former Trump administration had rejected the rules-based multilateral trading system as unfair, preferring to adopt a bilateral approach toward international trade. As a result, bilateral relations between the United States and China have deteriorated sharply in the last few years. For many MNEs, cost, efficiency, and profitability are no longer the only factors to consider in their outsourcing investment decisions; they must also take into account geopolitical developments. Most importantly, geopolitical considerations, specifically those between the United States and China, are expected to remain a major factor (ACC 2020) and will likely impact the GVC reconfiguration going forward.

Resilience is another important consideration by MNEs that has risen to the fore because of the massive disruptions brought about by the recent pandemic and natural disasters in the 2010s. Disruptions to global supply chains caused by natural disasters and pandemics highlighted the risks to having widely dispersed supply chains, especially of critical products such as medical supplies, which are concentrated in a few economies. While in the past, the focus was mostly on operational efficiency and costs, supply chain decisions now put a premium on risks, heretofore unpriced and ignored. When an earthquake and tsunami struck Japan and flooding occurred in Thailand in 2011, the auto and electronics global supply chains were disrupted because suppliers from Japan, many of them SMEs, could not produce the necessary parts and components. Similarly, Thailand's floods brought to the global computer industry to a standstill, as hard disk drives—90 percent of global supply comes from Thailand—could not be produced.

These various reasons—such as increasing costs in formerly low-wage economies, technology advancements that require high-skilled labor, desire to build more robust supply chains to avoid disruptions, rise in populist movements and protectionism—explain the rising interest among governments and foreign companies for reshoring and reconfiguring the existing global supply chains. Indeed, even before the pandemic, the relocation of production facilities was already occurring. For example, in 2012, General Electric reshored a portion of its appliance manufacturing in Kentucky. It had struggled with inventory and delivery issues in its China facilities that had offset its savings on labor costs. More importantly, because its high-end appliance customers are mostly based in the United States, the company found it more cost-effective to be close to its market. The COVID-19 pandemic has heightened concerns over supply disruptions and, for some MNEs, accelerated plans and decisions toward alternative GVC outsourcing strategies. For example, the pandemic has prompted Google and Microsoft to move part of their production lines of mobile phones and earphones, respectively, from China to Vietnam (Ting-Fang and Li 2020a, 2020b).

Figure 2.17. Selected ASEAN+3 and United States: Wages
(2005 = 100)



Sources: National authorities via Haver Analytics; and AMRO staff calculations.
Note: Data for China and India refer to the average nominal annual wage of all units; for Indonesia, average net wages of employees; for the Philippines, the legislated daily wage rate; for Singapore the average resident monthly earnings of industry; for Thailand, the average monthly wages per person; for the United States, the minimum hourly wage rate; and for Vietnam, the average monthly earnings.

Box 2.4:

Free Trade Agreements and GVCs: The Case of Vietnam

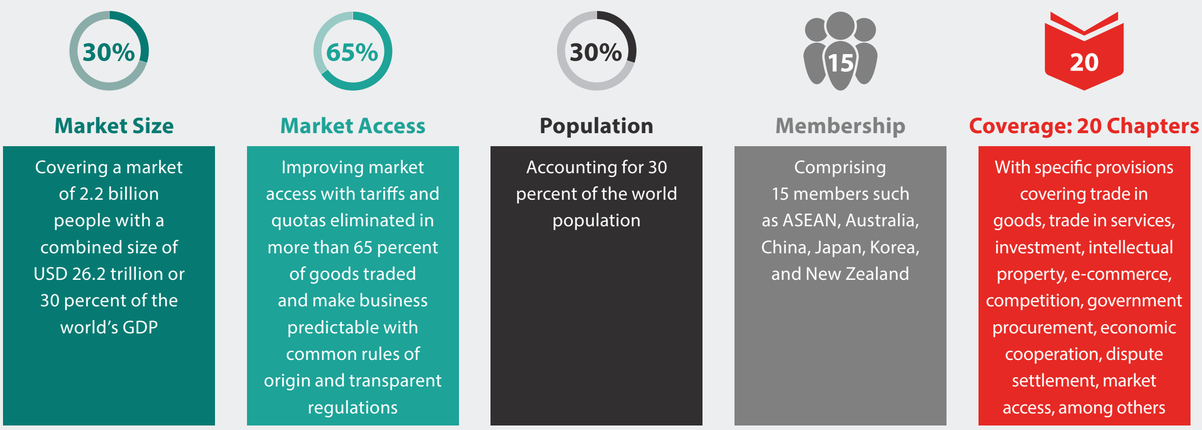
Trade agreements, especially high-quality ones with deep liberalization commitments, can be a mechanism for an economy to signal that it is "open for business." An economy's commitment to liberalize its market, open its sectors to foreign investment, and bind lower tariffs, can constrain its policy discretions but does not completely eliminate them. Yet, such commitments and bindings provide certainty to market participants and thus help enhance investor confidence. More importantly, preferential access to the markets of its partners as dictated by trade agreements is a strong impetus for foreign investors who are interested precisely in the benefits of preferential access.

Trade rules encapsulated in trade agreements impact the architecture of GVCs. For example, in the apparel industry, the now-defunct Multifibre Agreement (MFA) had spurred the growth of global production networks in apparel since the 1970s in economies with available quota. When the MFA was abolished in the 1990s and replaced by the WTO Agreement on Textiles and Clothing, apparel production became concentrated in a few low-cost production economies such as China, India, Indonesia, and Turkey (Gereffi, Humphrey, and Sturgeon 2005).

Vietnam is an ASEAN+3 economy that has benefited from GVC investments seeking to diversify sourcing from China (Choi and others 2021). It has the standard economic characteristics that are attractive to investors, such as low wages, good infrastructure, duty-free access to major markets, fiscal and investment incentives, and political stability. But very likely, its openness and ability to sign regional trade agreements as well as a number of bilateral trade deals have also contributed to its newfound success in attracting investments. For example, Baier and Bergstrand (2007) find that an FTA approximately doubles partners' bilateral trade after 10 years. Similarly, Kohl (2014) finds that trade agreements can increase trade by nearly 50 percent but the results vary significantly among different trade agreements depending on their institutional quality, agreement design, as well as their involvement in the WTO.

Vietnam, along with Malaysia and Singapore, are signatories of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP).[1/] It is also part of ASEAN FTA, ASEAN+1 FTAs with Australia and New Zealand, China, India, Japan, Korea, and the newly signed Regional Comprehensive Economic Partnership (RCEP) (Figure 2.4.1). It also has bilateral trade agreements with the United States, the European Union, Korea, Japan, China, Chile, and Hong Kong (Figure 2.4.2). It is therefore no surprise that there has been a surge in FDI flows into Vietnam, leading to a four-fold increase in capitalization of foreign projects from 2010–19. These FDI flows, in turn, have sharply boosted exports, much of which come from sectors with significant FDI (Figure 2.4.3).

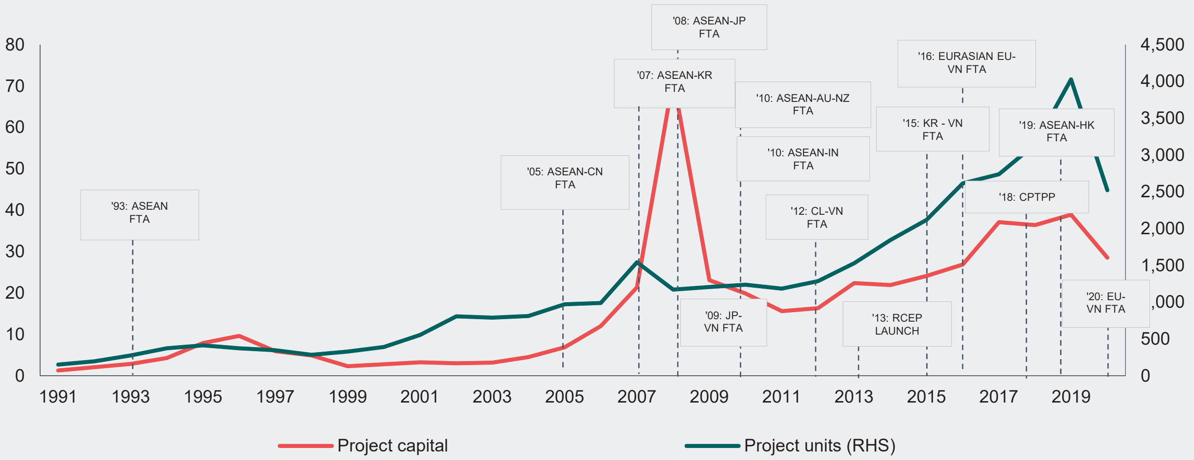
Figure 2.4.1. Regional Comprehensive Economic Partnership—An Infographic



Source: ASEAN Secretariat.

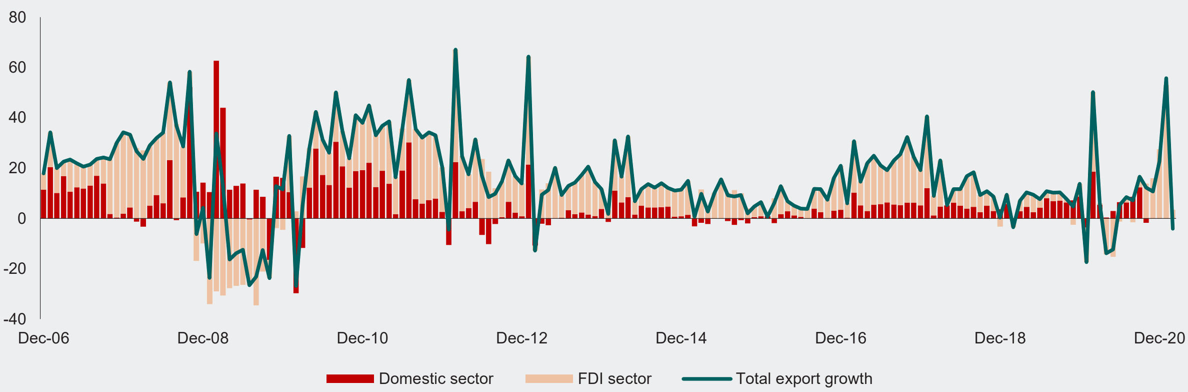
1/ The CPTPP came into force for Vietnam in January 2019. It gives it preferential market access to 11 countries in the Asia-Pacific including advanced economies such as Australia, Canada, Japan, Korea, and New Zealand.

Figure 2.4.2. Vietnam: Inward FDI Flows and Free Trade Agreements, 1991–2019
(Billions of US dollars; Number of projects)



Sources: Asian Development Bank; national authorities via Haver Analytics; and AMRO staff calculations.
Note: CN = China; CL = Chile; FTA = free trade agreement; HK = Hong Kong; IN = India; JP = Japan; KR = Korea; and VN = Vietnam.

Figure 2.4.3. Vietnam: Contributions to Export Growth by Type of Enterprise
(Billions of US dollars)



Sources: National authorities via Haver Analytics; and AMRO staff calculations.
Note: FDI = foreign direct investment.

The authors of this box are Marthe Hinojales and Gloria O. Pasadilla.

Box 2.5:

Technology, Jobs, and Equity

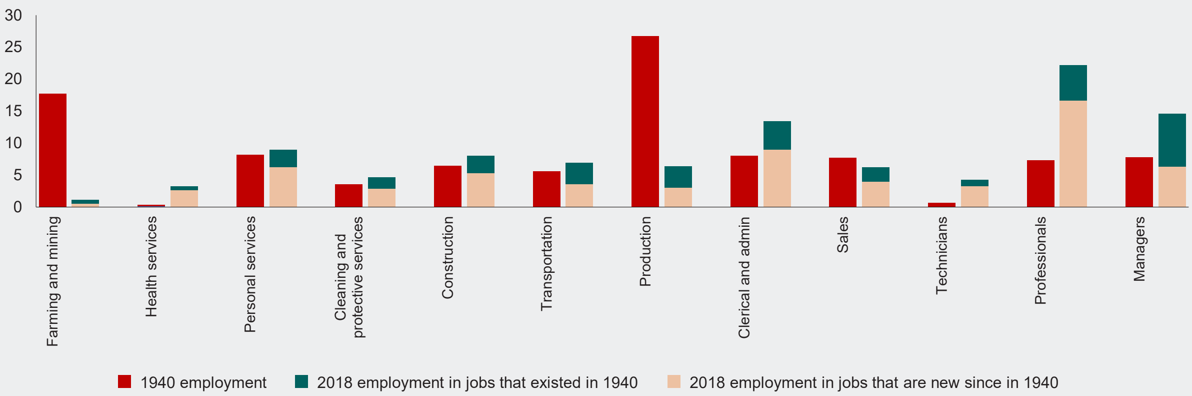
Will automation and artificial intelligence (AI) replace humans in the workplace? History tells us that technology can be a very disruptive force, eliminating traditional jobs but also creating new business models and jobs. A study by the Massachusetts Institute of Technology on the future of work shows that, historically, some types of dominant occupations such as farming and production work have almost disappeared, while other occupations like managers and other professions have expanded sharply (Autor, Mindell, and Reynolds 2020) (Figure 2.5.1). A World Economic Forum study on the future of jobs projects that 75 million jobs might be displaced by machines and algorithms but 133 million new jobs could be created (WEF 2020b). Some of these new jobs have descriptions that did not even exist until recently, such as big data analysts, AI trainers, AI translators, and AI specialists, blockchain traders, and cybersecurity specialists.

Some technologies lead to deskilling of the workforce (Tschang and Mezquita 2020), resulting in the loss of routinized, middle-skilled work. This, in turn, aggravates the polarization into low- and high-skilled jobs, and a distorted employment structure with only a small minority at the top. This structure appears to be reflected in the polarized employment growth between high- and low-paid jobs, with middle-skill level employment appearing to be hollowed out (Figure 2.5.2). The low-paid occupations are manual service jobs like personal services that demand, besides physical dexterity, "situational adaptability or context-recognition." Studies show that this ability is difficult to be replaced by machine learning AI, while it is possessed by adults with even modest levels of education (Tschang and Mezquita 2020).

Job polarization is, in turn, reflected in living standards that have enriched the few at the top without lifting up those at the bottom. Technological innovation has made some highly educated workers more productive and exceptionally well paid. Since 1973, average compensation in the United States has lagged productivity growth while median compensation has basically stagnated, leading to a widening gap between median and average compensation (Figure 2.5.3). Indeed, the median wage has stayed close to the average wage of relatively low-skilled production workers, which implies that most of the productivity gains, and hence income, for more than half a century have accrued to those at the higher end of the income scale.

This finding of highly skewed distribution of benefits from productivity has profound implications for income distribution and equity, and is one factor fueling the rise of protectionism in the United States. This trend could stem from the offshoring of innovative technologies being perceived as having prevented wage increases in the United States (Figure 2.17).

Figure 2.5.1. Dominant Jobs, 1940s versus 2018

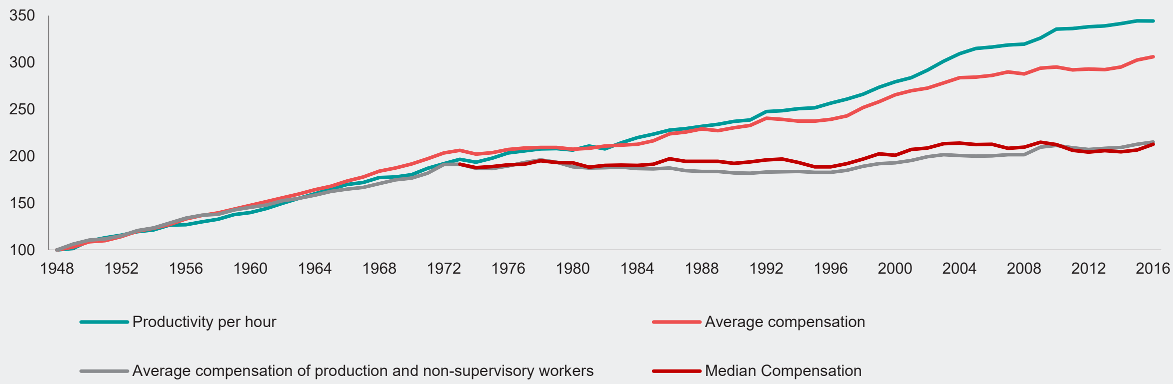


Source: Autor, Mindell, and Reynolds (2020).

Figure 2.5.2. United States: Employment by Salary Scale
(Percent, year-over-year)

Source: Autor, Mindell, and Reynolds (2020).

Figure 2.5.3. United States: Average versus Median Compensation
(1948 = 100)



Source: Autor, Mindell, and Reynolds (2020).

The author of this box is Gloria O. Pasadilla.

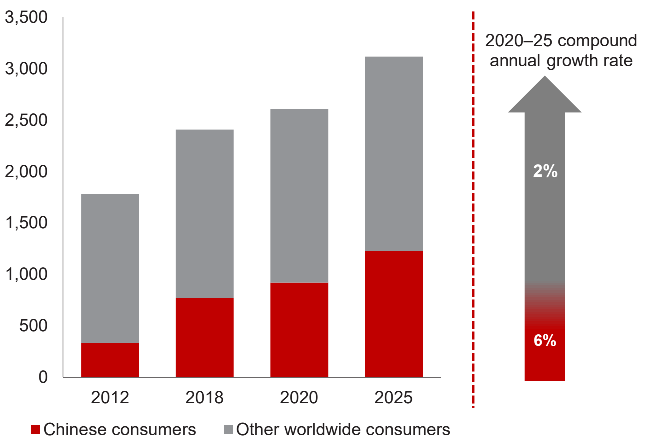
Arguments against GVC Reconfiguration

Several arguments against GVC reconfiguration, however, are for maintaining the status quo. First, Asia, led by China, is one of the fastest-growing regions in the world (AMRO 2020). It is expected that by 2030, more than 70 percent of the Chinese population could be middle-class consumers, up from only 3 percent in 2000 (CSIS 2020) and would consume approximately USD 10 trillion of goods and services (EC 2020). Southeast Asia's middle class is also projected to reach 163 million households by 2030, up from about 80 million a few years ago (McKinsey & Company 2019b). By 2030, the ASEAN+3 region could account for 42 percent of global urban consumption growth, with China doubling its consumption of luxury goods to CNY 1.23 trillion by 2025—or some 40 percent of the global luxury goods market (Figures 2.18–2.19). Because proximity to consumers is an important consideration for GVC location, it would make sense to locate supply chains closer to the fast-growing markets of China and the rest of ASEAN+3, which is why so many foreign auto makers, for example, are located in China.[8/]

Second, the deep supply chains and ecosystem in China are difficult to replace and replicate in just a few years. Over time, this might be possible, but the "stickiness" of GVC investments and relationships points to difficulties ahead for alternative GVC strategies. This stickiness among GVC participants is due to sunk investment costs, including the matching and search costs expended to find the right suppliers and buyers. Once a partnership is established, relationship-specific investments—either in the form of specialized equipment or customized products or inputs—are formed, along with the complex exchange of intellectual property, designs, technology, or even credit in some cases. These exchanges require trust that is built over time through repeated interactions among GVC participants, making up for the weak legal environment that often exists in many emerging markets. This is why firms spend considerable time and resources deciding whether transactions should occur within or across firm boundaries and in designing the organizational structure of their production networks (Antras 2020).[9/]

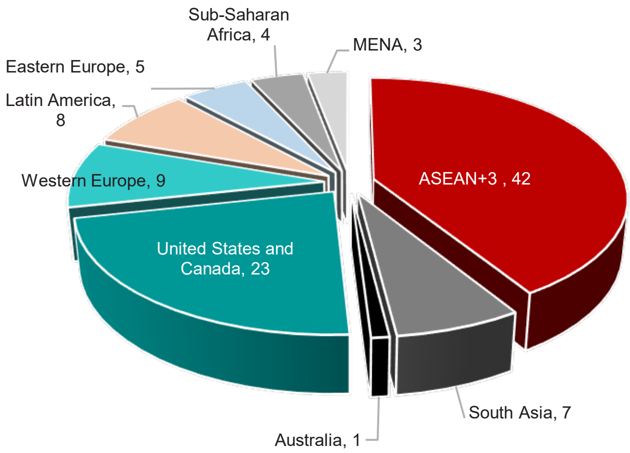
In addition, exiting China and reshoring back to the United States are efforts that have also not been easy. Winding up operations in China requires careful attention to detail. For example, the company might have outstanding long-term labor contracts that are difficult to withdraw from. There are also taxes and other fees to settle, and in some cases, permission from the government is needed, before a company can fully close down its operations in China (Coates 2020). Skilled labor availability in the reshoring destination can also be a challenge. For example, in its first year of relocation, a company that reshored to South Carolina found it challenging to get workers to operate its advanced equipment in the United States.

Figure 2.18. China and the Rest of the World: Spending on Luxury Goods
(Billions of Renminbi)



Source: McKinsey & Company (2019a).

Figure 2.19. Share of Urban Consumption Growth, 2015–30
(Percent)



Sources: McKinsey & Company (2019b); and AMRO staff calculations.

8/ In theory, GVCs can be located anywhere and still be able to sell to a large domestic market. In practice, however, an important consideration for MNEs in locating subsidiaries or affiliates, especially if they are chasing demand, is a large and growing domestic market (see, for example, Cohen and others (2018)). Likewise, in an industry that caters to fast-changing consumer preferences, for example, the fashion or luxury car industry, having a presence in the market allows MNEs to make quicker adjustments. Finally, rules and regulations in the destination market, such as local content requirements or rules of origin become, additionally, a pull for GVCs to locate in a large domestic market, along, of course, with other considerations like labor cost, technology, and logistics, among others.

9/ According to US customs data, close to 50 percent of US imports involve related-party transactions. Globally, intra-firm trade is about one-third of total world trade flows (Antras 2020). This shows high degree of vertical integration and the importance of direct investments despite the existence of alternative "arm's-length" GVC relationships such as contracting or licensing.

To summarize, while compelling arguments exist both for the reconfiguration and the maintenance of the current GVC structure, it is likely that the experience of supply chain disruptions of critical products during the COVID-19 pandemic, the heightened protectionist environment, and changed geopolitics, could prompt more MNEs to reconfigure their existing China-centered supply chains. In much the same way that more Japanese multinationals regionalized their production chain in the aftermath of the 2011 Great East Japan Earthquake, more MNEs operating in GVCs that are highly dependent on China, will seek to diversify suppliers to build resilience. Still, to leave China or Asia altogether is not an option because growth in the coming decades will come mostly from the ASEAN+3 region (AMRO 2020). Therefore, a China+1 strategy appears to be the preferred strategy among various alternatives to build greater resilience and achieve diversification.[10/] Additionally, to maintain a major presence in Asia, the plus-one location needs to be based in Asia. In a China+1 strategy, ASEAN economies stand to gain in attracting many of the GVC-related investments. Indeed, many ASEAN economies are positioning themselves to attract such investments.

Emerging Evidence of GVC Reconfiguration

Is any reconfiguration strategy already evident in the data, especially in planned foreign investments? Evidence from planned investments data, so far, appears ambiguous. On one hand, project announcements from foreign investors to the ASEAN+3 region, both in terms of number of projects and project values, fell in 2019 and 2020, but global investments did as well (Figures 2.20–2.21). In other words, the drop in planned investments may have been because of the global recession and uncertainties over the global economic outlook arising from the COVID-19 pandemic rather than any reconfiguration trend. On the other hand, the sharp rise in FDI projects into ASEAN economies starting in 2018 points to a possible China+1 GVC reconfiguration strategy in the wake of the US–China trade tensions.[11/] These could continue and even accelerate in the post-pandemic period, with ASEAN economies being the prime recipient of diverted investments from China.

Reflecting the trade tensions and the improving investment climate in member economies, more relocation investments are expected to move to ASEAN. Recent data from Orbis Crossborder show that 14 out of 33 relocation projects went to ASEAN, while China received 9, Hong Kong 2, and Japan and Korea 8 in 2020 (Table 2.1). Of these projects, 11 of them were in manufacturing, accounting for USD 10.5 billion, of which 7 are going to Indonesia. The remainder of the projects are distributed across a range of services activities, including establishment of regional headquarters, business services, data centers, and logistics and distribution activities (Table 2.1). The United States accounted for the highest number of relocation projects in 2020, followed by Japan, Korea, and Switzerland. In terms of value, US relocation projects stood at USD 318 million, slightly behind similar projects from Japan. These went to Japan, Korea, and Singapore (sales offices), Japan and Malaysia (regional headquarters), Indonesia and Malaysia (manufacturing plants) and the Philippines (customer contact center). None went to China. The relocation projects to China in 2020 were from European countries and catered to the domestic market.

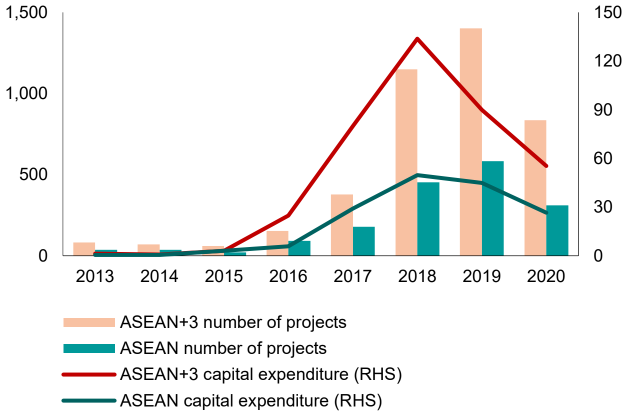
Some investments that have moved from China to other economies in the ASEAN+3 region include Tier 1 suppliers of big multinational firms. For example, Hyundai Mobis, a supplier of auto parts for Hyundai Motor and Kia, Samsung Electronics, and LG Electronics moved back to Korea, partly to escape from the tariff war. GoerTek, a major supplier of Apple's wireless earphones, moved parts of its assembly to Vietnam, following a similar announcement from Apple, also to dodge fallouts from the US–China tariff escalation.

Interestingly, from 2017 until 2020 when COVID-19 hit, regional economies had become a top source of FDIs in the ASEAN+3 (Figure 2.22). In 2018 and 2019, ASEAN+3 economies' intra-regional investments reached 32 percent of total announced investment projects, but dropped to about 26 percent in 2020. China, in particular, had been catching up with Japan especially in 2018 and 2019. A deeper look into the investor companies in China, however, shows that in the last three years, about half of the project announcements that originated from China to ASEAN were made by foreign enterprises that were based in China (Figure 2.23), rather than by Chinese enterprises. Moreover, most of the foreign China-based investing enterprises were also Asian-owned, led by Hong Kong, followed by Vietnam, Thailand, Malaysia, and Singapore. These new projects were mostly geared toward their home economies. For example, China-based Vietnam investment announcements were bound for Vietnam, and the same for Thailand, Hong Kong, and Malaysia. Although a large part of China-based Singapore investments was destined for Malaysia, the bulk of it was still invested in Singapore. It is possible that these "round-tripping" investments were trying to take advantage of foreign investment incentives in their home markets.

10/ China+1 strategy is a GVC strategy that seeks parallel supplier networks to lessen over-dependence on China.

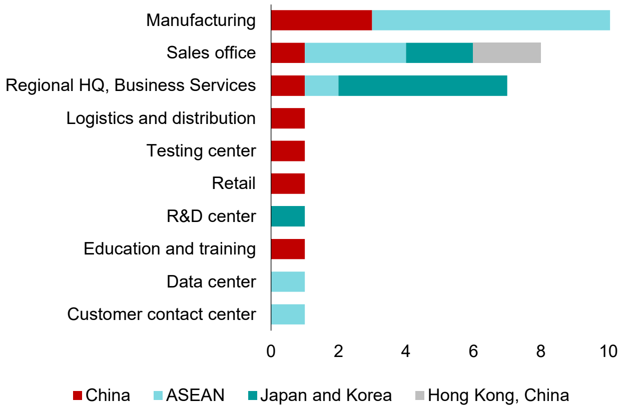
11/ In 2020, ASEAN penciled in 37.2 percent of the region's total inward announcement and 48 percent of the estimated capital expenditure (roughly valued at USD 26.5 billion).

Figure 2.20. ASEAN+3: Annual Inward Project Announcements
(Number of projects; billions of US dollars)



Sources: Orbis Crossborder; and AMRO staff calculations.

Figure 2.21. ASEAN+3: Inward Relocation Announcements by Sector, 2020
(Number of projects)



Sources: Orbis Crossborder; and AMRO staff calculations.
Note: HQ = headquarters; R&D = research and development. Logistics and distribution include transportation.

Table 2.1. ASEAN+3: Inward Relocation Announcements, 2020

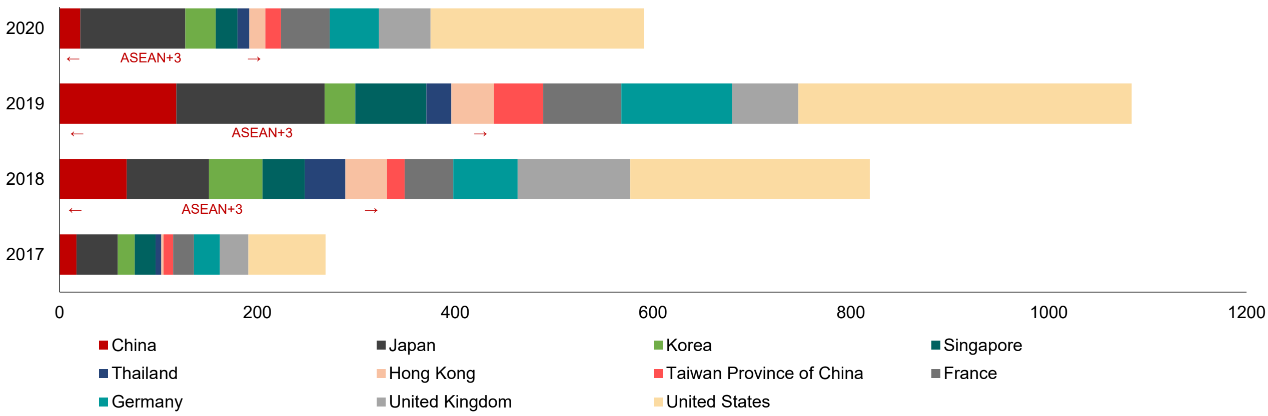
Project sector	Project headline
Customer Contact Centre	Uber Technologies to relocate its customer contact center to Manila, Philippines
Data Centre	Naver to relocate its data center to Singapore
Education & Training	Interroll Holding AG to relocate its training center in Suzhou, China
Logistics and Distribution	DHL Express to relocate distribution center in Sakai, Japan
Manufacturing	CDS to relocate its lighting product manufacturing plant from Xiamen, China, to Java, Indonesia
	Denso to relocate its electronic component manufacturing plant in Batang, Indonesia
	Hempel A/S to relocate its protective coatings factory in Zhangjiagang, China
	Hempel to relocate its protective coatings manufacturing plant in Yantai, China
	Interroll Holding AG to relocate its conveyor roller manufacturing plant in Suzhou, China
	LG Chem to relocate its lithium battery manufacturing plant in Batang, Indonesia
	LG Chem relocate its nickel smelter in Batang, Indonesia
	Meiloon to relocate audio and visual products factory to Subang Jaya, Indonesia
	Panasonic to relocate its electronic component manufacturing plant in Batang, Indonesia
	Sejin Fashion to relocate footwear manufacturing plant in Pati, Indonesia
	Tremco to relocate adhesive and sealants manufacturing plant in Serendah, Malaysia
R&D Centre	Hempel A/S to relocate its research and development centre in Zhangjiagang, China
Regional Headquarters Business Services	Asiamet to relocate its regional headquarters to Jakarta, Indonesia
	Dassault Systems to relocate its regional headquarters in Shanghai, China
	Deriv Services to relocate regional headquarters in Cyberjaya, Malaysia
	Greenpro Capital to relocate regional headquarters to Kuala Lumpur, Malaysia
	JAE to relocate its regional headquarters in Hong Kong
	U-Freight to relocate its regional headquarters in Incheon, Korea
	Yext Japan to relocate its sales office in Tokyo, Japan
	Kennedys Law to relocate its legal office in Hong Kong
Retail	Interroll Holding AG to relocate its showroom in Suzhou, China
Sales Office	Amazon.com to relocate its sales office in Singapore
	ClassNK to relocate its sales office in Busan, South Korea
	JAE to relocate sales office in Seoul, South Korea
	New York Times Company to relocate its sales office to Seoul, South Korea
	Nord Lock to relocate sales office in Shanghai, China
	ON24 Inc to relocate its sales office in Japan
	Xiaomi to relocate sales office in Japan
Testing Centre	Interroll Holding AG to relocate its testing center in Suzhou, China

Source: Orbis Crossborder.

Business surveys, like planned investment announcements, also point to ambiguous future directions for the reconfiguration of GVCs. Certainly, no evidence has emerged of any large-scale withdrawal from China. In fact, many companies appear to remain bullish about China, although tempered by ongoing US–China tensions. In a July 2020 survey of 346 American companies in China, 79 percent reported no change in investment allocations in 2020, suggesting plans for neither relocation nor reshoring. However, the percentage of companies that plan to increase investment in China decreased from 47.2 percent in 2019 to 29 percent in 2020, likely due to the heightened US–China tensions, which a third of the respondents expected to continue for the long term (ACC 2020). In another ACC survey after the November 2020 US election, companies were asked about their de-risking plan under the Biden administration. More than half of the 124 surveyed MNEs expect no change in investment plans, 13.7 percent expect an increase, while only 5.6 percent will "commence, continue or consider a China de-risking strategy" (Bloomberg 2020).

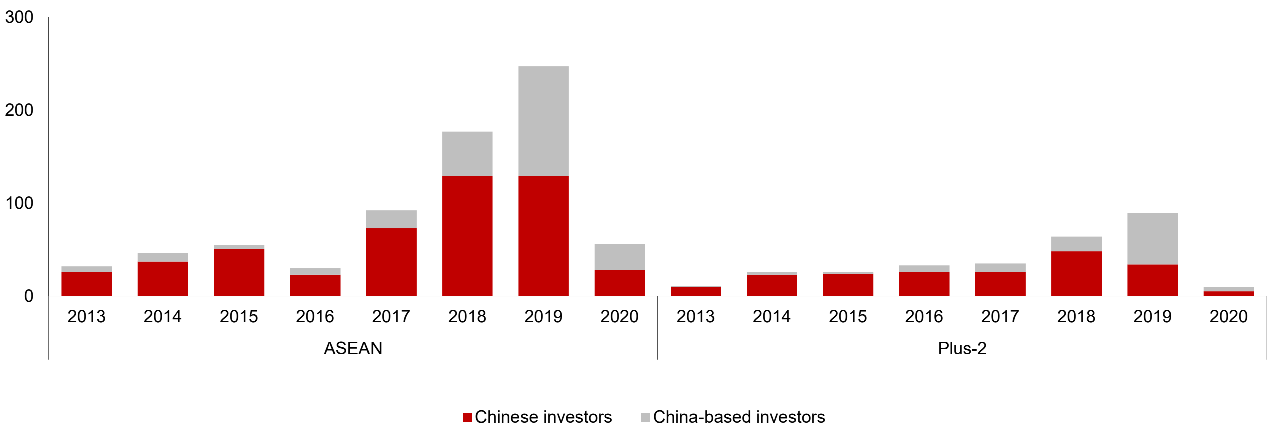
The de-risking strategy of companies can mean many things, but most likely includes building resilience in their supply chains. Multinational surveys in the aftermath of the pandemic show that companies are keen to employ multiple resilience strategies, instead of merely moving geographically (McKinsey & Company 2020a). An August 2020 McKinsey & Company survey suggests dual sourcing, increasing inventory of critical products, nearshoring, and regionalizing the supply chains as among the top options (Figure 2.24). Of these, dual sourcing, regionalizing supply chains, and backup production sites appear to support a China+1 GVC strategy, which would be favorable to ASEAN, while reshoring or nearshoring would benefit other regions like Latin America and Mexico (with respect to US MNEs) and Eastern Europe (with respect to European MNEs).

Figure 2.22. ASEAN+3: Top Sources of Inward Project Announcements
(Number of projects)



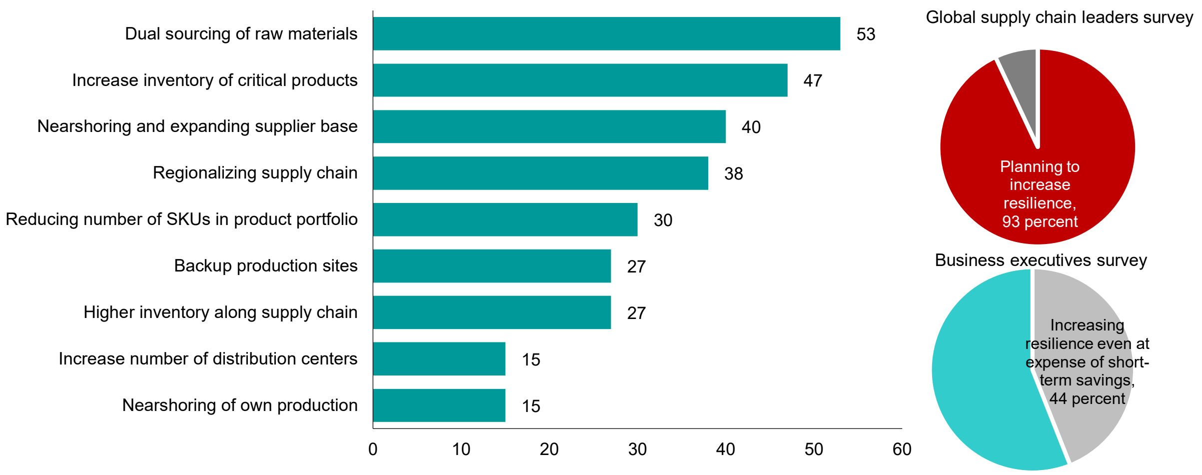
Sources: Orbis Crossborder; and AMRO staff calculations.

Figure 2.23. China: Investment Announcements to ASEAN+3 by Ownership
(Number of projects)



Sources: Orbis Crossborder; and AMRO staff calculations.

Figure 2.24. Corporate Survey: Planned Actions to Build Resilience
(Percent of total respondents)



Source: McKinsey & Company (2020a).
Note: SKUs = stock-keeping units. Global supply chain leaders and business executives' surveys as of May 2020.

Which GVC Sectors can be Easily Reconfigured?

If reconfiguration takes place, rather than the entire production supply chain, what will likely be relocated are some stages of the supply chains that exhibit certain characteristics. In particular, GVC nodes that are labor-intensive and do not require high skill levels, such as assembly operations—even in capital-intensive industries like automobile or machinery and electronics—are more likely to move because they are sensitive to labor costs. They are also easier to relocate because less tacit knowledge is needed in the assembly phase.[12/]

In general, based on an analysis of GVC governance (Box 2.3), the stages that involve no large fixed costs both when setting up or closing down, require neither high-skilled workforce nor tacit knowledge, and those that entail simple routine work processes, are strong candidates for relocation from China when trade costs or geopolitics come into play. However, GVC nodes that have high sunk costs (like hierarchy or relational GVCs) will be difficult to uproot, and if ever, will take a longer period of time. Likewise, GVCs of companies that cater to the domestic China market are unlikely to move out.

For GVCs that move out, among the key considerations for location would still be economic factors such as labor costs, as well as infrastructure quality, ICT development, skilled labor availability, and market size.[13/] Based on these factors, ASEAN+3 economies compare well with those in other regions. The "Transferability" index, a simple average of of the z-scores of nine chosen indicators is relatively high for most ASEAN+3 economies, compared to those in Latin America, Africa, or emerging Europe (Figure 2.25). Eastern Europe's infrastructure, labor quality, and ICT development provide the region with a significant advantage as possible locations for GVCs, but its labor costs are relatively high. Within the ASEAN+3, Malaysia and China score the highest, but Malaysia's labor costs are relatively high, in the same league as Thailand, and to a lesser extent, Brunei Darussalam. Indonesia's advantage is its large market size but it lags in other indicators. Similarly, the Philippines' advantage is its low labor costs, but it could gain higher scores if it accelerates its program for infrastructure development, including ICT.[14/]

Despite rising labor costs and bilateral tensions with the United States, China remains a strong contender for GVC location because of its huge domestic market and highly developed ecosystem for manufacturing, which make decoupling from China difficult. The case of the apparel and garment industry is an example of the challenge of ignoring China in the supply chain. Labor-intensive, this sector has already started to move its supplier base to low labor-cost locations such as Bangladesh or the CLMV economies. Yet China, even with its higher labor costs, remains the biggest global player for garments. This outcome is attributable to the fact that China has upgraded itself in the garment GVC over time and captured the more capital-intensive parts of the value chain, such as fabrics and components manufacturing. It has an extensive supply network for yarns, dyes, fasteners, zippers, trimmings, and the like. Some Chinese firms have

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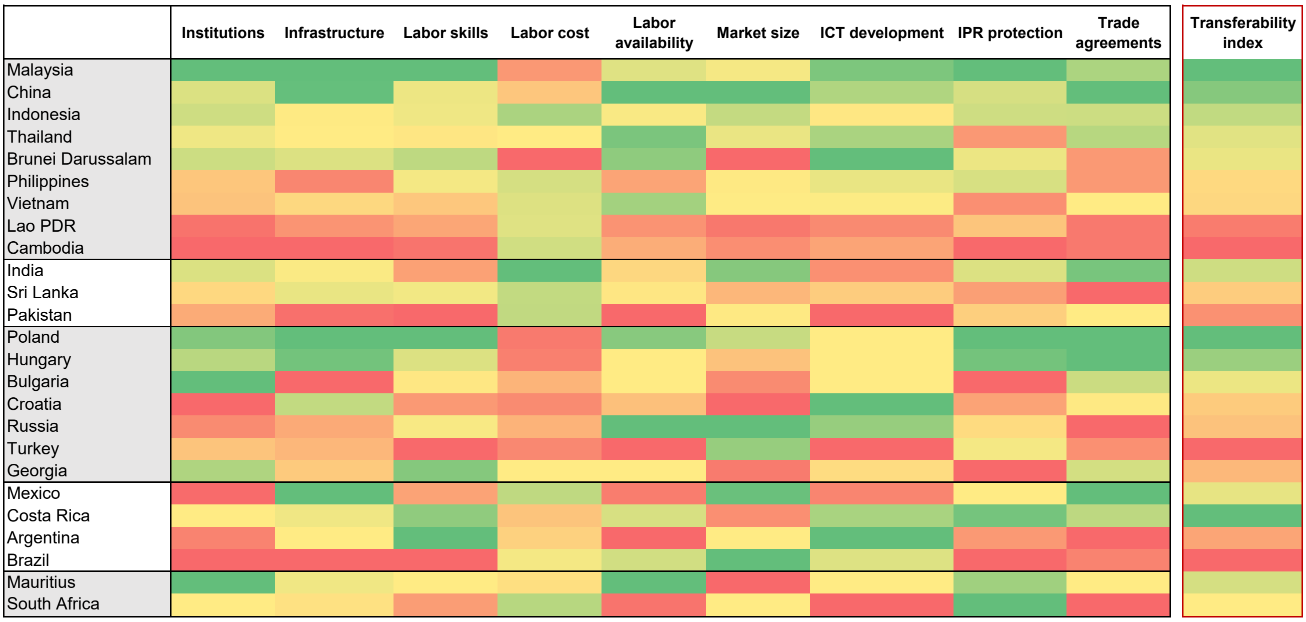
12/ The "modular" type of GVC governance is an example of where less tacit knowledge is exchanged.
13/ Other factors such as geopolitics may well be important going forward, but are hard to capture in available indicators.
14/ Indeed, the current Philippine administration has been pushing strongly toward infrastructure and ICT development. In the legislative front, the recently-passed Internet Transactions Act (House Bill No. 7805) complements the administration's initiative by passing a regulation protecting consumer and data privacy in commercial activities carried out through the internet.

Figure 2.25. Heatmap for GVC "Transferability"
(z-scores)



Sources: Asia Regional Integration Center, ADB; International Labour Organization; World Economic Forum; World Bank; World Trade Organization; United Nations International Telecommunication Union; United Nations Population Division; national authorities via Haver Analytics; and AMRO staff calculations.
Note: Underlying data are calculated z-scores for a group of 46 developing economies, with the above a selected subset. Data for institutions, infrastructure, labor skills, and IPR protection are from the World Economic Forum's scores for each particular indicator, as of 2019. Market size refers to latest data point for private consumption (as percent of GDP) from the World Bank World Development Indicators. ICT development is from the United Nations ICT Development Index, as of 2017. Labor cost refers to the mean nominal monthly earnings of all employees, at purchasing power parity in 2017 (international dollars, as of the latest year) from the International Labor Organization and national authorities, where applicable. Labor cost for India refers to the average monthly earnings for the manufacturing sector, while for Mauritius, it is the designated minimum wage. Trade agreements refer to the absolute number of agreements the economy is a signatory of. Labor availability refers to the ratio of the working-age population (ages 20– 64 years old) to the overall population as of 2020, based on the United Nations Population Division. The overall Transferability index is a simple average of the nine indicators for each economy. The greener the color, the higher its relative z-score and the greater the GVC transferability to that economy or location; the redder, the lower the attractiveness for GVC relocation.

upgraded well enough and have even automated, using industrial robots ("sewbots") to overcome the constraints of higher wages and an aging Chinese workforce. These firms can afford to move even to high-wage locations like the United States because proximity to consumers is a key factor supplanting wage considerations in the fashion industry.

What the ASEAN+3 Region Can Do

The potential for GVC reconfiguration presents an opportunity for ASEAN+3 economies to enhance and upgrade their participation in GVCs, and not shy away from closer integration with one another and the rest of the world. Developing economies in the ASEAN region, for example, stand to gain from a China+1 GVC strategy of foreign MNEs who want to remain in Asia for the long term. Some, like the CLMV economies, can still leverage on their relatively low labor costs to attract GVC investments. However, this approach alone will not be sufficient in the long term, not only because there are other low-cost locations such as South Asia and Africa, but also because technology is making labor costs a less important factor. Countries need to improve other equally important factors to make themselves more attractive to foreign investments. Time and again, the experiences of economies that succeeded in hosting GVCs highlight the importance of having a predictable and efficient business environment, relatively skilled labor, and efficient infrastructure.

Strong GVC participation is linked to several factors for competitiveness, but especially to good hard and soft infrastructures. Thanks to technological advances, distance is no longer a major obstacle to trade, but logistics costs and connectivity are. The challenge for some ASEAN economies going forward is how to fund the building of hard infrastructure, especially as their fiscal space has narrowed considerably because of the massive fiscal stimulus spending during the pandemic (Box 2.6).

The middle-income ASEAN economies may have the edge in attracting the more knowledge-intensive industries because these depend on specialized and reliable suppliers and higher-skilled labor. However, these countries, too, need to invest in continuous skills upgrading, especially as more industries shift to 4IR products and technologies (AMRO 2020). Economies that are already plugged into GVCs should invest more in R&D and process upgrading to capture more value in the supply chain and, at the same, increase the productive capacity of the economy—just as China has done over the years. Additional soft infrastructure improvement will also help, such as Indonesia's recent enactment of the Omnibus Law to liberalize the labor market, open more sectors to foreign investment, and remove red tape that shackle the economy (Box 2.7).

Many ASEAN economies will want to acquire technology through GVC investments, but such technology transfers are not a matter of course. Lead MNEs usually have control over the technical and technological transfers to subcontracted suppliers. Firms in ASEAN need to develop stronger relationships with GVC lead firms and also greater trust to enhance the likelihood of more knowledge and technology transfers. Good intellectual property protection laws in ASEAN economies will help foster this confidence, along with more proactive approaches to sustainability, built into their environmental and social policies, and governance frameworks.

Finally, governments play an important role in attracting investments through investment promotion policies and incentive programs, committing domestic policies to binding international agreements, and a cohesive GVC strategy that synergizes with its existing trade, investment, and other macroeconomic policies. Foreign investors want policy predictability and certainty, and high-quality FTAs help provide them with that assurance. Governments can facilitate GVC operations by reducing tariffs and non-tariff barriers for imported production inputs, and above all, ensuring efficiency and predictability in the business environment. Services that have increasingly played a greater role in manufacturing export competitiveness, such as transport and logistics, warehousing, and other business services, will need to be boosted for greater efficiency, which may include opening up more service sectors to foreign investment.

Box 2.6:

Infrastructure and Funding Challenges for the ASEAN+3 Economies

An adequate and reliable physical infrastructure plays a vital role in promoting an economy's GVC participation and attracting FDI. Data suggest that economies with good infrastructure, reflected for instance in high infrastructure quality scores, tend to have higher GVC participation rates (Figure 2.6.1). Singapore and Hong Kong, for instance, have high GVC participation rates relative to other economies in the region, and they also rank high in infrastructure quality. High levels of FDI inflows also tend to be observed in economies in the region whose infrastructure are more developed. An IMF study on the determinants of bilateral GVC participation using a time-invariant model has similar findings, suggesting that a 1 percent increase in infrastructure quality of the importer leads to an increase in its GVC participation by 0.412 percent (IMF 2019).

While hard infrastructure is indispensable, soft infrastructure also plays a crucial role in increasing a country's participation in GVCs. Data suggest that economies in the region with more skilled workforce and better institutional quality tend to have higher levels of productivity and GVC participation (Figures 2.6.2–2.6.3). A skilled and disciplined workforce, along with continuous skills upgrading, enables an economy to attract better quality FDI that also allow greater participation in value chains.

Similarly, institutional quality has also been cited as having significantly positive impact on FDI inflows. Developing economies in the region still need to put more effort into enhancing their soft infrastructure and developing stronger institutions to enhance their GVC participation (Figure 2.6.4).

A debt sustainability indicator developed by Poonpatpibul and others (2020) suggests that while most ASEAN+3 economies retain significant room for expansionary fiscal policies, there is considerable unevenness across the region (Figures 2.6.5–2.6.6). Furthermore, even members that have stronger fiscal positions have expended large amounts of fiscal resources to support their economies during the pandemic. The region as a whole is therefore tackling the post-pandemic challenges from a significantly weakened fiscal position, compared to the pre-pandemic period. In a way, this issue goes back to the perennial funding gap challenge—discussed at some length in AMRO (2019).

Figure 2.6.1. ASEAN+3: GVC Participation versus Infrastructure Development

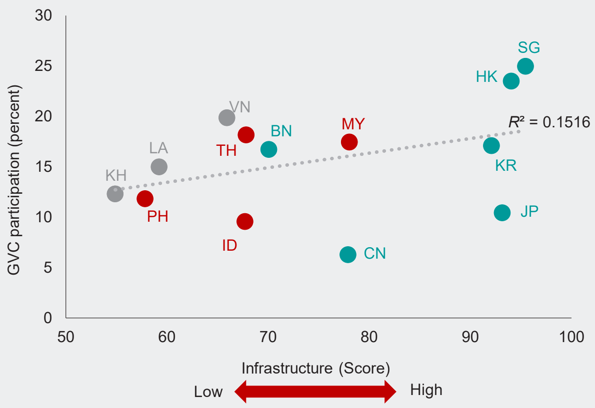
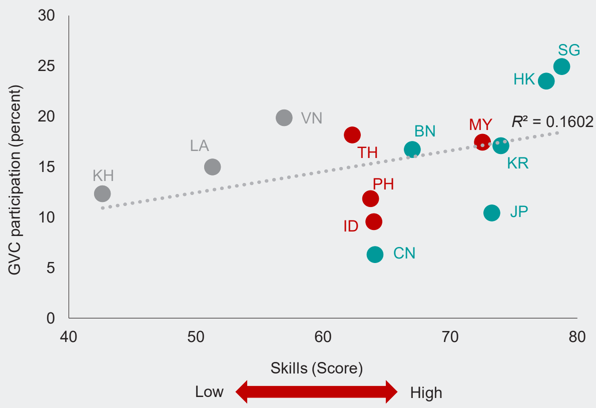
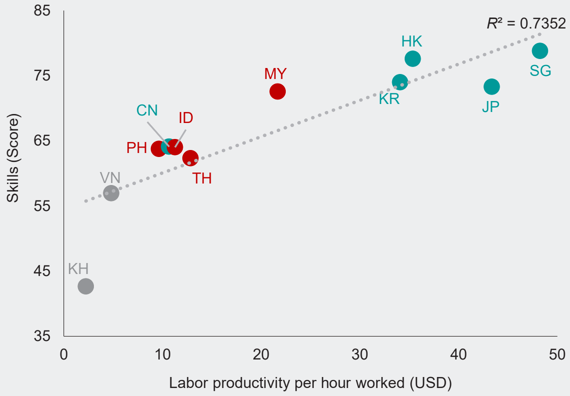


Figure 2.6.2. ASEAN+3: GVC Participation versus Skills



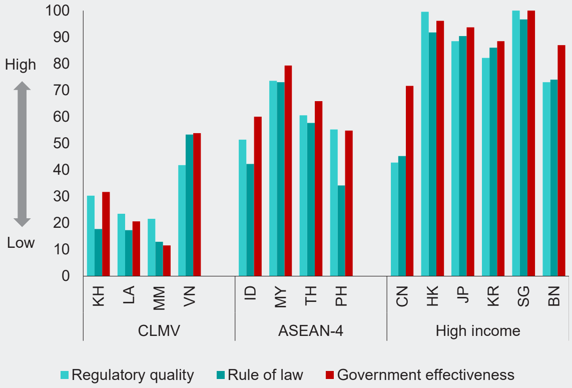
Sources: Asian Development Bank; World Economic Forum; and AMRO staff calculations.
Note: BN = Brunei Darussalam; CN = China; HK = Hong Kong; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; LA = Lao PDR; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; VN = Vietnam. Data for Myanmar are not available. The latest data point for GVC participation and score of infrastructure and skills is 2017 and 2019, respectively. Skills refer to the Pillar 6 of the World Economic Forum (WEF) Global Competitiveness Index, which covers skills of the current workforce (skills of graduates, quality of vocational training, digital skills, etc.), as well as skills of the future workforce (critical thinking in teaching and pupil-to-teacher ratio in primary education). Infrastructure is the Pillar 2 of the WEF Global Competitiveness Index, which focuses on hard infrastructure, including transport and utility infrastructure. Colors denote the selected groupings for these two figures: gray for the CLMV economies, red for the ASEAN-4, and teal for the high-income economies.

Figure 2.6.3. ASEAN+3: Productivity per Hour Worked versus Skills, 2019
(US dollars; Score)



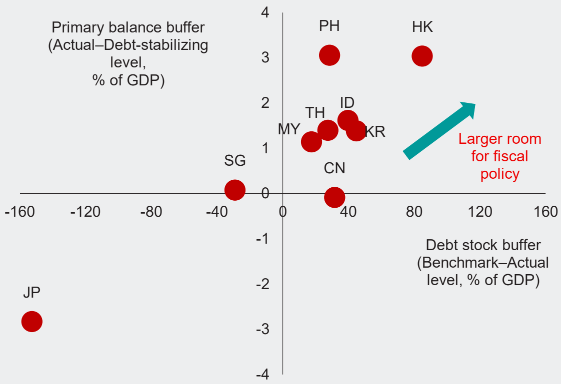
Sources: University of Groningen; Our World in Data; and World Economic Forum.
Note: CN = China; HK = Hong Kong; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; VN = Vietnam. Labor productivity per hour is measured as GDP per hour of work. GDP is adjusted for price differences between economies (PPP adjustment) and for price changes over time (inflation). Labor productivity per hour data are available up to 2017, and not available for Brunei Darussalam, Lao PDR, and Myanmar.

Figure 2.6.4. ASEAN+3: Selected Governance Indicators, 2019
(Percentile rank)



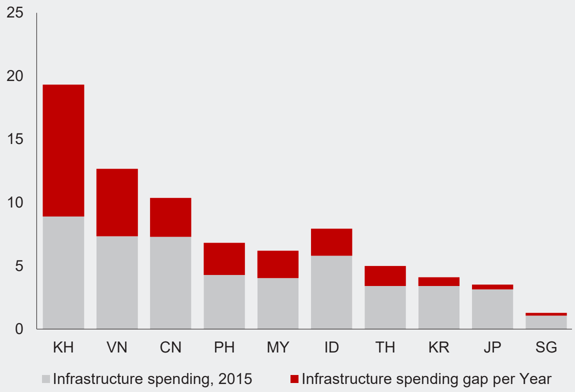
Source: World Bank.
Note: BN = Brunei Darussalam; CLMV = Cambodia, Lao PDR, Myanmar, and Vietnam; CN = China; HK = Hong Kong; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; LA = Lao PDR; MM = Myanmar; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; VN = Vietnam. Percentile rank indicates the economy's rank among all economies covered by the aggregate indicator, with 0 corresponding to lowest rank, and 100 to highest rank.

Figure 2.6.5. ASEAN+3: Debt Sustainability Indicator



Sources: International Monetary Fund; and AMRO staff estimates.
Note: CN = China; HK = Hong Kong; ID = Indonesia; JP = Japan; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand. As of 2019; Debt stock buffer = Debt burden threshold (85 percent for advanced economies, 70 percent for emerging markets) – government debt level (at the end-2019); Primary balance buffer = Realized primary balance (2017–19 average)—estimated debt-stabilizing primary balance level.

Figure 2.6.6. ASEAN+3: Infrastructure Spending and Funding Gap, 2015
(Percent of GDP)



Sources: Oxford Economics; Global Trade Analysis Project; and AMRO staff estimates.
Note: CN = China; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; VN = Vietnam. Infrastructure spending gap per year over the next two decades.

The author of this box is Vanne Khut.

Box 2.7:

Will the New Omnibus Law Boost Indonesia's Participation in GVCs?

With abundant natural resources, a large domestic market, and a rapidly growing middle class, Indonesia remains highly attractive to foreign investors. Indonesia's middle class is large and growing; 52 million strong, it accounts for nearly 20 percent of the population and 43 percent of total household consumption (World Bank 2019). The economy's official population stood at 268 million in 2019 and is projected to reach 292 million in the next decade (United Nations Population Division 2019).

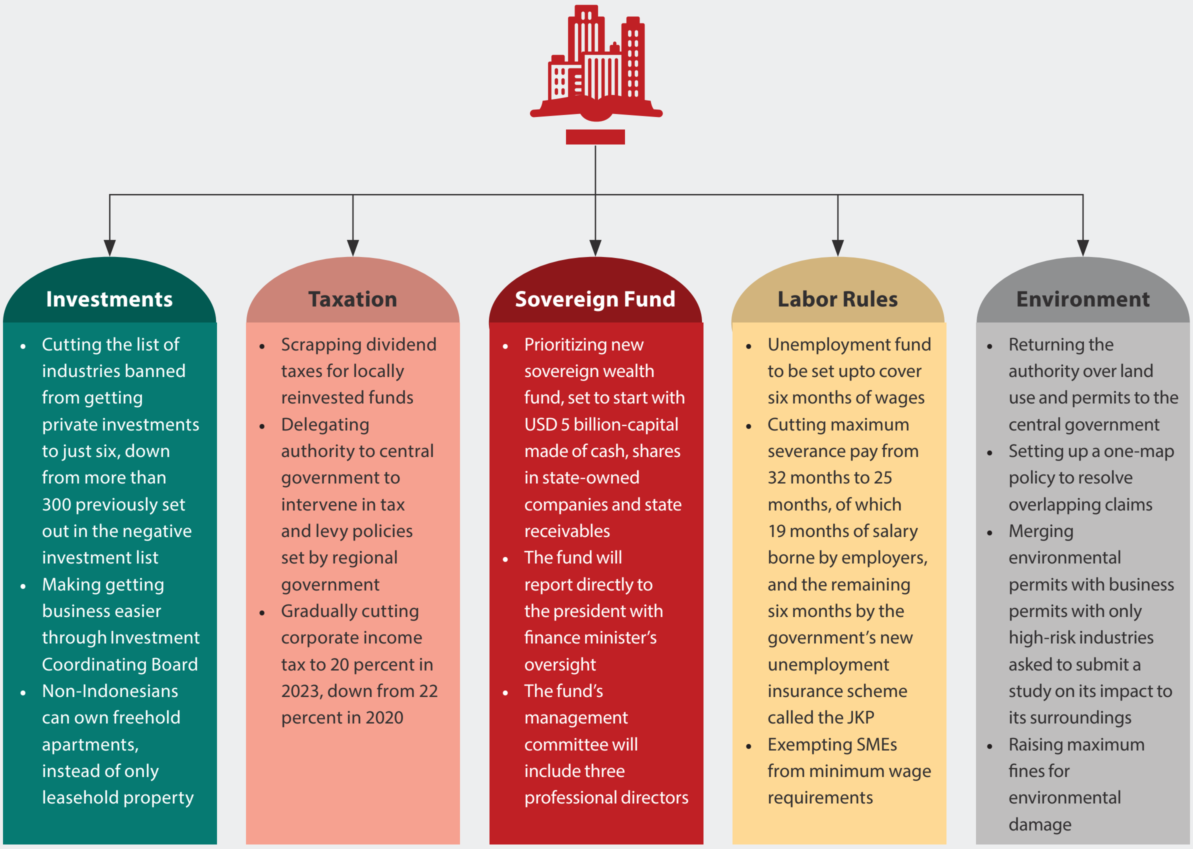
However, Indonesia, along with the Philippines, has not so far captured major GVC-related investments unlike Vietnam, Malaysia, Thailand, and Singapore. Hence, the Indonesian government has been stepping up its efforts to make the country more attractive to foreign investors. Both Indonesia and the Philippines have put together ambitious investment programs to significantly improve the quality of their physical infrastructure. In the case of the Philippines, the CREATE (Corporate Recovery and Tax Incentives for Enterprises) Law that is awaiting approval, and the EODB-ARTA (Ease of Doing Business and Anti-Red Tape Advisory) that was recently passed by the legislature, both aim to boost investment by, respectively, allowing flexibility in granting incentives to compete for high-value investments and reducing corruption and facilitating business registrations. Likewise, the Indonesian government passed the Omnibus Law on Job Creation last October 2020, aimed at boosting employment and investment.

The law seeks to eliminate red tape as well as other overlapping and contradictory regulations which have thus far undermined the economy's competitiveness (Lingga 2020). Its key provisions include: (1) reducing the number of industries in its negative list for foreign investment participation from more than 300 to only 6—a staggering policy move for Indonesia; (2) easing the application for obtaining business permits; (3) allowing non-Indonesians to own freehold apartments instead of only leasehold property; (4) scrapping dividend taxes for locally reinvested funds; and (5) setting up an unemployment fund to cover six months of wages while reducing the maximum severance pay borne by employers to 19 months of salary, down from 32 months (Figure 2.7.1). If implemented effectively, the Omnibus Law will help enhance Indonesia's investment climate, improve its ease of doing business, and attract more FDIs into its economy.

Notwithstanding some concerns on labor and environmental issues in the Omnibus Law,[1/] market reactions to the law have been generally positive (Wiranto 2020). The potential impact on investment is expected to help create jobs for nearly 3 million new entrants into the labor market and 6 million people who were laid off during the COVID-19 pandemic (Wijaya 2020).

[1/] Some shortcomings of the law in relation to labor and environment issues include abolishing sectoral minimum wage, reducing severance pay, allowing overtime to increase to a maximum of four hours in one day and 18 hours per week, reducing restrictions on outsourcing, and relaxing environmental standards (Wijaya 2020).

Figure 2.7.1. Indonesia's Omnibus Law: Key Revisions



Source: Sihombing and Aditya (2020).
Note: SMEs = small- and medium-sized enterprises. The six banned industries are using controlled drugs, engaging in gambling, catching endangered fish, harvesting corals, and manufacturing chemical weapons and industrial chemicals.

The author of this box is Vanne Khut.

III. Technology and Global Value Chains

Technology has enabled the rapid development of global supply chains and is a key driver of globalization, but it is now a key factor determining the reconfiguration of supply chains. First, advances in technology have, in some cases, eliminated or rendered irrelevant the labor cost differential between economies. Because of technology, high labor productivity can erase the low labor-cost advantage of developing and emerging economies. Second, advanced economies have a relative abundance of skilled labor needed for advanced technologies. For example, aircraft manufacturers, such as Airbus and Boeing, require specialized engineers to help build aeronautics engines; these professionals are easier to find in bigger numbers in Europe or North America. Third, technologies have become highly proprietary and require strong intellectual property rights (IPR) protection. MNEs are sometimes also statutorily barred from exporting the technology for national security reasons, which will be discussed in greater detail below. To guard against technology leakage, MNEs could decide that it is safer to use the technology at home or only in economies with reliable IPR protection. Finally, new technologies, such as 3D printing and automation, already make local production costs of certain products lower than when outsourced to other economies, especially for products that are customized to users or markets such as specialized parts or components.

Considering the importance of technology in GVCs and its development, it is important to discuss the implications of US–China technology tensions on developments in technology, existing supply chains, and trade in general—and how it may affect the ASEAN+3 region. In particular, technology demands an ample supply of skilled workers, especially IT professionals, investments in R&D, and strong IPR protection, areas in which many economies in the ASEAN+3 are still working to achieve.

This section begins with some of these emerging technologies, the adoption of which has been accelerated by the COVID-19 pandemic. It is followed by a discussion on a few technologies that are highly connected with global supply chains. Finally, it tackles the implications of the technology tensions between the United States and China, raising the specter of technology bifurcation for the world and its potential impact on the future of global trade and investments.

COVID-19: Accelerating the Shift to Digital Economy

The COVID-19 pandemic has, inadvertently, accelerated the "flight to digital," and this change in behavior is unlikely to be reversed. Many technology platforms that are being used widely during the pandemic—such as e-commerce, videoconferencing, cloud services, remote working, and others that were critical in maintaining business continuity—have been available for some time but were not widely used and diffused, especially in non-urban areas or with businesses that operate more traditionally. The pandemic has managed to put an end to any hesitation in using these technologies and accelerated its wide adoption and diffusion among households and firms.

A well-known example of technology adoption is evident in the unprecedented growth of e-commerce and other online businesses in the past year. Global digital sales of various items jumped by 71 and 55 percent year over year in the second and third quarter of 2020 (Shim 2020) (Figure 2.26). Online sales worldwide of food and beverage increased the fastest with an impressive growth of 153 percent, an upsurge never seen before. Likewise, in the ASEAN+3 region, while physical retail sales plunged during the pandemic, online sales soared (Figure 2.27).

Along with the boom in e-commerce, the growth in the number of ASEAN Internet users doubled compared to the average annual growth in users between 2015 and 2019 (Google, Temasek, and Bain & Company 2020). New users appear to be coming from smaller, non-metropolitan cities in the region's economies, and the increase in internet usage is no doubt prompted by the pandemic—as some businesses shifted to online meetings, conferences, seminars; students to virtual education; shoppers to online shopping; as well as to the increased use of digital banking and other services (Figure 2.28). Social distancing and lockdown measures that prompted patient-doctor consultations to be conducted online during the pandemic also gave a boost to telemedicine operators (Figure 2.29). Telemedicine users in the ASEAN countries have increased fourfold since the middle of 2020, reportedly attracting new investments into the sector (Google, Temasek, and Bain & Company 2020).

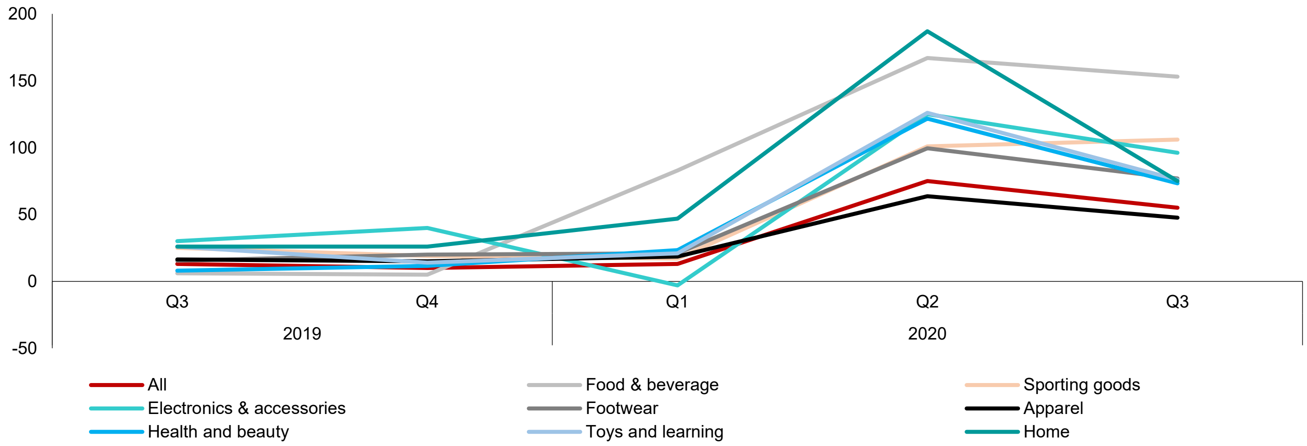
Substantial progress has also been made in the adoption of technology by businesses in their day-to-day operations. In particular, physical on-premise work has given way to remote working arrangements due to lockdowns and other social distancing measures. The switch to work-from-home arrangements has spurred greater demand for not only computer hardware (for example, video equipment) and home office furniture globally (see Chapter 1), but also for various mobile and remote applications and software, as evidenced by an almost exponential increase in the number of users of video and teleconferencing services.

Consistent with the strong demand for these home- or remote-working tools, businesses that provide these goods and services have flourished, especially after governments implemented lockdown measures starting around mid-March 2020 and companies immediately put business continuity plans in place. For example, US-based telephony and online chat services provider Zoom Video Communications, disclosed earlier in April 2020 that it added 300 million daily meeting participants although for the whole of 2019, it added only 10 million users (Hughes 2020) (Figure 2.30). Similarly, its competitor Cisco Webex registered a record 590 million participants in September 2020, up from 324 million reported in March (Mukherjee and Nellis 2020). Two other major providers of the same service, Microsoft Teams and Google Meet, also reported an impressive growth in usage, with more than 115 million and 100 million participants signing into meetings on a daily basis, respectively (Hughes 2020). Forecast earnings of these companies suggest that future demand for these services will continue.

Post-pandemic, the outlook for digital service consumption is highly positive, especially as more consumers and businesses become increasingly comfortable using digital services. Inadvertently, the social distancing measures and other restrictions have not only reduced barriers to technology use, but also provided a tremendous boost to the digital industry. More importantly, the pandemic has forced a change in the mindset of businesses and consumers alike when it comes to the utility of technology. COVID-19 has also caused an exponential shift in the pace of corporate digital transformation.

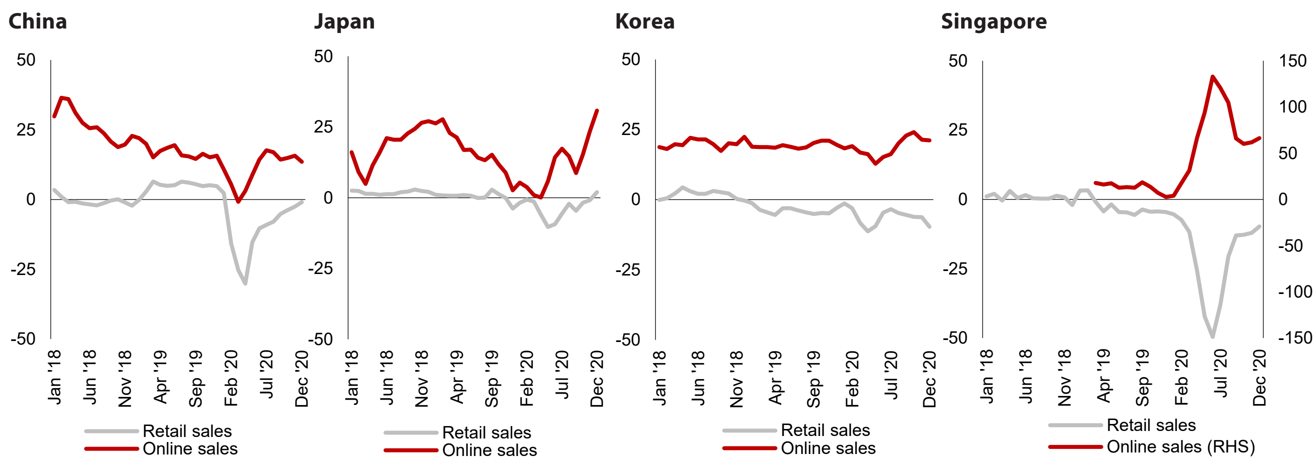
Moreover, a whole slew of new technologies is expected to become mainstream in the coming years, though more gradually, as they will require the installation of new support infrastructures, especially for the ASEAN+3 region (Box 2.8). Some of them, like self-driving autonomous cars, are already being tested and used on a controlled basis in some economies, such as China, Japan, Korea, and Singapore; while others like artificial intelligence, are being piloted or incorporated into medium- to long-term economic plans (such as in Indonesia, Singapore, and Thailand), but are still far from widespread commercial deployment. But as these technologies improve, are tested, and become widely adopted, future generations will most likely recall the COVID-19 pandemic as providing a much-needed push in the shift to greater global openness and embrace of new technologies.

Figure 2.26. Selected Sectors: Growth in Global Digital Commerce
(Percent year-over-year)



Sources: Shim (2020); and AMRO staff calculations.
Note: Health and beauty is the simple average of the growth of beauty and makeup, beauty and skincare, and health and beauty. Footwear is the simple average of the growth of active footwear and general footwear. Apparel is the simple average of the growth of apparel-active, apparel-general, and apparel-luxury.

Figure 2.27. Selected ASEAN+3: Retail and Online Sales
(Percent year-over-year, 3-month moving average)



Sources: National authorities via Haver Analytics; and AMRO staff calculations.
Note: Retail sales exclude online sales.

Figure 2.28. ASEAN: Services Most Used by New Digital Customers, 2020
(Percent of total service consumers)

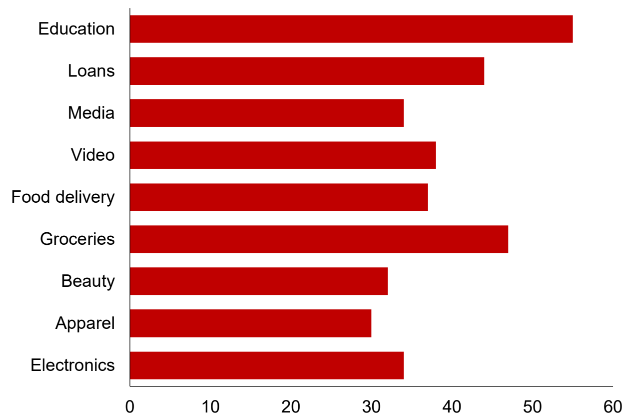
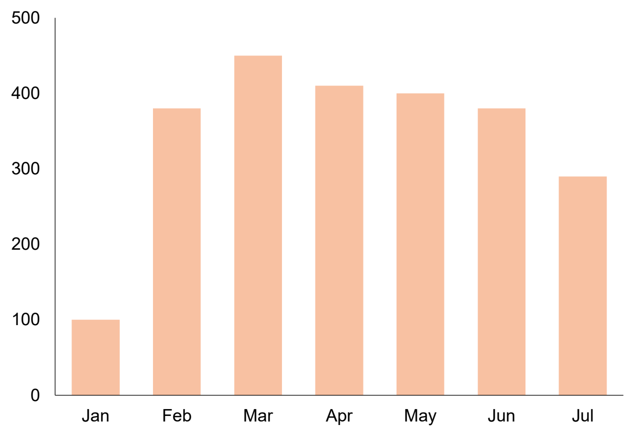
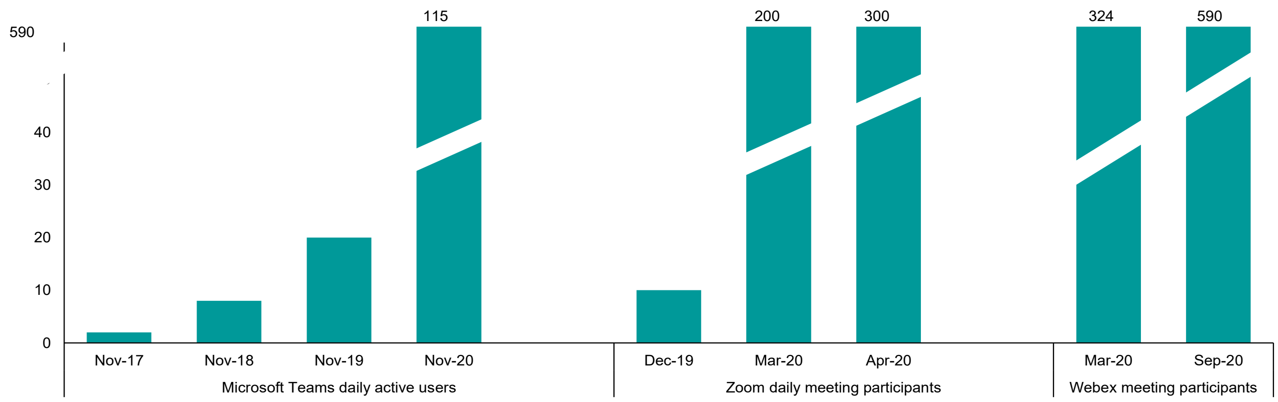


Figure 2.29. ASEAN: Number of Active Users of Telemedicine Platforms, 2020
(January 2020 = 100)



Sources: Google, Temasek, and Bain & Company (2020); and AMRO staff calculations.

Figure 2.30. Selected Online Meeting Service Providers: Microsoft Teams, Zoom, and Cisco WebEx
(Number of users)



Sources: Reuters; TechRepublic; Business of Apps; and Gadgets.
Note: Axis breaks are used to enhance the readability of the figure.

Box 2.8:

What are the New Infrastructures Required by the New Technologies?

Existing infrastructures were designed mainly for the non-digital economy. Thus, as new technologies emerge, successful deployment requires new kinds of infrastructure (Table 2.8.1). Beginning with electric vehicles (EV) and autonomous vehicles (AV) that need to be power-charged, charging stations should be more widely available both in urban areas as well as in long-drive expressways—in much the same way that petrol stations are currently available in the ICE (internal combustion engine) automobile world. Private EVs and AVs should also be chargeable at home, at work, or in specific charging depots, which would require a more reliable power source, for example, one not subject to frequent power outages and disruptions.

As the demand for electricity increases with more adoption of these EVs and AVs, there would be a need to modify the current electricity distribution networks as well as the installation of smart technologies to manage power demand (PwC 2020). For example, smart street sensors will need to be built, along with wireless transmitters on the road to facilitate communications among passing EVs and AVs. Technology-enabled aerial systems—such as drones and flying taxis—have similar infrastructure needs to EVs and AVs, with the addition of landing pads. In the ASEAN+3 region, Singapore is set to host the world's first electric-powered air taxi by the end of 2023, in partnership with German partner Volocopter GmbH (Weiss 2020).

For greater travel mobility, interfaces connecting different transportation modes—such as trains, buses, or the last mile of travel such as bike-docking stations—need to be built. This connectivity would require integration and trust in data sharing among different stakeholders—those that operate the infrastructure, IT equipment, as well as those that aggregate and analyze the data (Deloitte 2020, PwC 2020).

Most other emerging technologies, such as autonomous cars or artificial intelligence (AI), need advanced telecommunications infrastructure to support them. 5G technologies, for example, need more spectrum allocation, perhaps through re-farming some existing 2G or 3G spectrum (McKinsey & Company 2020b). To support the expected surge in data traffic from more smart devices connected to the network, more macro-cell sites are required outdoors. This can be achieved through the building of more cell towers, similar to what China is aggressively doing, or by upgrading existing 4G networks. Building more cell sites and/or base stations is particularly useful in specific areas, especially since high-frequency radio waves (used for 5G) do not travel far. In densely populated areas where it is spatially challenging to build new towers, or for indoor digital use, companies can deploy small-cell transmitters.

New investments may also be needed to improve or install more submarine cables, or to build mobile satellites and fixed broadband capacities, which would help connect base stations with core networks or increase backhaul capabilities. Technological options include more fiber optics and other wireless technologies that can link to backhaul infrastructures efficiently. If communication tower space appears to be a constraint, high-altitude platform systems (HAPS) could also be used instead to facilitate wireless connectivity. HAPS are also especially useful to have in hard to reach, isolated regions.

Other technologies, such as cloud computing and 3D printing, also require a similar set of new infrastructures. An increase in demand for cloud computing services may also require more data centers in several locations. In the case of 3D printing, this also requires the capabilities of 5G technologies and thus its infrastructure needs are similar to other digital applications. In addition, fab printing shops may need to be built in convenient locations for greater consumer accessibility.

Building these new infrastructure requirements will be a challenge especially for low-income economies in the region, because of not only weaker fiscal positions but also the need to prioritize basic infrastructure such as roads, bridges, hospitals, schools, and others in their budget allocation. Nonetheless, some of these new technologies—such as 5G, 3D printing, and cloud computing—may be more accessible for low-income economies, especially if facilitated by strong bilateral (multilateral) cooperation; for example, by the more advanced partner providing access to international expertise, financial aid for infrastructure support and usage of technology, as well as the mobilization of public-private partnerships, among others.

Table 2.8.1. New Technologies and Required Support Infrastructure

<table>
<tr><th>Type of New Technology</th><th>Economies with government policies or actions on specific technology</th><th>Required Infrastructures for Widespread Use or Commercial Deployment</th></tr>
<tr><td>Electric vehicles (EVs)</td><td>Plus-3: CN, HK, JP, KR
ASEAN: BN, ID, LA, MM, MY, PH, SG, TH, VN</td><td rowspan="2">• Wide availability of charging stations (for example, at work, home, depots)
• More reliable power sources and electricity distribution networks and smart technologies to manage power demand
• Interfaces to connect physical infrastructures (rails and roads for example) to operational technology that generates the data (sensors and payment systems), digital infrastructures (to carry the data), and other IT equipment and software to aggregate and analyze the data
• Outfitting more streetlights with sensors
• 5G or WiFi transmitters
• Smart meters and smart motorways</td></tr>
<tr><td>Autonomous vehicles (AVs)</td><td>Plus-3: CN, HK, JP, KR
ASEAN: ID, MY, PH, SG, TH, VN</td></tr>
<tr><td>Drones</td><td>Plus-3: CN, HK, JP, KR
ASEAN: ID, LA, MM, MY, PH, SG, TH, VN</td><td rowspan="2">• Landing pads</td></tr>
<tr><td>Flying Air Taxis</td><td>Plus-3: CN, HK, JP, KR
ASEAN: MY, SG</td></tr>
<tr><td>5G</td><td>Plus-3: CN, HK, JP, KR
ASEAN: BN, ID, KH, LA, MM, MY, PH, SG, TH, VN</td><td rowspan="2">• Additional cell towers and base stations
• Additional spectrum allocation
• Small-cell deployment in densely populated areas
• Submarine cables
• Mobile satellite and fixed broadband to support backhaul capabilities and increasing data demands
• Connection links between base stations and core network (backhaul) relying on fiber and wireless technologies with sufficient microwave and satellite links capacities
• High-altitude platform systems (HAPS)-to facilitate wireless connectivity
• Data centers</td></tr>
<tr><td>Cloud Computing
Internet of Things
Machine-to-Machine Communication
Artificial Intelligence</td><td>Plus-3: CN, HK, JP, KR
ASEAN: BN, ID, KH, MY, PH, SG, TH, VN</td></tr>
<tr><td>3D Printing</td><td>Plus-3: CN, HK, JP, KR
ASEAN: ID, MY, PH, SG, TH</td><td>• Fab shops</td></tr>
</table>

Sources: McKinsey & Company (2020b); PwC (2020); and AMRO staff.

The authors of this box are Marthe Hinojales and Gloria O. Pasadilla.

Technology in Supply Chains

Some new technologies have direct applications for global supply chains and for facilitating global trade, including (1) blockchain technology, (2) artificial intelligence and big data, (3) 3D printing, and (4) financial technology for supply chain finance. These four examples and their applications are discussed in detail below.

Blockchain, Logistics, and Supply Chains

Blockchain, a decentralized digital platform that allows the creation of an immutable and accurate record of all transactions in real time, is increasingly being employed in trade logistics. A fully transparent system to all relevant parties of all transactions in real time, all network parties have an end-to-end visibility of the blockchain's (or distributed ledger's) supply chain information, from the time a product leaves a factory or warehouse up to its final delivery to the consumer.

Blockchain reduces bottlenecks and clerical errors that cost the shipping and retail industries at least USD 500 billion in losses every year (Daley 2019). Cross-border product shipment tends to be administratively cumbersome and costly, for reasons such as its over-reliance on paper transactions along with the labyrinthine procedures required, before a product leaves the port of origin until it arrives at its final destination. Even banks have been slow to change from paper transactions to digital format (Box 2.9). IBM and Maersk, for example, tracked the shipment of fresh flowers from Mombasa, Kenya to Rotterdam, Netherlands, and their study concluded that the simple refrigerated shipment passed through more than 30 different organizations/government agencies—from the source economy, to transshipment points, and to the point of final destination—and required more than 200 separate communications (Forbes 2017).

The myriad transactions and signatures that are needed, from the bills of lading to a variety of customs forms, add to the risk of losses and frauds along the way, and to the possibility of the shipment being held up in customs for a long period of time. Blockchain technology helps eliminate these and many other administrative, paper-based steps, by digitizing and automating bills of lading and other required forms (that are still largely processed manually), thereby cutting costs, and removing or minimizing trade disputes and errors.[15/] With blockchain, transactions can be put in templates and executed seamlessly between multiple parties, backed by cryptographic signatures (WEF 2020a) (Figure 2.31). Blockchain also helps customs organizations make the clearance and other customs procedures much quicker and more efficient (WEF 2020a).

Artificial Intelligence, Smart Contracts, and Big Data

The use of smart contracts in blockchain technology can minimize the number of intermediaries (for example, brokerages and other third parties) that increase transaction costs, while simultaneously securing compliance with all relevant laws. It also helps accelerate payments because the transparency afforded by the distributed ledger minimizes disputes among the parties.

This is where artificial intelligence (AI) and big data, supported by trustworthy information in the logistics ecosystem, can also play a very useful role in supply chain management. AI helps, for example, in providing efficient route information for trucks, location tracking, and vehicle-to-vehicle communications that allow for both fuel efficiency and safety. Blockchain-enabled Internet of Things (IoT) sensors and other smart devices can help monitor and control temperature and humidity during the transportation and storage of highly sensitive and perishable goods, such as some pharmaceutical products. AI thus helps minimize losses and waste, and provides secure and accurate records throughout the shipping process. Different technologies such as blockchain, AI, machine learning, as well as cloud technology have their own unique but complementary roles to play throughout the different stages of cross-border trade (Figure 2.32).

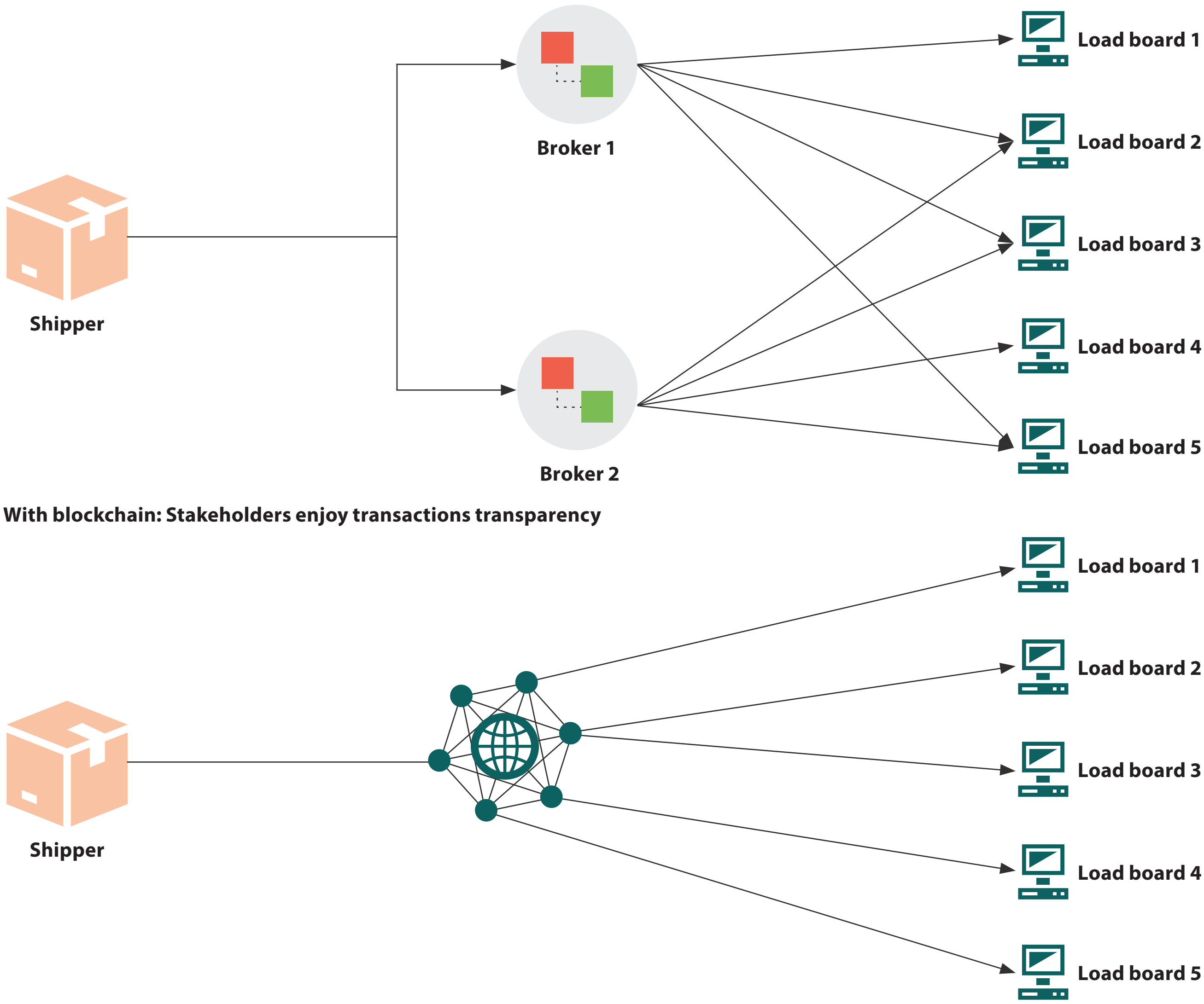
Similarly, technology also supports many services sectors' value chains, for example the tourism industry. The new tourism value chain uses technology to facilitate linkages, exchanges, and transactions among tourism-related enterprises and tourists (Zhao, Cao, and Liu 2009), while using AI to enhance the customer experience, such as digital concierges (Figure 2.33). According to a Google Travel study, 74 percent of travelers plan their trips online, whereas only 13 percent still depend on travel agencies (Singh 2019). The use of big data has facilitated the identification of products and services that tourists demand; while social networks, for example, Facebook, TripAdvisor, among others, help promote tourism activities and products throughout the world, at times inadvertently. Tourism businesses in the ASEAN+3 region, in particular, have used the ICT infrastructure extensively, relying on the large number of tech-savvy users in the region to promote tech-driven tourism products efficiently and effectively (Figure 2.34).[16/]

[15/] Delays can be caused by something as simple as signature disputes.

[16/] The ASEAN+3 region has 1.5 billion total number of internet users (as of May 2020) or 64.1 percent of its total population.

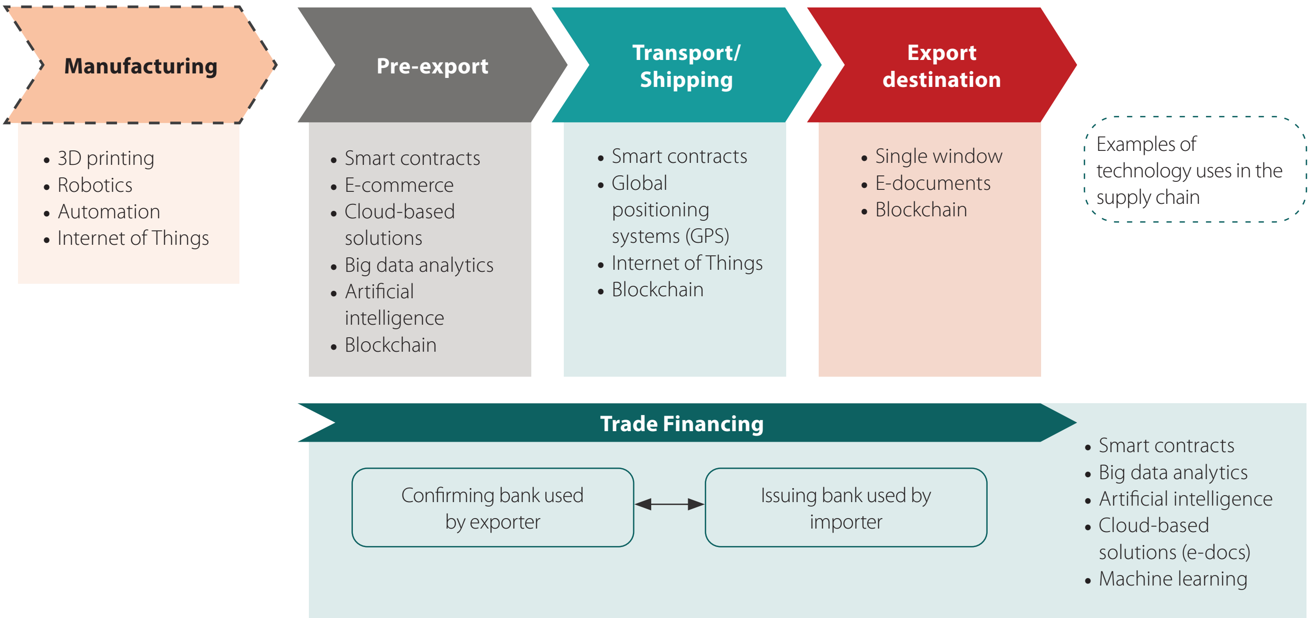
Figure 2.31. Trade Logistics: With and Without Blockchain Technology

Without blockchain: High likelihood of potential errors



Source: World Economic Forum (2020a).

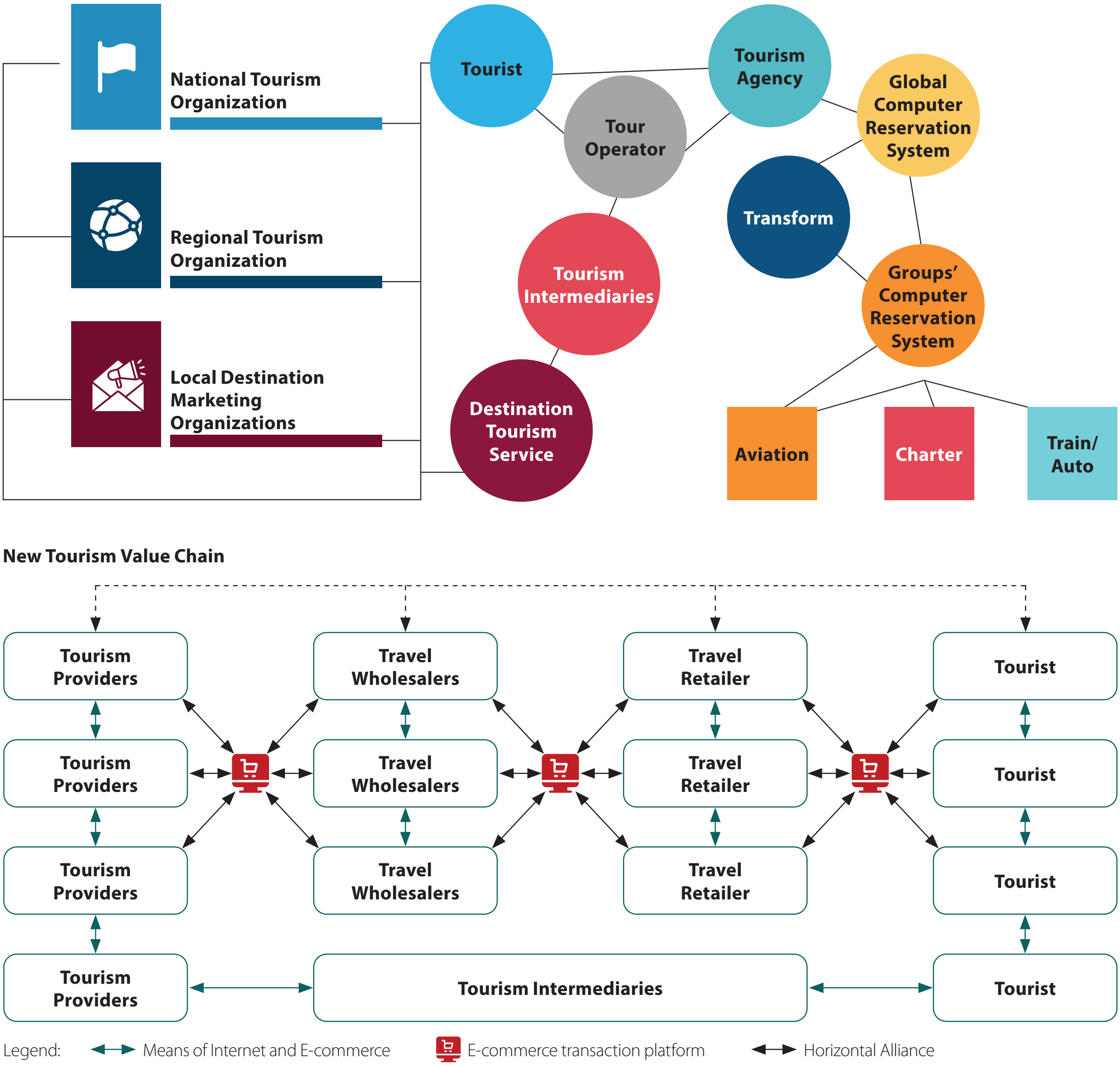
Figure 2.32. Technology in Supply Chains



Sources: Asian Development Bank; and AMRO staff.

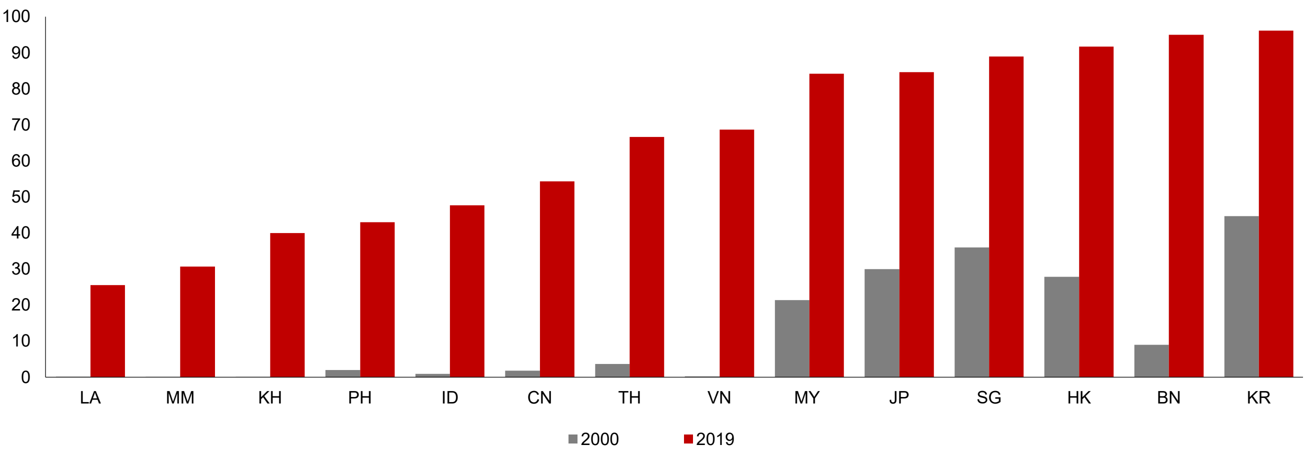
Figure 2.33. Tourism Value Chain

Traditional Tourism Value Chain



Source: Zhao, Cao, and Liu (2009).

Figure 2.34. ASEAN+3: Internet Users, 2000 and 2019
(Percent of population)



Sources: International Telecommunication Union (ITU); and World Bank.
Note: CN = China; HK = Hong Kong; ID = Indonesia; JP = Japan; KH = Cambodia; KR = Korea; MM = Myanmar; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; VN = Vietnam.

3D Printing and Supply Chains

3D printing is already being used in several manufacturing sectors in the region, ranging from food to automotive to aerospace. In the medical field, bespoke body parts, such as knee or hip implants, as well as hearing aids are a few of the products that have already been 3D-printed. New auto prototypes, which used to cost hundreds of thousands of US dollars and months of waiting, have been 3D-printed within four days and for less than 1 percent of their usual costs (McKinsey & Company 2014). 3D printing requires new materials: new resins, polymers, and powered metals designed for 3D printers—giving the chemical industry a once-in-a-generation transformation and profit opportunity. McKinsey & Company (2014) forecasts that the 3D printing market will grow to USD 550 billion by 2025. In the region, China appears to lead the adoption of 3D printing, with nearly 78 percent of surveyed companies having adopted the technology by 2019 (Steinberg and Karevska 2019).

Within ASEAN, adoption varies across economies—with Singapore at 40 percent, followed by Thailand with 25 percent, to only about 1 percent for economies such as Myanmar and Lao PDR (ThyssenKrupp 2019). Singapore, for example, is already using 3D printing to make spare parts for maintenance and engineering operation of buses and trains. For the CLMV countries, 3D printing is mostly for retail rather than commercial use.

3D printing has the potential to reconfigure supply chains in a variety of ways. Instead of relying on imports, companies can produce some components closer to the customer market. Stocking up on components would be rendered unnecessary because they can be 3D printed on an as-needed basis and delivered on demand. Clients can be involved in the design and production process and as such, products can be tailored to the client's specific requirements and preferences. 3D printing also reduces the time-to-market as it eliminates the need for international product shipping, customs clearance, or tariffs. Warehousing and logistics needs are minimized. Overall, 3D printing can reduce many of the steps associated with GVCs, from procurement or sourcing to product assembly and shipping, potentially lowering the costs of production as well as logistics costs.

Nonetheless, current 3D printing technology remains limited to customized production and is not (yet) ready for mass production. It is useful for producing highly complex and customizable products and parts. For now, however, the cost of materials, hardware, and handling of 3D-printed spare parts is still high, and the technology still cannot replace large manufacturing factories. But as these costs decrease over time, especially with improvements in materials technology and in 3D printers themselves, 3D printing might in the future become widespread.

Besides cost, other key success factors include improvements in process speed and quality of printing, the availability of warranties and liability frameworks, and the security of digital files from piracy. Piracy, in particular, is a problem that media companies faced in the past with regard to digital music and video files, and still continues as a challenge today in some places.

Financial Technology and Supply Chain Finance

Financial technology (fintech) can also change the dynamics in the trade and supply chain finance markets. Letters of credit are still the most widely used financing instrument for international trade transactions, and banks are the lynchpin for trade financing. With an increase in digitization, this dynamic is set to change, primarily because of the entrance of new fintech players who want a piece of the USD 7.3 trillion trade financing market, potentially posing a major threat to the central role of banks in trade finance (McKinsey & Company 2020c). Banks will have to continually upgrade their digital technology infrastructure, and/or work in partnership with fintechs to remain a vital player in trade financing (Box 2.9).

A large portion of global trade is financed through inter-firm trade credit. Currently, 60 percent of international transactions are financed through inter-firm trade credit, either on open account (akin to sellers providing lines of credit to buyers) or cash-in-advance (akin to buyers providing credit to sellers) (Table 2.2). The remaining portion (40 percent) have been traditionally intermediated by banks through instruments like letters of credit, documentary collections, guarantees, or supply chain finance.

Of the trade finance instruments, supply chain finance (SCF) is the smallest segment, currently with only 7 percent of the market. Nonetheless, it is expected to grow the fastest, especially with the entry of fintechs. Fintech platforms, in partnership with banks and other financial institutions, can eliminate suppliers' cash constraint without hurting the cash flow of the buyer. The increasing number of financial institutions, technology firms, and/or corporates in SCF collaboration points to increasing dynamism in this area that can change the industry landscape especially in supply chain finance (Box 2.9).[17/]

[17/] Some players in this space include: Taulia (funding from Ping An (insurance, China) and JP Morgan); Traxpay (funded by Deutsche Bank); C2FO (US-based); Tradeshift; Marco Polo; Komgo (consortium of financial institutions, Shell oil Company); TradeLens (owned by Maersk and IBM); Alibaba's partnership with Kinnek; and Amazon with Predix.

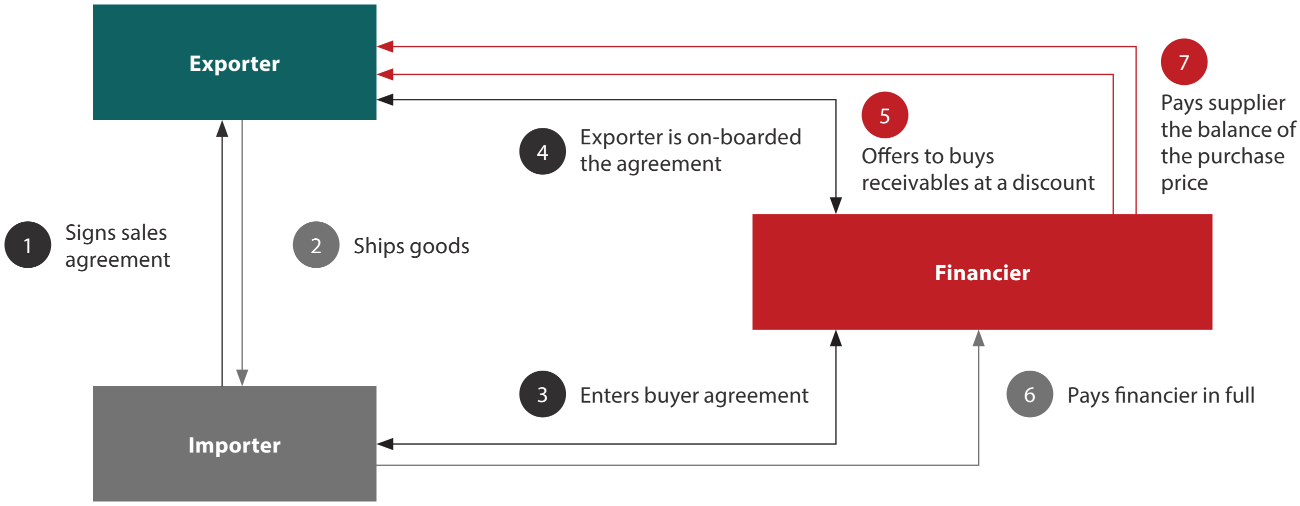
SCF works through the collaboration of financial institutions and big buyers, usually GVC lead firms, and entails less credit risk (Figure 2.35). Typically, the financial institution and the buyer-importer agree on the SCF program, through which its suppliers can opt to sell its receivables. The financial institution, meanwhile, takes care of onboarding the qualified seller-exporters and carries out the requisite Know Your Customer due diligence. As long as the buyer is of high credit standing—and usually, this is the case for lead firms of GVCs or big retailers such as Walmart—financial institutions face minimal credit risk. Through the SCF platforms, suppliers can get paid earlier, alleviating their working capital constraints while still maintaining payment extension of up to 120 days for buyers. SCF has been especially useful for lead firms to ease capital constraints faced by their small suppliers, in turn making their own supply chains more resilient.

Table 2.2. Financing Trade Transactions

Inter-Firm Trade Credit (60 percent)	Bank-Intermediated Trade Finance (40 percent)	
Open account	Letters of credit	Supply chain finance
Cash-in-advance	Documentary collections	Guarantees
Global merchandise export		

Source: McKinsey & Company (2020c).
Note: Trade financing can be divided into three main segments (McKinsey & Company 2020c): (1) Documentary business that is largely hinged on letters of credit with banks providing the funds and working with suppliers and/or buyers; (2) Seller-side finance or receivables financing wherein the sellers/suppliers obtain working capital by selling or borrowing against receivables, and banks or nonbanks (sometimes called 'factors') are the source of financing; sellers on open account terms usually resort to this type of financing to fund their working capital; and (3) Buyer-led supply chain finance wherein intermediation takes place through digital platform. Banks, fintechs, and other industry players may operate the platform that contains buyer-approved invoices. Alternatively, fintechs alone may operate the platforms, connecting buyers and sellers directly, to facilitate the dynamic discounting of the invoices.

Figure 2.35. Supply Chain Finance



Source: United Nations Economic and Social Commission for Asia and the Pacific—Asian Development Bank (2019).

Box 2.9:

Conservative Banks, Dynamic Fintechs

Financial institutions have been conservative in moving to fully digitized global trade transactions, particularly in removing the use of physical paper. An International Chamber of Commerce survey shows that banks' digitization progress had been slow up until 2018 (Figure 2.9.1) (ICC 2020). With respect to document verification for example, 45 out of 103 surveyed banks had made no progress in digitizing paper documents, while only about 50 percent had achieved some document digitization.

On the other hand, fintechs are introducing technology into many financial transactions, including supply chain finance (SCF). In fact, fintech involvement will likely change the dynamics in the supply chain finance market and take on more and more prominent roles (Figure 2.9.2). McKinsey & Company (2020c) considers four different possible evolutions in SCF:

- Model 1, an integrated system run by banks, will likely remain one of the options. Large global banks have the advantage in this end-to-end model, which facilitates transactions between buyers and sellers and offers value propositions from procurement services to data sharing on its proprietary platform, all the way to trade credit provisioning.

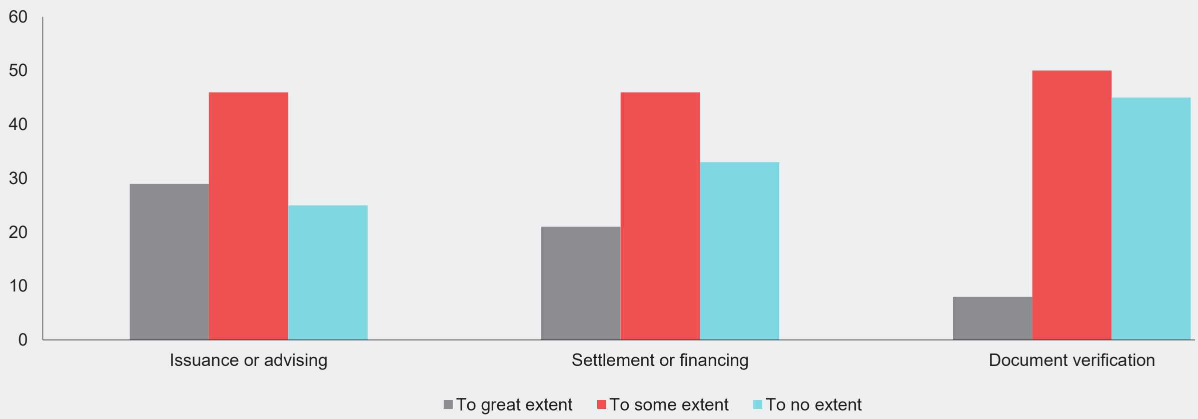
- Model 2 is a bank and platform partnership model where platforms operated by fintechs take care of SCF services like client on-boarding and data sharing. Banks handle the beginning and end-processes including financing.

- Model 3 is where fintechs take over most of the stages in SCF except financing, where both banks and nonbanks (including the fintech itself) may be involved.

- In Model 4, a broad set of service providers coexist, including niche SCF solutions for specific industries.

This diversity in SCF models shows that traditional banks' business models are increasingly being disrupted by financial technology. As more fintech players enter markets that used to be the domain of banks, the latter will either have to continually upgrade their technology offerings to consumers or embrace partnerships with technology firms.

Figure 2.9.1. Bank Survey on Removing Physical Paper for Documentary Transactions in Cross-Border Trade
(Number of respondents)



Source: ICC (2020).

Figure 2.9.2. Different Supply Chain Financing Market Models

<table>
<tr><th>Providing SCF</th><th>Model 1. End-to-End Bank Delivery</th><th colspan="2">Model 2. Banks and Platform Partner for Digital-Led Delivery</th><th colspan="2">Model 3. Platform-Led with Bank/Nonbank Financing</th><th colspan="2">Model 4. Free-For-All Ecosystem</th></tr>
<tr><td>Enterprise resource planning (ERP)/ procurement mandate</td><td rowspan="5">Banks</td><td>Banks</td><td>ERPs</td><td colspan="2" rowspan="3">Fintech platform</td><td rowspan="3">Fintech platform</td><td rowspan="3">Banks</td></tr>
<tr><td>Distribution and onboarding of suppliers/invoices</td><td colspan="2" rowspan="2">Fintech platform</td></tr>
<tr><td>Data sharing and integration</td></tr>
<tr><td>Credit decision-making</td><td colspan="2" rowspan="2">Banks</td><td rowspan="2">Banks</td><td rowspan="2">Nonbanks</td><td rowspan="2">Banks</td><td rowspan="2">Nonbanks</td></tr>
<tr><td>Credit provision (and risk sharing)</td></tr>
<tr><td>Actions to create transformative change</td><td>Invest in technology platforms; Increase efficiency in onboarding, credit decision-making, reduce cycle time</td><td colspan="2">Better integration of bank and fintech systems and processes; Widen scope of platform to bring full set of SCF products to firms</td><td colspan="2">Increase platform investment and accelerate coverage for full value chains in key geographies; Develop second market for SCF assets to increase penetration of nonbank lending</td><td colspan="2">Industrywide support for common standards and approaches (including application program interface, libraries, data sharing); Increase platform investment and accelerate coverage for full value chains in key geographies; Develop secondary market for SCF assets to increase penetration of nonbank lending</td></tr>
<tr><td>Strategic options</td><td>Big global banks have advantage</td><td colspan="2">Small and regional banks benefit because they do not need to invest on a fintech platform; For customers in given verticals or selected steps in supply chain</td><td colspan="2">Small and regional banks benefit because they do not need to invest on a fintech platform; For customers in given verticals or selected steps in supply chain</td><td colspan="2">Possible that large e-commerce players will coalesce in platform-based model, serving SMEs; Fintech companies and consortia could struggle in achieving scale</td></tr>
</table>

Sources: McKinsey & Company (2020c) with minor addition from the authors.

The author of this box is Gloria O. Pasadilla.

Technology Competition and Its Implications for the Global Economy and GVCs

Technology, from 5G and blockchain to IoT and AI, is what will shape the future landscape of the global economy, and hence, the fierce competition among the major tech companies and countries. Many industries, from agriculture to manufacturing to tourism and finance, will be disrupted, giving birth to new ones. The countries that are at the forefront of technology will stand to reap huge economic benefits as the United States, Japan, and some European countries have done for close to a century now. This advantage explains the ongoing battle for supremacy in technology—the race to be the first or most advanced. Nowhere is it more obvious than in the race for patents and setting of industry standards, because the country and the tech companies that set the standards will dominate the industry.

Many technological advances over the last century have come from developed economies, especially the United States, Japan, and a few European countries. The world has benefited enormously from these advances, as has the United States as the dominant economic power that developed many of these technologies and set the industry standards. But the 21st century is seeing the emergence of an economic and technological powerhouse from Asia, notably China, which has grown in its capacity to develop competing technologies that can either narrow or overtake US technological leadership, including in areas that the United States considers to have implications for national security. China's rapid technological ascent has led to the recent heightening of tensions with the United States over trade in certain advanced technology products, especially in telecommunications and semiconductors, where the latter currently has a marked advantage (Box 2.10).

This section discusses the technology tensions between the United States and China and its implications for the global economy and trade. It first recapitulates some of the technology-related measures and countermeasures that the two countries have imposed on each other. Next, the section addresses the potential effects of these technology tensions on GVCs, and in particular, on global trade that, in the past has followed a rules-based multilateral trading system, rather than unilateral or bilateral trade policies.

United States and China: Tech-Related Measures and Countermeasures

The tensions between the United States and China are perhaps most intense in the technology space. The tit-for-tat goods tariff escalation between the two economies has been a drag on global trade and growth since 2018 (see Chapter 1). In 2020, tensions heightened further with the imposition of restrictions by the United States on the purchase of telecommunication equipment from and sales of semiconductors to some of China's high-tech companies.

Technology-related measures implemented by both the United States and China range from export restrictions to outright bans, licensing, investment restrictions, and domestic regulations that have the effect of restricting or prohibiting imports or acquisitions of certain strategic technologies (Appendix Table 2.2.1). Although it is natural for countries to adopt restrictive measures to safeguard their national security, the measures taken by the United States are explicitly targeted at China's high-tech companies. In response, China has similarly placed restrictions on sales of advanced technologies to the United States. Some of China's measures pre-dated the recent technology conflict, for example its internet geo-blocking, and the "Great Firewall of China," all of which were aimed at supporting indigenous innovations, the development of domestic technology companies, minimizing dependence on foreign technology, and of course national security.

The technology tensions have inadvertent spillover effects on other economies and their exports. As China is a major high-tech exporter and importer, a decline in its production—resulting from either the technology tensions or the pandemic—can also result in a decline in the high-tech goods exports of economies such as Japan, Korea, and Malaysia (Box 2.11). Similarly, if these ASEAN+3 high-tech exporting economies reduce their intermediate exports to China, the latter's exports to major global markets would decline significantly.

Box 2.10:

Semiconductor Value Chain: China's Challenges

Despite its advance in technology, China still lags behind in foundational technologies for semiconductor production. While China has developed its capacity in advanced chip design and also in semiconductor chip manufacturing, so far they are not the most advanced chips used in frontier technologies. To bridge the gap, China has depended on the semiconductor supply chain by importing advanced chips from foreign semiconductor companies. However, in the current tech tensions with China, the United States has imposed restrictions on the sale of semiconductors and key equipment to China's tech companies. This has set back China's efforts to develop advanced technologies based on the semiconductor.

There are three major stages in the semiconductor production chain. The first stage is integrated circuit design, followed by semiconductor manufacturing or fabrication, then assembly and testing. In circuit design, China is at the frontier, leveraging its large number of skilled engineers and an equally large number of design startups (Kotasthane and Seth 2020). The hurdle, however, is that the United States has banned the sale of the software used for integrated circuit design, the Electronic Design Automation (EDA) tools, to China. Developing self-sufficiency in EDA tools would require huge investments in research and development, and an in-depth knowledge of chip fabrication, which would take a long time.

The next stage in the semiconductor supply chain—chip fabrication—is also dominated by the United States. Although China's semiconductor national champion, Semiconductor Manufacturing International Corporation (SMIC), can fabricate 14 nanometer chips, the latter is still considered a lower-generation chip compared to the five nanometer chips that are produced by TSMC.[1/] In a fast-evolving industry, by the time SMIC is able to catch up with the current generation of advanced chip technology, the frontier would have already moved to a yet more advanced one. On the other hand, chip fabrication involves the use of special manufacturing equipment, some of which are also produced by US companies. High-end chip fabrication requires machines that use lithography technology produced by ASML, an Amsterdam-based company, which is under US pressure not to sell to China (Alper, Sterling, and Nellis 2020).

The last stage, which is labor-intensive—assembly and testing—is where China is consistently making an inroad. However, the materials used for the semiconductor supply chain, including for assembly and testing—silicon wafers, photoresists, and essential packaging chemicals, among others—are controlled by Japanese companies whose high-quality production capabilities are hard to replace.

The different major players at each stage of the semiconductor value chain illustrate the complex interdependencies among economies and how they depend on one another for technology, production, and materials (Figure 2.10.1). For any economy, including China, an integrated production capacity in this sector will be a challenge to build.

Figure 2.10.1. Semiconductor Supply Chains

Source: Adapted from Kotasthane and Seth (2020).
Note: EDA = electronic design automation; IPR = intellectual property rights.

The author of this box is Gloria O. Pasadilla.

[1/] Nanometer size indicates transistor size. A smaller nanometer is more high-end and delivers higher device performance.

Box 2.11:

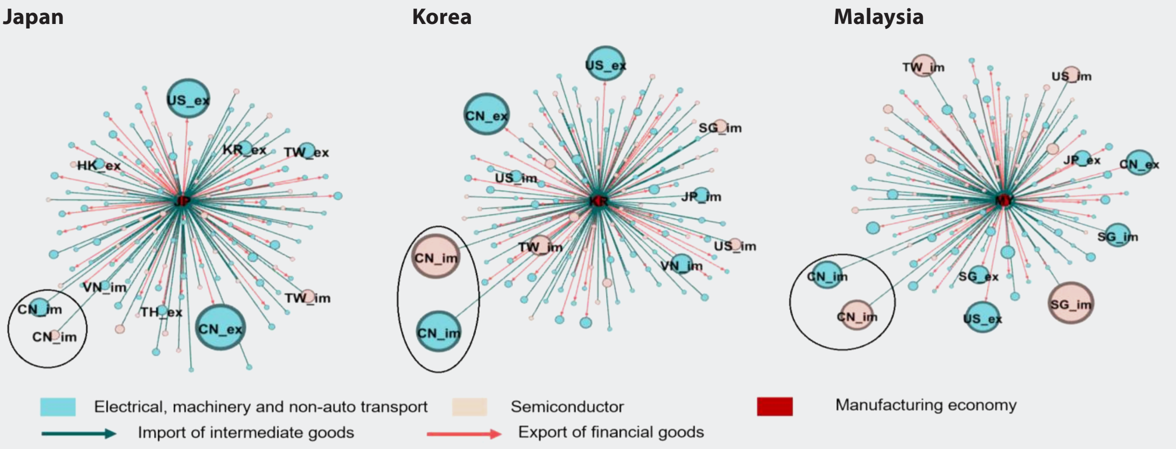
US–China Tech Tensions: Impact on ASEAN+3 Exports

China is a key supplier of intermediate goods in high-tech GVCs in the ASEAN+3 region. Using granular trade data to analyze the import-export networks for the region, a study by Sun and others (2021) reveals that China is a major supplier of semiconductors and electrical/electronic components to major high-tech ASEAN+3 exporters, including Japan, Korea, and Malaysia (Figure 2.11.1). Based on montly trade data between January 2005 and 2020, the authors estimate the elasticities of high-tech exports of Japan, Korea, and Malaysia to different destinations with respect to their imports of machinery and electrical parts from China. The elasticities then allow for the quantification of the impact of supply chain disruptions, such as COVID-19 or the tech tensions, on high-tech exports of China and other economies.

As a major GVC node, supply disruptions in China adversely affect regional economies' exports. A stress test performed in Sun and others (2021)—assuming that the growth of China's supply of machinery and electrical parts falls by 30 percentage points either due to lockdowns or the tech tensions—shows the impact on the export growth of other ASEAN+3 economies. Korean manufacturers would see their high-tech export growth to Vietnam, Indonesia, the European Union (EU), and Thailand fall by 3 to 15 percentage points (Figure 2.11.2). The decline in Japan's high-tech export growth to overseas markets would be somewhat milder but significant relative to its historical averages. Malaysia's high-tech export growth to the United States and Singapore would decline by as much as 11 and 6.5 percentage points, although those to the EU and China markets would only be marginally affected. The diverse results are not unexpected because these regional economies export distinct products to different markets, and the degree of substitutability of inputs from other economies for China's is also different across high-tech export products.

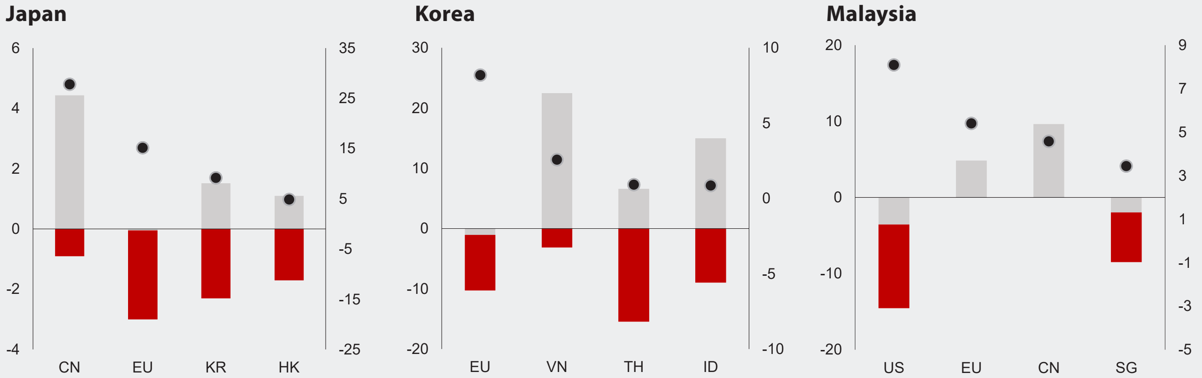
In turn, China is affected by disruptions to global supply chains emanating from other ASEAN+3 economies. In particular, the import-export network (Figure 2.11.3) demonstrates China's dependence on semiconductor and machinery/electrical components from Japan, Korea, Taiwan Province of China, and to a lesser extent, the United States. The results of similar stress tests—assuming that US pressure on other economies leads to semiconductor and machinery/electrical components from the three economies declining by 30 percentage points—suggest that growth in China's high-tech exports could decline by 5 to 17 percentage points (Figure 2.11.4).

Figure 2.11.1. Import-Export Network of Selected Manufacturing Economies for Machinery/Electrical Products
(Trade values)



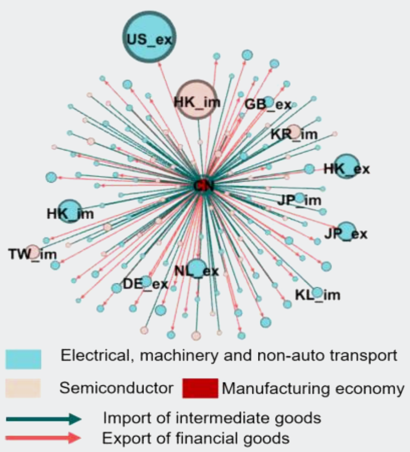
Sources: IHS Markit Global Trade Atlas; and AMRO staff calculations.
Note: A node represents an economy that provides intermediate inputs, for example, CN_im, if it has a green arrow going into the manufacturing economy in the center. A node represents an export destination of products, for example, US_ex, if it has a red arrow going out of the manufacturing economy in the center. Size of the node represents the import or export value of the manufacturing economy from the supplier origin or to the export destination. Data are 12-month averages of the import or export values from February 2019 to January 2020. CN = China; DE = Germany; HK = Hong Kong; JP = Japan; KR = Korea; MY = Malaysia; SG = Singapore; TW = Taiwan Province of China.

Figure 2.11.2. Stress Test on Machinery/Electrical Exports from Selected Manufacturing Economies
(Percent year-over-year; billions of US dollars)



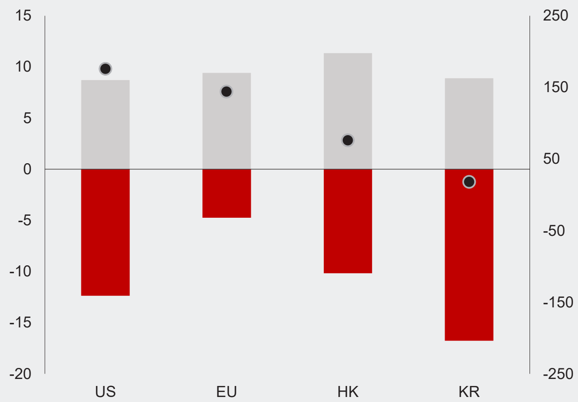
Sources: IHS Markit Global Trade Atlas; and AMRO staff calculations.
Note: The stress test assumes a 30 percent decline in China's supply of machinery parts. The growth rate is proxied by a one-year difference in log levels. Economies along the x-axis denote export destinations of the manufacturing economies. CN = China, EU = European Union, HK = Hong Kong, ID = Indonesia, KR = Korea, SG = Singapore, TH = Thailand, US = United States, and VN = Vietnam.

Figure 2.11.3. Import-Export Nexus for China's Machinery/ Electrical Production
(Trade values)



Sources: IHS Markit Global Trade Atlas; and AMRO staff calculations.
Note: A node represents an economy that provides intermediate input, for example, HK_im, if it has a green arrow going into the manufacturing economy in the center. A node represents an export destination of products, for example, US_ex, if it has a red arrow going out of the manufacturing economy in the center. Size of the node represents the import or export value of the manufacturing economy from the supplier origin or to the export destination. Data are 12-month averages of the import/ export values from February 2019 to January 2020. CN = China; DE = Germany; HK = Hong Kong; JP = Japan; KR = Korea; MY = Malaysia; NL = Netherlands; SG = Singapore; TW = Taiwan Province of China.

Figure 2.11.4. Stress Test on Machinery/ Electrical Exports from China
(Percent year-over-year; billions of US dollars)



Sources: IHS Markit Global Trade Atlas and AMRO staff calculations.
Note: The stress test assumes a 30 percent decline in semiconductor and machinery parts from the United States, Japan, Korea, and Taiwan Province of China. The growth rate is proxied by a one-year difference in log levels. See methodology in Sun and others (2021). Economies along the x-axis denote export destinations of the manufacturing economies. EU = European Union; HK = Hong Kong; KR = Korea; and US = United States.

The authors of this box are Wei Sun and Foo Suan Yong.

Will Tech Tensions Result in Technology Bifurcation?

What do the prevailing tit-for-tat technology measures mean for global trade? This is an important question because the United States and China are not only huge markets but also technology leaders. Some have argued that this tension could result in a bifurcation of technology globally, where some parts of the world uses Chinese technology, while others use US technology. As China becomes more technologically self-sufficient and able to export its technologies to other parts of the world, the prospect of a bipolar technology world is indeed a possibility. But can China successfully extricate itself from technologies that have been developed in the West and that are woven into many day-to-day applications?

What does technology bifurcation mean in the first place? To understand its meaning, we need to differentiate it from the status quo that we are familiar with. In the Internet realm, for example, unless filters and geo-blocking are put in place, a globalized internet means that one can access anything from anywhere at any time. A non-bifurcated technology means that devices can seamlessly connect with other devices, and communicate easily with one another. This interoperability is made possible because most devices work on common standards, or if not, program interfaces have a way of linking different standards.

Standards are like a common language that allows technology to work seamlessly, besides promoting trust in product quality and ensuring consumer safety. Technology standards are a set of characteristics or quantities that assure compatibility across products and devices. In the face of multiple languages, interpreters can still facilitate communication—similar to what program interfaces do in technology.

Non-bifurcated technology is particularly important as IoT is fully rolled out. These myriad of smart appliances and objects need to be interoperable and should communicate and interconnect—therein lies the need for common standards. Standards require transparent algorithms, open-source architecture, and applied program interfaces for manufacturers and third-party service providers to be able to connect with different devices or smart objects.

On the other hand, a bifurcated technology destroys the single universe of interoperability and creates different universes. Devices operating, say, on a distinct "China standard" will be a universe unto itself; while the rest of the devices will only communicate with others on a different (Western) standard. Is this situation bad? It is workable but not the first-best. In a way, we have seen this bifurcation happen before (Box 2.12). China had managed to seal off partially its domestic telecommunications sector by employing a different standard, its own WAPI, from the global WiFi standard. Japan, likewise, had its own technology universe geared to the more advanced and sophisticated Japanese market.

Notwithstanding, the lesson from these examples is that, because of the network effect, it is very likely that a global standard—one that is used by the greatest number—eventually emerges, and helps unify the market. The more users there are of devices based on a particular standard, the more users there would be of devices based on the same standard. This network effect[18/] helps many technology businesses to achieve a "winner-takes-all" or "winner-takes-most" advantage, often leading to a dominant market position, a monopoly, or an oligopolistic market structure. An example is the Ethernet, which became the standard protocol for local computer networks after the DEC, Intel, and Xerox were persuaded to adopt it. Competing protocols existed but as Ethernet pulled away and began to get more market share, Ethernet-compatible products flooded the market. Eventually, Ethernet ports became the standard feature of all modern computers (Currier 2019). Ethernet's "success" illustrates how network effects help embed a standard (protocol) in all products that are based on that protocol.[19/]

The network effect is not exhibited by all industries; it is observed mainly in new markets created by the internet as well as in ICT. In emerging technologies such as autonomous cars, for example, driver assistance systems such as Mobileye, become better the more miles the system drives (for example, more users); the better it becomes, the easier it is to sell the system (to more users). This network effect in the autonomous vehicle market helps establish a dominant position to whichever company that can lock in a large user base. Network effects are also found in hardware systems with large numbers of compatible software applications that attract buyers and thus further incentivize development of more apps; in social media platforms like Facebook with its massive number of users providing value to each new user who, in turn, adds value to existing users; as well as in e-commerce platforms where the large number of buyers attracts a large number of sellers that, in turn, helps attract even more buyers.

18/ A phenomenon whereby the bigger the number of users or participants, the greater the user value of a good or service. User value also depends on the number of users of compatible products. For example, a hardware becomes more useful with the growth of compatible software.

19/ Another example is how VHS won the video recording machine market competition with Betamax in the 1980s because more manufacturers supplied VHS machines, and more titles of pre-recorded cassettes were available for VHS than Betamax (Ezel and Atkinson 2014). That is, the bigger number of complementary goods (VHS cassettes) increased the value to the consumer of the product (VHS machines), which resulted in higher sales of VHS and to the production of more VHS cassettes. This was a result of JVC's widespread licensing of VHS format, in contrast to Sony's control over the license of the Beta format. Sony's mistake is a case of disregarding the network effects from the availability of rental tapes of pre-recorded movies (Economides 2008).

Understandably, the huge benefits to be reaped from technology dominance and capturing the first-mover advantage in new and emerging technologies help explain countries' urgency and rush to introduce their own technology to the global market. Whichever country is able to get the first-mover advantage—which depends on whether its technology is widely used and becomes established as the global standard—will crowd out other competing technologies, and determine the future of a whole body of products, services, and firms based on the technology (Besen and Farrel 1994, Marukawa 2014). The potential benefits from such dominance explain the current global competition in technology standards. China, a late starter, has been investing heavily in R&D to catch up with the other advanced economies. In 2020, it spent USD 563 billion on R&D, equivalent to 1.98 percent of its GDP, ranking second to the United States (Heney 2020) (Figure 2.36). Along with providing large government subsidies, China has also implemented measures that shield local technology companies from foreign competition in the domestic market (Appendix Table 2.2.1.).

All these measures have placed China among the top economies in terms of innovation, but especially in specific technologies such as facial recognition, AI, autonomous driving, and others. In R&D World (2020), China placed second to the United States last year for expenditure in R&D in advanced materials, computing and information technology, energy, ICT technologies, and electronics. It ranked second to Japan for automotive research expenditure and second to Germany for environmental and sustainability research spending (Heney 2020). With these efforts, China has groomed its own "big tech" companies into internationally recognized brands, such as Alibaba, Baidu, Huawei, Tencent, and ZTE.

China's technology firms have also been very active in global standard setting. They actively participate in standard-setting organizations like the International Standards Organization (ISO), the 3rd Generation Partnership Project (3GPP), and other multilateral organizations, while avoiding standard-setting organizations run by private companies that are usually dominated by American firms.[20/] China's technology companies have also been actively applying for patents with the World Intellectual Property Organization, and as of 2020, China is the top economy with the most patent applications.

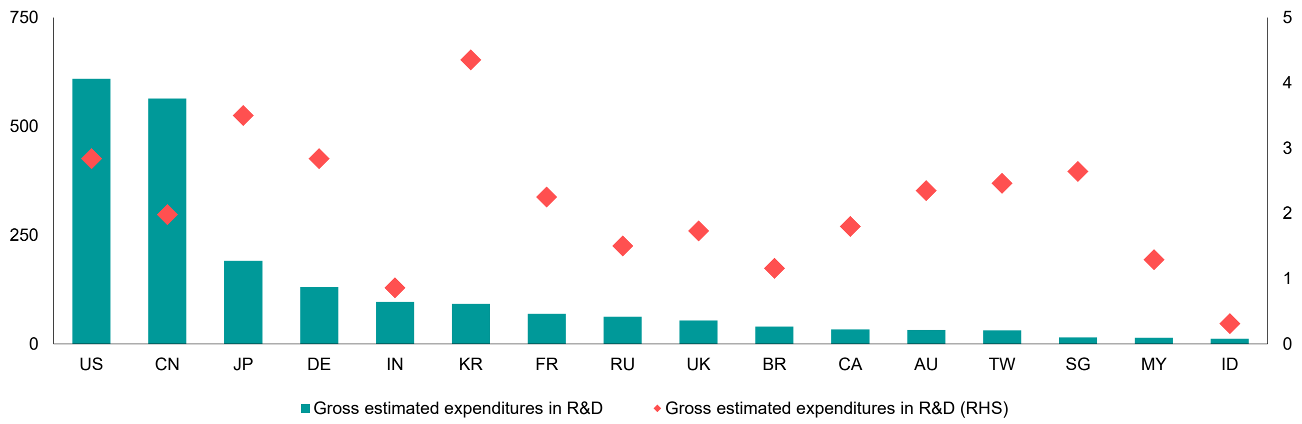
Although most patent applications from China are considered to be of mediocre quality and not foundational, some are considered highly advanced. In 5G technology, for example, Huawei and ZTE hold, respectively, 15 and 11.7 percent of standard essential patents (SEPs), which can make them dominant in later generations of 5G devices (Kim, Lee, and Kwak 2020).[21/] China's technology companies, altogether, already have 34 percent of total 5G SEPs, followed by firms from the European Union (Nokia and Ericsson) and then from Korea (Samsung and LGE) (Figure 2.37). With patents entitling its holders royalty incomes, the more these patents are used in devices, the greater the royalties for patent holders.[22/] Patents help dictate industry standards (Box 2.13); owning a significant portion of the patents in the underlying technology, say in 5G, helps in bidding cost-effectively for projects (for example, network projects)—with great potential for network externalities. It is also a security advantage because "whoever controls the technology knows intimately how it was built and where all the doors and buttons are" (Zhong 2018).

20/ The 3rd Generation Partnership Project (3GPP) is a group of telecommunications standards development organizations.

21/ These patents are indispensable for the implementation of a standardized technology.

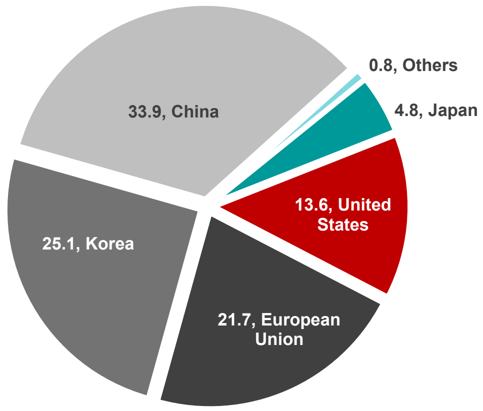
22/ Essential patents can be pooled to minimize risk and cost of negotiating individual royalties and facilitate further innovations. Patent owners receive royalties according to their proportion in the size of the patent pool.

Figure 2.36. Estimated Gross Expenditures on Research and Development, 2020
(Billions of US dollars in PPP terms; percent of 2019 GDP)



Source: *R&D World*.
Note: AU = Australia; BR = Brazil; CA = Canada; CN = China; DE = Germany; FR = France; ID = Indonesia; IN = India; JP = Japan; KR = Korea; MY = Malaysia; RU = Russia; SG = Singapore; TW = Taiwan Province of China; UK = United Kingdom; US = United States.

Figure 2.37. Selected Economies: Shares in 5G Standard Essential Patents
(Percent share to total)



Source: Adapted from Kim, Lee, and Kwak (2020).
Note: Standard-essential patents, or SEPS, are indispensable for the implementation of a standardized technology.

Box 2.12:

Technology Bifurcation: Not New

This box discusses two examples of how China sought to develop its own "endogenous" technology, as well as Japan's ICT experience of what is now known as the Galapagos Syndrome (Ezel and Atkinson 2014). For China, the first example is the rollout of WAPI, a wireless local area network (LAN) protocol developed for the domestic telecommunications market, the aim of which is to take the place of the international LAN standard WiFi. Another is TD-SCDMA, a China standard for 3G mobile technology. The result in both examples is the emergence of an ICT universe and ecosystem of devices, parallel to the global ICT, which leverages the large Chinese domestic market, but is not usable outside of China.

WAPI—Wireless Local Area Network Authentication and Privacy Infrastructure. WAPI is a home-grown security protocol for wireless local area networks (WLAN) that the Chinese government had pushed mobile carriers to adopt in China, instead of the international wireless standard WiFi. It is a policy that China arguably holds to be in line with the WTO/TBT Agreement.[1/] WAPI is designed to have built-in security standards that address its concerns over the existing encryption security flaws of WiFi which, to China, pose risks to national security. Nonetheless, the IEEE802.11i standard, commonly known as WiFi, is the approved standard by the Institute of Electrical and Electronic Engineers and is the global de facto technical protocol standard for data transfer in WLAN; as such, this is the standard that electronics manufacturers all over the world, outside China, conform to. One global standard helps create a single market in WLAN equipment, wherein parts and systems connect seamlessly across borders and device platforms.

Unlike the free WiFi algorithm, WAPI is a proprietary standard, whose algorithm is known to only 24 government-designated Chinese firms. To gain access to the WAPI, foreign firms must negotiate with these designated firms for a license. This carries the risk of technology transfers, loss of intellectual property, as well as high license charges. Foreign companies were required to pay royalties for the use of WAPI and provide their proprietary technical specifications to sell equipment in China. There is also the loss of economies of scale for wireless chip manufacturers associated with the single global WiFi standard. Since WAPI and WiFi standards are incompatible, many WiFi products cannot be used in the Chinese market. Intense pushback from foreign companies and governments has caused China to shelve the mandatory rollout of WAPI across the country, and allow alternative WLAN technologies to operate in parallel to access private networks. However, China continues to require WAPI protocol for all government procurement of WLAN technologies, as well as for access to public networks across the country.

Today, Chinese and foreign technology standards co-exist in the domestic market; wireless devices sold in China incorporate chipsets that support WAPI along with alternative WLAN technologies (for example, Wi-Fi Protected Access, Wi-Fi Protected Access II, and Wired Equivalent Privacy). With the use of WAPI, China earns from license fees collected from foreign manufacturers that sell in the Chinese market.

TD-SCDMA—Time division-synchronous code division multiple access. TD-SCDMA is the Chinese standard of third-generation (3G) mobile telecom technology, along with two other 3G international standards: Wideband Code Division Multiple Access (WCDMA) and Code Division Multiple Access (CDMA) 2000. For China, the TD-SCDMA is promoted for national security and is an accepted international standard. Although it did not manage to get worldwide adoption, it helped China gain experience in developing and working toward approval of global technology standards. TD-SCDMA was also a negotiating tool to lower royalties for overseas patents. The perception of weaker 3G technology standards, however, cost China Mobile, the state-owned telecommunications operator forced by the government to use TD-SCDMA, to lose its dominance in China's mobile phone market. While China Mobile's share in the 2G market was a commanding 70 percent, this dropped to 40 percent in 3G, while its competitors using WCDMA and CDMA2000 gained market shares (Ezel and Atkinson 2014).

[1/] The WTO/TBT Agreement states as legitimate objectives for member economies the following: national security requirements; prevention of deceptive practices; protection of human health or safety, animal or plant life or health, or the environment (Article 2.2 of the TBT Agreement). Article 2.4 further specifies that where relevant international standards exist […] members shall use them (or relevant parts thereof), as basis for their technical regulations except when such international standards or relevant parts would be ineffective or inappropriate for the fulfilment of the legitimate objectives. For China, the WiFi's fundamental security flaws make it inappropriate for national security protection.

China delayed the introduction of 3G mobile services for about three years until the TD-SCDMA standard was ready for the market. The delay unwittingly hurt the development of the domestic mobile phone economy that thrives on a mobile applications ecosystem.

Galapagos Island syndrome: Japan also has experience in developing unique technology standards for 2G and 3G mobile networks that gave local companies advantage in the domestic market. In fact, these standards were far more advanced and innovative than what were then used in the United States and in Europe in the 1980s and 1990s. But because these standards were developed for Japan's market, Japanese mobile manufacturers had difficulty exporting their products to foreign markets. They were eventually left behind by other manufacturers that were using global standards, and later emerged as ICT leaders. The Japanese cell phone phenomenon of technology isolation came to be known as the Galapagos Island Syndrome. It takes the name of the island in Ecuador that Charles Darwin discovered in 1835 to have fantastically evolved flora and fauna, the species of which were different from those in mainland Ecuador.

The author of this box is Gloria O. Pasadilla.

Box 2.13:

5G: Standards and Patents

Fifth generation wireless technology, or 5G, is the emerging new standard for wireless telecommunications. Nonetheless, it is more than just a new wireless protocol. 5G is not only faster than 4G with low latency (that is, minimal delay), it is also a bunch of technologies like antennae designs and device communication protocols that can standardize how networks and network applications collaborate (Deloitte 2019). 5G is thus expected to spur the wider adoption of the next generation of technologies such as artificial intelligence, Internet of Things, augmented reality, robotics, and autonomous driving, among others.

While earlier telecommunication technology made people-to-people (P2P) connectivity possible, 5G enhances this, and also accelerates machine-to-machine (M2M) connectivity. The more devices are connected, the greater the network effect. The data from these machine interactions generate yet again another layer of network effect—the "data-network" effect. Just as the first group of economies that adopted the early generations of wireless technology—from 1G to 4G or LTE—reaped huge economic benefits, 5G adoption is also expected to generate unprecedented commercial payoff. The first-mover advantage for an economy that adopts 5G and installs a large base of users for its technology therefore beckons.[1/]

The huge benefits accruing to the global standard setter help explain the large financial support that some governments are providing for 5G research and development, for building infrastructure, as well as for influencing global standards in 5G and other advanced technologies.[2/] Efforts appear to be paying off for China—Huawei, for example, now leads the global 5G patent race (Figure 2.13.1).

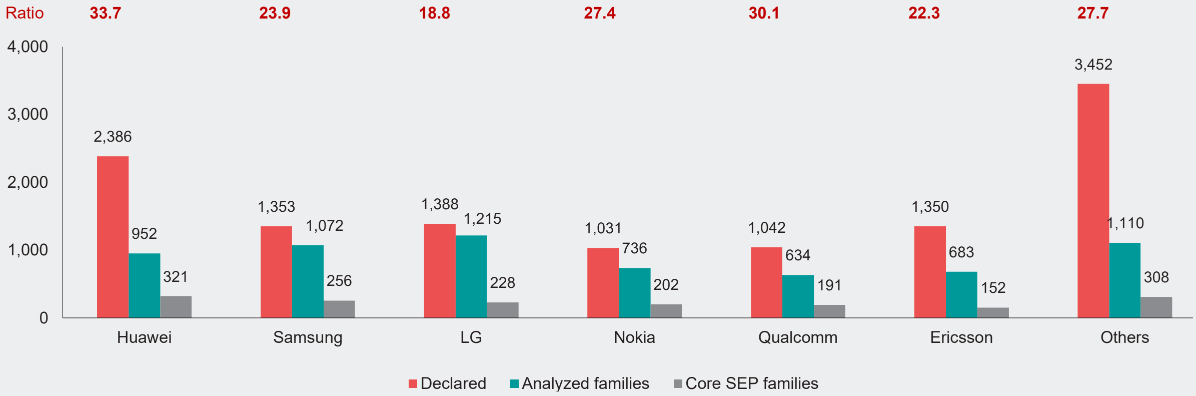
While a dominant firm, a regulatory body, or an industry body may set standards for the domestic market, where the battle is currently raging is in the setting of international or global standards. China has learned its lessons from previous efforts at establishing domestic standards that are not internationally compatible. Thus, instead of having a China-only domestic standard, it now seeks to influence the global standards through active participation in international standards-setting bodies such as the International Telecommunications Union (ITU), or the 3rd Generation Partnership Project (3GPP), an umbrella organization for a number of standards organizations that develop protocols for mobile telecommunications (Duesterberg 2019). Some 5G standards fall under the auspices of 3GPP.

Patent owners (or patentees) benefit from the established standards that use its patented technology through royalty payments. More importantly, the firm that controls a technology that becomes established as an industry standard can have an extremely profitable position, through the so-called "architectural franchise" (Besen and Farrel 1994). An early lead is a strong advantage, even if it is an inferior technology, if it is able to establish a large base of many compatible products. In network markets such as telecommunications, a winning standard eventually emerges as dominant (Besen and Farrel 1994). The prize is especially alluring in network markets where users want to buy products compatible with those bought by others. This explains the intense competition to have one's technology become the standard. The bigger the potential market and payoff, the fiercer the standards competition.

1/ Yet while 5G will generate new products and services, it is not certain whether the telecommunications operators who enable it will capture the benefits. Previously, instead of telecom operators reaping new revenue streams from LTE rollout, the benefits primarily went to over-the-top applications providers whose traffic volume grew exponentially. In other words, carriers generated positive externalities that did not translate into increased revenues for them but for others. Among carriers with legacy systems, an investment case is still being sought for the new 5G infrastructures and the capital expenditures they will involve.

2/ A standard is a technical requirement that establishes engineering or technical criteria, methods, process, and practices (WIPO 2014). Some standards aid in security or safety in the use of a product but from a commercial point of view, standards are important for the widespread use of new technologies that help companies attain economies of scale. Global standards obviate the need to significantly alter products for different markets. In turn, the savings derived from economies of scale can be used to generate new products and innovations.

Figure 2.13.1. Essentiality Ratio of Top Companies' Core Standard Essential Patents
(Number of patents)



Source: Telecoms.com.
Note: Standard essential patents, or SEPS, are those that are indispensable for the implementation of a standardized technology. Essentiality ratio is defined as "the ratio of actual standard essential patents to the total number of patents declared as essential for LTE Standard by prominent telecommunication companies" (Singh 2020). The ratio for Huawei, for example, is computed by dividing the value of the grey bar with the teal bar, multiplied by 100.

On the other hand, standards can also become barriers to entry for would-be competitors, especially if an otherwise voluntary standard—which most global standards in fact are—is made mandatory, usually through government fiat. Standards also become barriers to entry when switching from one standard to another is very difficult. However, once switching costs decline, returns from winning the standards competition diminish. In 3G standards, for example, the switching cost between WCDMA and CDMA2000 or for that matter, TD-SCDMA, eventually became negligible because technology made it possible to build chips that incorporate all types of 3G standards (Marukawa 2014). Indigenous standards under a low-switching cost scenario ultimately provide little help to domestic firms as they have minimal impact on foreign competitors. Alternatively, firms can agree to explicitly or implicitly make their products compatible, eliminating artificial barriers to competition between technologies. Instead, they compete in the usual market dimensions, such as price or specific product features and services.

Patentees may also own different patents relevant to a standard. In this case, a patent pool is formed and a standard license with respect to the patent pool is agreed on, where each patent owner is allocated an agreed share of the licensing fee. A patent owner may choose to become a barrier and refuse to join the pool, but competition rules can serve as a check on that patent owner's power.

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What are the Implications of a Bifurcated Technology World?

The current tech tensions between the United States and China have led to concerns over the emergence of two competing technologies and a bifurcated technology world. However, in industries that exhibit network effects, for example 5G telecommunications technology, it is possible that one of them could eventually emerge as the dominant technology and the industry standard setter in the long term (Box 2.13).

Before one technology eventually dominates, however, the global market might have to work with different devices that are compatible with only one or the other technology standard. Simply put, technology bifurcation may emerge. It will limit the compatibility and communication among all 5G devices, which will be divided into two groups, with each group of devices aligned with the same standard. This has important ramifications for the Internet of Things wherein machines, appliances, and other smart objects need to communicate with each other. Such bifurcation can result in a loss of economies of scale (Boxes 2.12, 2.13). Still, just as what happened with other technologies, the switching cost to migrate from one technology standard to another is likely to decrease over time as interface technologies are developed to overcome the problem of incompatibility. Hence, divergent technology standards will not stymy the global advance in new technologies for long. While technology bifurcation can exist in the short term, developments in technology itself—such as tech interfaces—will likely solve the incompatibility issue, making the differences in technology standards inconsequential in the long term.

However, while the technology bifurcation itself can be remedied in the long term by advances in technology interfaces or open architectures, the dominant position that was initially established can be sustained because of "path dependence" that also characterizes network industries.[23/] The concept refers to the dependence of a system or network on past decisions of producers and consumers (Economides 2008), which can explain why a dominant position may persist. This is also the reason economies and businesses put a high priority on establishing a large installed base of users of a technology and race to be a dominant firm early on. An example of how path dependence has protected a company's dominant position is Google. Now, even as other websites such as Bing have emerged, Google remains a leader in the search engine market outside China, because users are so used to using the search engine that "to Google" has become synonymous with searching the internet, even if another engine is being used.

Although technology itself might ultimately solve the problem of incompatible standards, the problems that are harder to unravel are those that are rooted in regulation, security, or more recently, geopolitics. In particular, the localization of data[24/] that is rooted in culture—for example, where personal privacy and security trump all other economic considerations, or the national security rationale wherein data transfer is considered a strategic matter—are what can significantly slow the interconnectedness that new technology is meant to create.

IV. Summary and Policy Implications for the ASEAN+3

This chapter discussed the likelihood and implications of GVC reconfiguration and technology bifurcation as a result of the tensions between the United States and China, amplified by the supply disruptions during the COVID-19 pandemic. The evidence, so far, does not point to a wholesale reshoring (or nearshoring) or transfers of manufacturing capacity out of China, which has become a dominant player in the global supply chains of many products. There are, undoubtedly, movements by a few Tier 1 suppliers of specific manufacturing products, either back to the United States or to other countries in the region, especially Vietnam. Many labor-intensive and cost-sensitive suppliers of GVCs have likewise left China even earlier, to move to other lower-cost economies in Asia or in other regions. More outward movements will no doubt be observed in the future as more MNEs seek to build global supply chains that are not only more efficient and cost-effective but also more resilient.

Nonetheless, the ASEAN+3 region remains an attractive location for GVCs because of its large and rapidly growing middle class and strong growth prospects, as discussed in Section II. It may also require considerable transition costs to completely decouple from China, because of the sticky

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23/ Path dependence is the dependence of a system or network on past decisions of producers and consumers (Economides 2008). This explains the importance of a large installed base of users of a technology and the race for early dominance.

24/ Data regulations are current issues that are too big to discuss in detail in this chapter. Nonetheless, the authors recognize that data regulations present major hurdles that can lead to "splinternet" or to the lack of interoperability among smart devices, and that further research on this area is needed.

characteristics of GVC investments, especially in sectors such as electronics and automotive manufacturing. The complex ecosystems that China has built around different GVCs, including in automotive and apparel manufacturing, are also difficult to transfer and replicate elsewhere. Hence, a China+1 strategy appears to be the most realistic and feasible option. Whichever economy—or subregion—captures most of the China+1 GVC investments stands to gain in higher employment and growth.

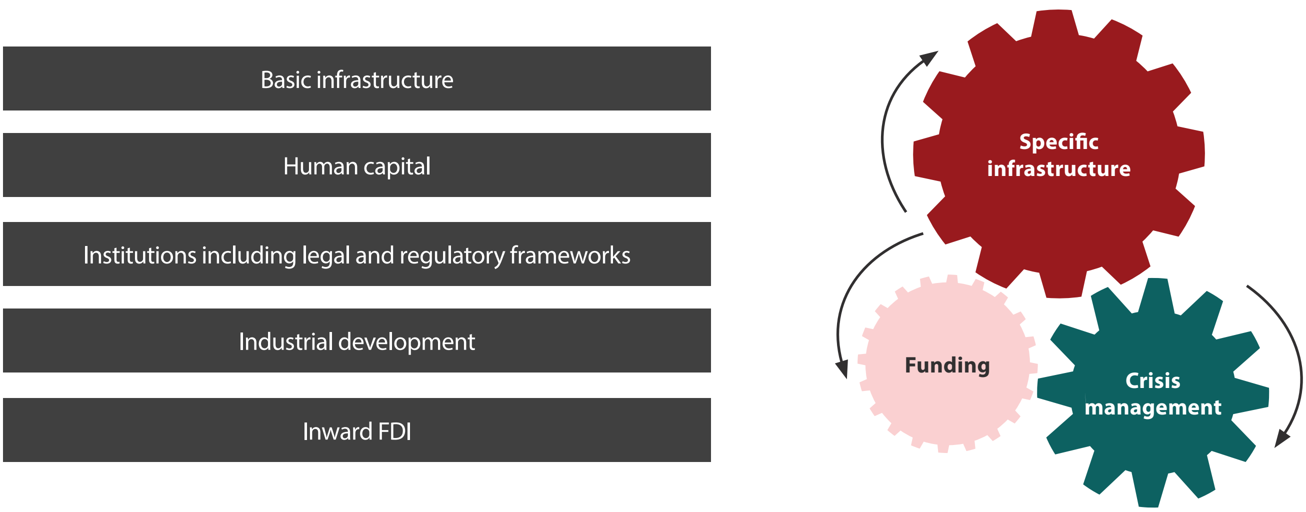
ASEAN is well-positioned to benefit from this global strategy given its diversity of factor endowments, its location in a fast-growing region, and a relatively well-developed manufacturing infrastructure. Every ASEAN economy will strive to attract GVC relocation investments and it is likely that each will attract those industries which play to its comparative advantage. Vietnam is an early beneficiary of the China+1 strategy because of its attractiveness as a manufacturing hub for labor-intensive industries. Indonesia and Thailand, on the other hand, would be attractive locations for the automotive industry and Malaysia for the electronics industry. Here, accelerating ASEAN's integration ambition, not only in goods but especially in services, will also be an enormous boost for attracting GVC relocation investments because integrated markets are favorable for supply chain operations.

The broad thrusts of ASEAN+3 economies' strategies for participating in GVCs, to grow and develop their economies, remain as relevant as ever. For manufacturing in particular, many ASEAN+3 economies have used an effective playbook. This has involved (1) building basic infrastructures and then adding to or improving them over time; (2) developing human capital and upgrading it with an increasingly strong vocational bent to meet industry needs; and (3) strengthening institutions, including legal and regulatory frameworks, and government bodies whose mandates include driving industrial development and attracting FDIs (Figure 2.38). These are basic but important elements of good economic policymaking and will remain relevant, no matter how GVCs are being, or will be, reconfigured. For developing economies in the region, these policies, especially building hard and soft infrastructures, should remain major priorities.

That said, at least three adjustments will be important for ASEAN+3 economies going forward in the wake of the COVID-19 pandemic experience. First, for most economies, this would mean tilting the balance from building generic to building digital infrastructure, such as telecommunications equipment for 5G networks, vocational schools for IT, and regulatory frameworks catering to the needs of the digital economy. For example, the ASEAN Digital Masterplan 2025 envisioning the region as an economic bloc powered by "secure and transformative digital services, technologies and ecosystem" (ASEAN 2021) and working closely with market players are steps in the right direction. Second, the region's economies must markedly strengthen their institutions and policy response frameworks for crisis management to better face future shocks. Third, they must work on rebuilding fiscal policy space and securing sustainable funding for the required infrastructure investments and institutional developments (Figure 2.38).

Leading manufacturing firms are increasingly looking for infrastructure ecosystems in production sites (World Economic Forum 2020b). Further, cases identified by the World Economic Forum's Global Lighthouse Network suggest that when MNEs decide where to anchor their global supply chains, they look for a minimum threshold of infrastructure quality. But once the minimum cross-border connectivity is met, these enterprises begin seeking high-technology and well-integrated sites from which they can carry out advanced production activities at scale, while ensuring operational continuity (World Economic Forum 2020b).

Figure 2.38. ASEAN+3: Strategies for Participating in GVCs, Past to Present and the Future



Source: AMRO staff.
Note: FDI = foreign direct investment.

For ASEAN+3 economies to attract and host leading MNEs, particularly in the 4IR sectors, it is important to focus on the specific types of infrastructures that lead firms require. As the 4IR picks up pace in the post-pandemic global economy—where financial resources are more limited than before and firms are more cautious about where to invest—such a policy focus would be necessary for ASEAN+3 economies to attract more inward FDIs and participate in the changed and digitalized GVCs. However, in less-developed ASEAN economies, "new infrastructures" such as charging stations for autonomous cars, should not displace the priority put on basic infrastructures like roads, hospitals, schools, or basic ICT. Plus-3 economies can help with technical and financial aid to transition infrastructures in less-developed ASEAN members toward more 4IR-supporting ones.

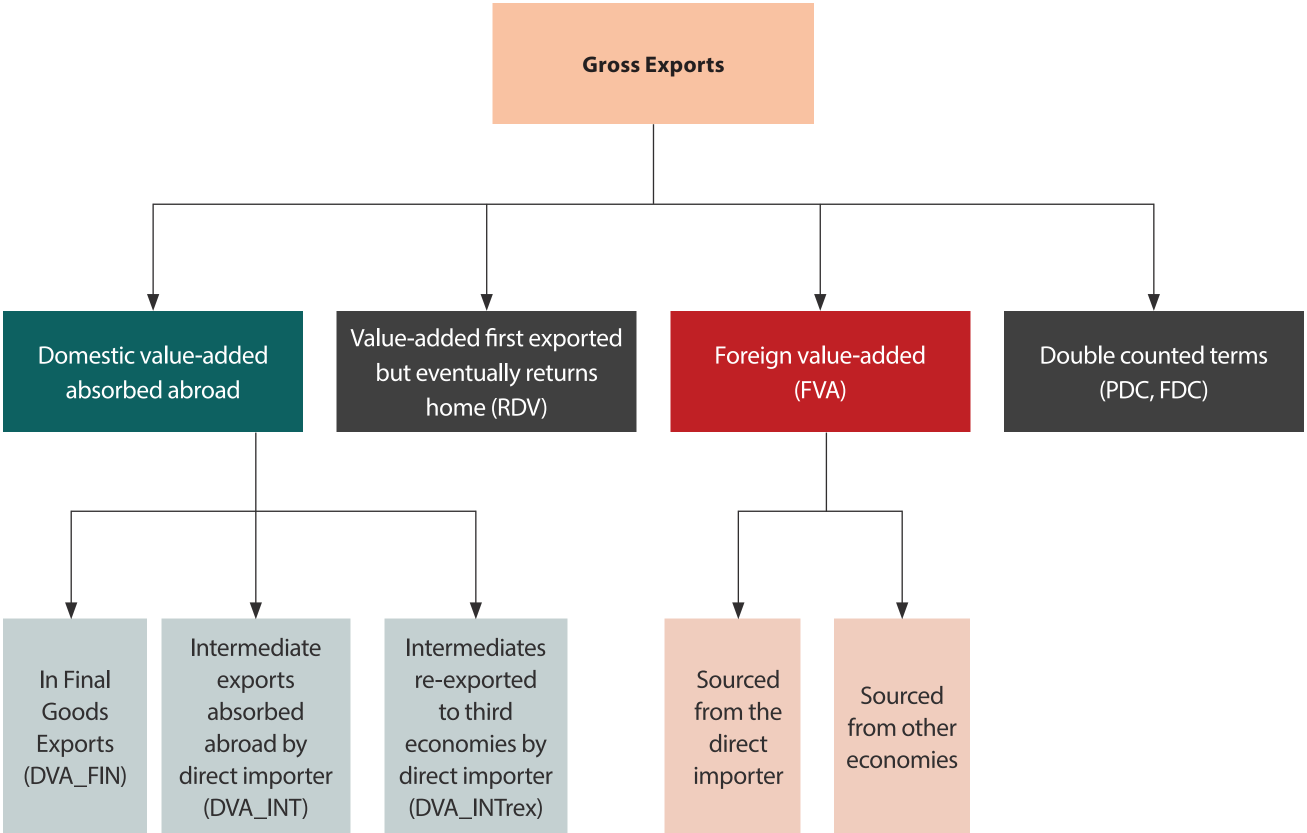
In the post-pandemic period, the nature of technological progress specific to different industries would likely lead to marked differences in whether supply chains in a given sector lengthen or shorten, become simpler or more complex, or turn out to be more capital- or infrastructure-intensive or less so. ASEAN+3 policymakers need to better understand the various factors driving the reconfiguration of GVCs. The pandemic experience has highlighted the need for a redesign of institutions and crisis management frameworks to ones that revolve not only around cost-efficiency, but also production at scale and resilience to operational disruptions. This has implications on how economies plan and design their cities to cater to the needs of the business community in the digital economy and in the design of industrial parks to cater to large-scale automated factories based on Internet of Things, AI, and robotics, as well as customer-centric plants that leverage on blockchain, data analytics, and AI for high degrees of customization and production.

The huge stimulus packages implemented to support the economies during the pandemic have reduced governments' policy space and fiscal buffers. This situation is more challenging for policymakers to mobilize the financial resources to fund the infrastructure needs and institutional reforms and developments. The pandemic experience has also underscored the need to rebuild the fiscal policy space as buffer against future shocks. Policymakers must therefore develop medium-term fiscal plans to rebuild policy space by restoring tax cuts, raising more revenue, reducing extraordinary transfers and spending during the pandemic, and restoring and prioritizing capital spending in their budget allocations—while ensuring that the withdrawal of stimulus measures does not jeopardize the transition of the economy to the "new normal."

Authorities should also partner with the private sector to mobilize funding and crowd in more investments, including tapping their expertise to develop the financial markets in the region. They could work more closely with the international community, especially the ASEAN+3 members, to strengthen financial cooperation and establish funding facilities for infrastructure investment and reform the institutional framework to enhance connectivity and promote the digital economy. The ASEAN Plus Three cooperation process can be tapped to explore more avenues for regional financial cooperation, as initiatives such as the development of local currency bond markets and the regional infrastructure for cross-border settlement will continue to be crucial in helping individual economies meet future investment and infrastructure needs. There is also scope for market practices across economies to be harmonized to facilitate closer financial ties, and in the aftermath of COVID-19, for these to be consistently reviewed and realigned with how markets change with the "new normal." Financial cooperation to provide more access to funding and markets for the region's SMEs, in particular, will also be critical in achieving strong and equitable growth for the ASEAN+3 in a post-pandemic world. Finally, taking the lessons of the pandemic to heart, policymakers should look ahead and prepare their economies to meet structural challenges from natural disasters, climate change, and other future disruptions.

Appendix 2.1. Methodology for Decomposing Exports

Appendix Figure 2.1.1. Decomposition of Gross Exports to Value-Added Terms



Source: Wang, Wei, and Zhu (2018).

Appendix 2.2. United States and China: Tech Tensions

Appendix Table 2.2.1. United States and China: Technology-Related Measures and Countermeasures

Measure	Implemented by the United States	Implemented by China
Export restrictions	Export control regime for sensitive technologies; prohibits transfer of US technologies Extended export restrictions on foreign country-produced semiconductor chips that use US software or technology (to bar China's semiconductor imports from third economies) Restrictions on sale of US software and technologies used in semiconductor manufacturing	Export control on rare earth metals (material used in electronics components manufacturing) Export control for additional 23 fields of cutting-edge technology, including laser, drones, ultra-high-voltage transmission, clean coal power generation, quantum encryption, early warning technology based on massive data harvesting, technologies used in 3rd and 4th generation nuclear equipment and materials, sea-borne satellite launching pads, engineering equipment, and machinery used in building manmade islands in deep water
Licenses	Sale of US technologies to Chinese firms in the Entity List requires US government license Firms on the Entity List are included on security grounds and for end-user and end-use direct control	License required to operate any Chinese website and requires local establishment License required for the technologies listed under export control License required for doing business with companies in Unreliable Entity List (a counterpart for the US Entity List)
Investment-related measures	Government review of foreign investments especially those targeting early-stage technology companies Prohibits foreign government-controlled (for example, state-owned) investment transactions in US technology	Foreign ownership limit of 50 percent on telecommunications value-added services Creation of Unreliable Entities List (of foreign companies) that succumbed to US pressure Outward investment strategy directed at foreign technologies, for example, design technologies (strategic priority)
Outright bans	Export control of US dual-use technology that could be used in weapons development, military aircraft, or surveillance technology	Foreign ICT products in critical infrastructures are banned for public procurement
Domestic regulations	US rural telecom carriers barred from using Huawei, ZTE network equipment in telecommunications infrastructure Reduce government's reliance on electronic parts from China Ban US telecommunications companies from buying, installing, or using foreign-made equipment from "foreign adversaries" Ban government procurement of contractors that use telecommunications or video surveillance equipment or services from five Chinese companies: Huawei, ZTE, Hytera, Hikvision, and Dahua	Centralized control of international gateways: blocking, filtering, and monitoring system through the "Great Firewall" Online censorship on media, blogs, forum content; data localization for online publishers Telecom operators, internet service providers required to monitor content and user behavior and to report to authorities Cross-border data transfer requires government permission Government procurement favors indigenous technologies where IPRs have been either created in China or been fully acquired Local content requirement of 60 percent minimum for export subsidies
Government subsidies		Subsidy on R&D and ICT technologies to reduce reliance on foreign technology imports Public investments in various Chinese internet startups
Taxes		Tax discrimination or discriminatory rebates for locally produced chips and software

Sources: Ferracane and Lee-Makiyama (2017); various media articles; and AMRO staff.

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