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# Global Value Chains: Overview and Issues for Congress

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## Global Value Chains: Overview and Issues for Congress

Global value chains (GVCs) divide production processes into discrete stages located around the globe. Using GVCs, companies can organize different parts of their value chain strategically, such as locating in a target customer's home market or a competitor's base. When deciding where to locate particular stages of production, firms typically consider key inputs such as raw materials and labor—along with associated accessibility, costs, and quality—and domestic policies that may encourage or discourage different types of investment. Congress, in particular, has an interest in understanding the economic and broader policy implications of the ongoing evolution of global value chains on U.S. businesses and consumers.

Since the 1990s, GVCs have shaped the global economy. More than two-thirds of world trade occurs via GVCs each year, representing a shift in how trade and commerce are conducted as trade in intermediate goods and services exceeds that of commodities and finished goods.

Unilateral trade liberalization and lower trade barriers made possible by free trade agreements (FTAs) and the creation of the World Trade Organization (WTO) have spurred GVC growth. Technology advancements and new internet-enabled services that lower costs and provide seamless connections around the world have also been a major factor. Consequently, companies and countries can focus on comparative advantages and specialize in different products and services within value chains, opening economic opportunities and new markets for small businesses and developing countries.

Despite the growing presence of GVCs in the global economy, recent events have highlighted the potential risks and vulnerabilities of GVCs, particularly those that are concentrated in a particular region or reliant on a single supplier. Worldwide natural disasters, emergencies, and other policy-driven circumstances, such as the Coronavirus Disease 2019 (COVID-19) pandemic, have shown that GVC links integrate and create interdependence between economies, which can leave companies vulnerable to external shocks, including interruptions in other countries. At the same time, interdependence can create broader economic growth and strengthened relationships among nations. After a period of rapid globalization through the 1990s and early 2000s, the growth of GVCs has slowed in recent years.

Concerns about U.S. value chains and the ongoing COVID-19 pandemic have raised questions about potential risks that GVCs may pose for particular economic sectors, the economy more generally, and, depending on the product and degree of external dependencies, national security. For example, recent events have shown that certain sectors, such as medical supplies and information technology and communications equipment, are susceptible to risks if the production of key components is concentrated in one country or controlled by one company. Some companies are seeking to diversify their supplier base across countries and regions, in part to increase their resilience and to lower their risk exposure. Some analysts foresee greater shifts in the future. To mitigate risks and vulnerabilities, companies may (1) rethink their business models and seek to build in redundancies for resilience, (2) focus more on shorter local or regional value chains, and/or (3) utilize emerging technologies to lower and diversify risks and costs. These shifts will likely vary across industry sectors, depending in part on the location and availability of suppliers and customers, as well as U.S. and foreign trade and investment policies.

In response to the risks described above, many policymakers, companies, and other stakeholders are reevaluating the role of GVCs in the economy. Several factors influence the formation and configuration of GVCs, including new and updated FTAs (e.g., the U.S.-Mexico-Canada Agreement), along with changes in import policies, rules of origin, export controls, investment regimes, and labor and manufacturing costs. These factors provide Congress with multiple levers to influence corporate decisions. Some U.S. and foreign policymakers have introduced legislation and other measures to incentivize, or in some cases force, companies or certain industries to shorten their value chains and increase domestic production. Such measures could affect the accessibility, quality, and price of goods sought by U.S. buyers.

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## **Introduction**

Global value chains (GVCs) are an important aspect of current international trade and investment. Such chains disaggregate production processes into discrete stages in various locations around the globe to achieve efficient production. Since the 1990s, powered by trade liberalization and advances in services and technology, companies have increasingly structured international trade around global value chains. Global commerce has grown more complex and involves less bilateral trade in final goods and services between two countries and more vertically integrated trade, often across many borders. As a result, to participate in the global economy today, countries no longer need to specialize in the full production of final goods and services. Instead, participating countries can focus on specific tasks and business functions in which they have a comparative advantage within a production process. For instance, design, engineering, and branding of a product may take place in the United States with managers overseeing assembly in Asia, with inputs that were manufactured in Asia, Latin America and Europe.

GVCs are used by firms of all sizes and across various industrial and commercial sectors. Some are relatively simple, involving a few players, while others are more complex, with partners and their suppliers supporting a multilayered GVC structure. Smaller firms participating in larger GVCs may not even know their ultimate end customer—a lack of transparency that may leave partners or firms further up the value chain vulnerable to sudden shifts or external events. Overall, GVCs are seen as beneficial in increasing trade and investment globally and ultimately leading to net economic growth. U.S. firms and their workers play leading roles in managing GVCs of multinational firms as well as participating as suppliers and partners in U.S. or foreign companies' GVCs. At the same time, the globalization of production has raised questions among some U.S. policymakers and challenged certain long-held perceptions about the impact and effectiveness of certain federal policies, including those related to international trade such as free trade agreements or import rules.

For many observers and analysts, the Coronavirus Disease 2019 (COVID-19) pandemic demonstrates how GVCs have grown more complex and global in scope. It also highlights the risks of relying on certain global value chains, in particular those with supply and distribution channels that are, on one hand, expansive or, on the other, highly concentrated and that use just-in-time manufacturing systems with minimal stockpiles. Shortages of intermediate and final goods during the pandemic have illustrated the resilience and robustness of some supply chains and the vulnerabilities and weaknesses of others.

Some policymakers, corporate leaders, and other stakeholders are evaluating current U.S. GVCs' patterns and policy aspects. In doing so, they are examining the costs, feasibility, risks, domestic capacity, and potential options to potentially shift or reconfigure some of these supply chains. Some Members of Congress and the Trump Administration have sought to incentivize U.S. domestic production to restore or “reshore” production to the United States, lessen U.S. reliance on certain imports, and diversify U.S. production bases geographically, particularly away from China. Some firms are seeking greater diversification to address certain unintended consequences that have become apparent during COVID-19, including with respect to the predominant role of China in certain GVC inputs.

This report provides an overview of GVCs, their potential costs and benefits including their emergence and role in the economy, explores possible vulnerabilities associated with GVCs, and identifies issues and options for companies and policymakers to reduce related risks and potentially strengthen the domestic economy.

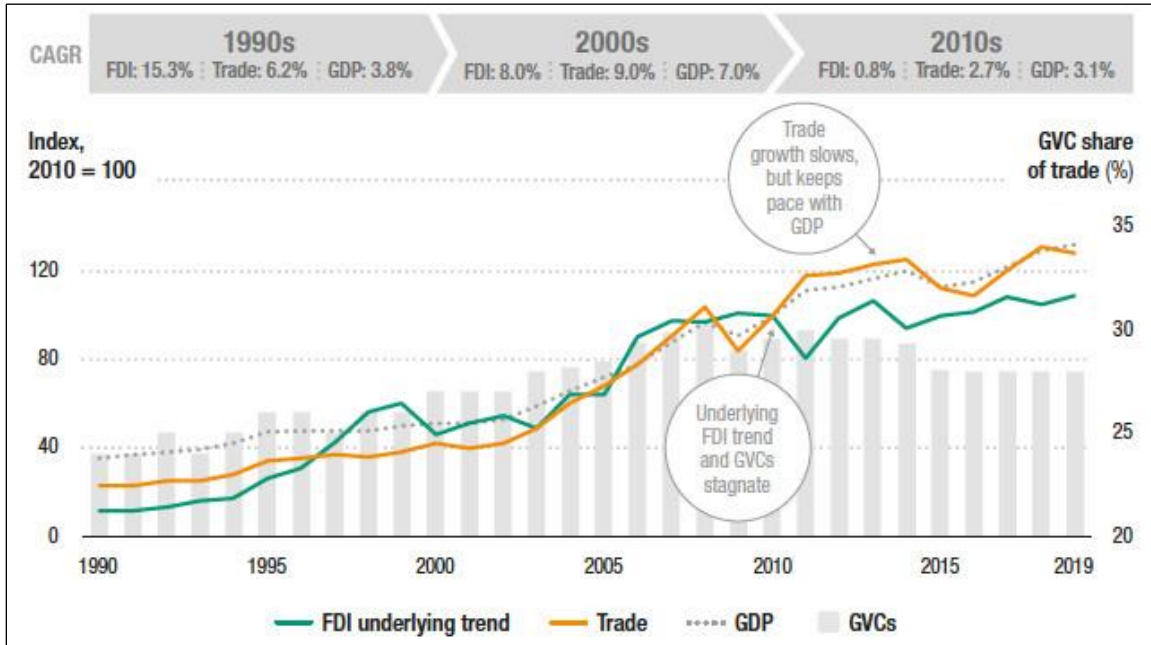
## Economics of GVCs

U.S. trade has become increasingly complex, and the changing dynamics of the global economy pose both opportunities and challenges for the United States. In the past, U.S. firms tended to source most or all of their production in the United States, using inputs and raw materials that were made or sourced domestically. The reasons for this insularity are largely historic and can be traced back to the early development of the U.S. economy. The Commerce Clause of the U.S. Constitution promoted interstate commerce by ensuring that individual state economies would unite into a single national market that allowed for the free movement of goods, capital, and labor anywhere within the nation. As the domestic economy developed over time, the U.S. government intervened to incentivize or subsidize transportation and communication infrastructure (e.g., roads, railways, ports, and eventually airports), regulate business activity, protect intellectual property, and encourage innovation. This large, unified market gave U.S. businesses a distinct advantage in global markets, since they could spread their operations across multiple state markets and take advantage of concentrations of consumers, natural resource endowments, and different labor skills and wages—all while operating under a common, shared federal regulatory system.

The paradigm under which many U.S. businesses operated for much of the 19<sup>th</sup> and early to mid-20<sup>th</sup> centuries was based on geographical boundaries, country-to-country trade of final goods, and vertically integrated, domestic manufacturing. The process of opening up economies, removing barriers to trade and investment, and deepening economic integration and interdependence, however, began to introduce fundamental changes to the U.S. and global economies. The growth of new competitors, many of them emerging market and developing economies, contributed—and in many ways continue to contribute—to changes in the direction and composition of international trade and investment, as well as to the redistribution of power within the global economy. Although the present period of economic globalization began after World War II, these trends accelerated in the 1980s with China’s economic reforms and opening-up, and intensified even further in the 1990s following the end of the Cold War (**Figure 1**)

**Figure I. GDP, Trade, FDI, and GVCs Trends: 1990-2019**

GDP, trade, and FDI indexed, 2010 = 100; GVCs, percentage



**Source:** United Nations Conference on Trade and Development, *World Investment Report 2020: International Production Beyond the Pandemic*, June 2020.

**Notes:** Trade is global exports of goods and services. GVC share of trade is proxied by the share of foreign value added in exports, based on the UNCTAD-Eora GVC database. The underlying FDI trend is an UNCTAD indicator capturing the long-term dynamics of FDI by netting out fluctuations driven by one-off transactions and volatile financial flows.

In particular, three revolutionary changes have helped to redefine business production methods and facilitate the growth of GVCs: (1) technological developments that reduced the costs of communication and transportation; (2) the rise of business management strategies that emphasized core competencies and just-in-time production;<sup>1</sup> and (3) the breaking down of trade and investment barriers across the globe and the establishment of an open, transparent, and non-discriminatory rules-based global trading system. This was accomplished through a wide range of international institutions and agreements, including the General Agreement on Tariffs and Trade (GATT) in 1947, and its successor, the World Trade Organization (WTO) in 1995. These changes contributed not only to the expansion of world trade and cross-border investment flows, but also to a dramatic increase in the world supply of labor, along with a shift in economic activity—particularly manufacturing—from developed to emerging markets. At the same time, developed economies became increasingly specialized in technologically advanced industries and high value added tasks (e.g., research, design, and engineering). Underlying all these changes has been a

<sup>1</sup> The idea of core competencies is that they represent the true sources of competitive advantage and that such competencies should be the focus of firm effort. All other activities could be outsourced. See G. Hamel and C.K. Prahalad. "The Core Competence of the Corporation," *Harvard Business Review*, vol. 68, no. 3, 1990, pp. 243-244. A just-in-time production system is the coordinated manufacture of components or products so that materials are received or produced at the precise time and in the exact quantity to meet the demand of the customer or the next operation in an assembly process. This coordination reduces costs by eliminating the need to hold large inventories of parts and product, and allows for defects in parts to be corrected before being incorporated into a product. Related to these changes is the steady improvement in product quality, risk minimization, flexibility in meeting consumer demand, and profit maximization over a supply chain rather than for each entity within that chain.

period of relative stability in the international order, coupled with the absence of conflict on a global scale that might have threatened production and international shipping.

The United States, in particular, was a driving force in breaking down trade and investment barriers across the globe and constructing the open and rules-based global trading system that has enabled GVCs to proliferate. While some workers and producers have experienced a disproportionate share of the short-term adjustment costs (e.g., through increased global competition or job losses) associated with the growth of GVCs, the *net* payoff to the United States and the global economy from GVC participation is estimated to be substantial. For example, stronger linkages to the global economy force U.S. industries and firms to focus on areas in which they have a comparative advantage, provide them with export and import opportunities, enable them to realize economies of scale, and encourage knowledge sharing and innovation. In addition, households have been able to enjoy lower product prices and a broader variety of goods and services—some of which may not be produced domestically.

GVCs also support a broad range of widely dispersed service-sector jobs in such areas as transportation, sales, finance, marketing, insurance, law, and accounting. Over the years, studies have shown that GVCs can boost growth, create better and higher paying jobs, and reduce poverty, especially when appropriate environmental, social, and governance policies are in place.<sup>2</sup> According to one analysis, trade-dependent jobs in the United States increased by 180% (from 14.5 million to 40.6 million) between 1992 and 2018.<sup>3</sup> Some job losses associated with GVCs, however, may be highly concentrated in certain industries or geographical regions.

These developments, and the linkages they have formed, have blurred the distinction between exports and imports as strictly domestic or foreign corporate activities. The globally-dispersed nature of production has increased the level of trade required to produce many final products in both developed and emerging markets. Trade in intermediate goods and services is associated with productivity gains in domestic industries, increased sophistication of production, and higher overall economic activity.<sup>4</sup> However, trade in intermediates also means that some imports have become essential inputs into the production of exports. As a result, products are often traded across borders multiple times, complicating the interpretation of bilateral trade balances. Within this context, understanding who benefits and loses from global trade and GVCs has become increasingly difficult.

Although a data time lag prevents analysts from developing a current understanding of GVC trends, some studies indicate that the growth of certain GVCs has slowed in recent years. For example, the WTO notes that between 2000 and 2007, GVCs, “especially complex ones, expanded at a faster rate than GDP... [There was] some retrenchment of GVCs [during the global financial crisis], followed by quick recovery (2010-2011), but since then growth has mostly slowed. However, most recent data for 2017 show that complex GVCs grew faster than GDP.”<sup>5</sup>

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<sup>2</sup> See, for example, World Bank, *World Development Report 2020: Trading for Development in the Age of Global Value Chains*, October 2019.

<sup>3</sup> Trade Partnership Worldwide, LLC, “Trade and American Jobs,” *Business Roundtable*, October 2020.

<sup>4</sup> See, for example, Sébastien Miroudot, Rainer Lanz, and Alexandros Ragoussis, “Trade in Intermediate Goods and Services,” *OECD Trade Policy Working Paper No. 93*, November 3, 2009.

<sup>5</sup> World Trade Organization, *Global Value Chain Development Report 2019: Technological Innovation, Supply Chain Trade, and Workers in a Globalized World*, 2019.



## Role of Services and Technology in GVCs

Trade in services and advances in information and communications technology (ICT) have enabled the growth of GVCs. In turn, GVCs have expanded and redefined the role that services play in international trade. Intermediate services, though often hidden and embedded within a value chain, facilitate GVCs. Such services include transportation and distribution, research and development (R&D), and design and engineering, as well as business services, such as legal, accounting, marketing, and financial services. In a GVC, partners involved in each of these areas can be located in widely different places. Innovations in communications, financial services, and transport have been key to the growth and dispersion of value chains.

For example, transportation services that move intermediate and finished goods along supply chains are essential to GVCs. The 20<sup>th</sup>-century shift in the maritime industry to transporting goods in standardized containers lowered costs, reduced the time ships spent in harbors, increased efficiency, and allowed for economies of scale—all leading to a growth in the volume and reliability of international trade by sea. Today, about 80% of the world’s trade is transported by container-based shipping.<sup>6</sup> The growth in air services, both via cargo planes and passenger planes that carry cargo, has also enabled GVCs to expand, particularly those that rely on fast delivery of continually changing and updating products or certain perishable goods.

Recent innovations and ICT advancements have enabled more complex supply chains, increasing the efficiency, and potential vulnerability, of GVCs. A 2019 report by multilateral organizations stated, “GVCs and digital technology cannot be separated and dealt with as independent trends and forces.”<sup>7</sup> According to one analysis of small and mid-sized enterprises in Asia, digital tools reduce export costs by 82% and transaction times by 29%.<sup>8</sup>

In particular, analysts point to digital platforms, automation, the Internet of Things (IoT), artificial intelligence (AI), and advances in data processing and analytics as key forces reducing cross-border transaction costs and promoting international trade.<sup>9</sup> Digital platforms, for example, power data exchanges, digital communications, and e-commerce—all of which enable large and small companies to reach suppliers and manufacturers abroad and to receive direct, immediate feedback on customer demand and partner capacity. At the early stages of the value chain, R&D, design, engineering, and marketing may use advanced analytics, job-specific or fit-for-purpose software, and technology platforms to accomplish their jobs. Some of these functions may be conducted at headquarters or in the home market, while others may be outsourced to vendors abroad, all connected via the internet.

Some analysts refer to the digitization and reorganization of supply chains using new emerging and advanced technologies as “Supply Chain 4.0” (see **text box**).<sup>10</sup> A recent study suggests that changes enabled by Supply Chain 4.0 could lead to an estimated 65% labor-efficiency increase

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<sup>6</sup> Christian Wienberg, “Global Container Giant Says Crisis Hasn’t Upended Trade Routes,” *Bloomberg*, March 23, 2020.

<sup>7</sup> WTO, IDE-JETRO, Organization for Economic Co-operation and Development (OECD), RCGVC-UIBE, World Bank Group, “Global Value Chain Development Report 2019,” April 13, 2019, [https://www.wto.org/english/res\\_e/booksp\\_e/gvc\\_dev\\_report\\_2019\\_e.pdf](https://www.wto.org/english/res_e/booksp_e/gvc_dev_report_2019_e.pdf).

<sup>8</sup> *Micro-Revolution: The New Stakeholders of Trade in APAC*, Alphabet, 2019.

<sup>9</sup> Susan Lund et al., “Globalization in transition: The future of trade and value chains,” McKinsey Global Institute, January 2019, and Susan Lund and Jacques Bughin, “Next generation technologies and the future of trade,” *Vox EU*, April 18, 2019.

<sup>10</sup> *Ibid.*

and a 30%-40% unit-cost reduction for manufacturing overhead.<sup>11</sup> Automated processes and analytics can improve supply chain efficiency. Blockchain is one such emerging technology.<sup>12</sup> Firms may use blockchain for logistics management to link different suppliers and partners and to expedite and monitor the movement of goods along a supply chain. For example, sensors connected to IoT devices allow manufacturers and shipping companies to track products, both intermediate and final goods, as they travel within a factory or across the globe. Firms that analyze large data sets with AI to predict demand can then efficiently move and allocate resources, ramping production up and tamping it down or making other adjustments, such as switching suppliers or cargo routes, in response to specific events or changing circumstances. Digitization allows firms to build resiliency by more easily replicating processes and storing data in multiple locations.

Although the use of many digital technologies is widespread, the applications of other advanced technologies continue to evolve impacting how companies organize and manage new and existing GVCs. Companies are adapting and incorporating these emerging technologies into their routines and systems at different speeds, varying by sector and corporate culture. The COVID-19 pandemic and related economic challenges have spurred some firms to increase investment in data and analytics to better understand utilization and performance of their GVCs. According to one report, annual spending by global manufacturers on data management, analytics, and other advanced capabilities is expected to grow to nearly \$20 billion by 2026, compared with \$5 billion in 2020.<sup>13</sup>

As companies rely on technology to inform business decisions and manage GVCs, securing ICT systems becomes essential, whether to protect intellectual property, private communications, or proprietary data, or to minimize disruptions from cybersecurity incidents. Implementing an effective ICT supply chain risk-management system based on best practices can help minimize risks. Seeing a need for such guidance, the Cybersecurity and Infrastructure Security Agency (CISA) has published multiple resources on ICT supply chain risk management.<sup>14</sup>

#### **Example of Supply Chain 4.0**

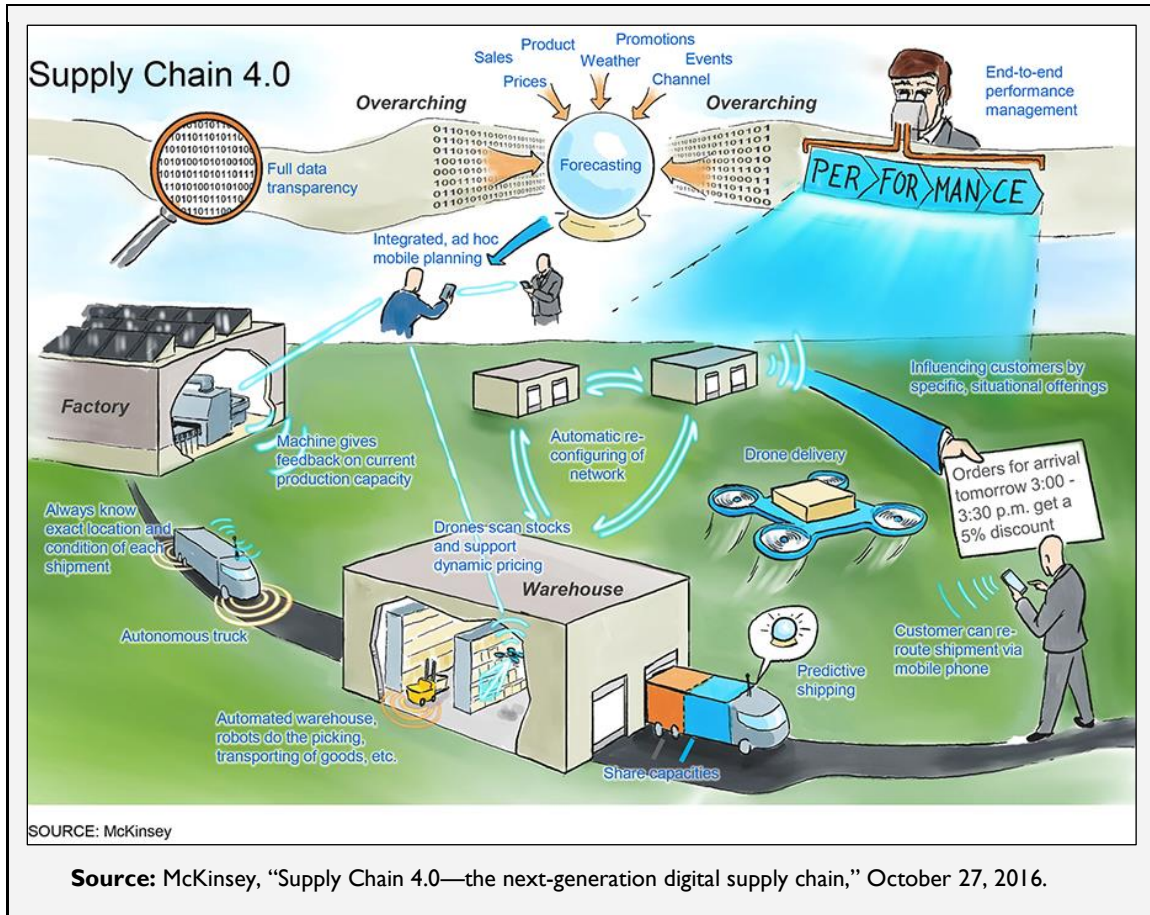
Some analysts point to technology as not simply enabling the use of supply chains, but as revolutionizing the ways supply chains traditionally work. For example, in the graphic below, a firm manages end-to-end performance, gathering data from multiple sources to build transparency along all points of the supply chain. The firm uses connected and advanced technologies to forecast supply and demand; automate planning and decision-making; continuously adjust and track factory production, warehousing, transportation and delivery; and communicate with partners and end customers. The inputs and points of the supply chain are not location-specific and could be situated within the same geography or across multiple geographies, such as different regions within one country or dispersed throughout various countries.

<sup>11</sup> Thomas Baumgartner et al., “Reimagining industrial supply chains,” *McKinsey and Company*, August 11, 2020.

<sup>12</sup> Blockchain is a distributed record-keeping system (each user can keep a copy of the records) that uses encryption to provide for auditable transactions.

<sup>13</sup> Angus Loten, “Pandemic to Jumpstart Spending on Data Tools at Manufacturers,” *Wall Street Journal*, June 2, 2020.

<sup>14</sup> CISA, “Building Collective Resilience for the ICT Supply Chain,” May 5, 2020, <https://www.cisa.gov/blog/2020/05/05/building-collective-resilience-ict-supply-chain>.



Although digitization has enabled GVCs to develop and expand, some industry experts are turning to technologies such as robotic automation and 3D printing to reshore or shorten existing GVCs. By digitizing processes that increase efficiencies and reduce labor requirements and costs, some firms may be able to consolidate sprawling supply chains into fewer partners or geographies, or to reshore certain value chain functions. One firm estimates that 40% of companies globally are increasing their use of automation to gain greater efficiency, speed, and control of their supply chains while cutting waste, labor needs, and operating costs.<sup>15</sup> Increasing automation, however, raises broader concerns about potential job losses and worker displacement.<sup>16</sup>

## Business Decisions and the Public Interest

In a world of GVCs, U.S. national and business interests may coincide—and at times conflict—with one another. A firm's headquarters may be located in the United States, but its production networks may be global. Firms generally attempt to maximize profits and efficiency across the entire supply chain, not just in the domestic portion of it. In addition, profits may accrue to the U.S. parent company, but many of the supplier, production, and assembly jobs may be abroad.

<sup>15</sup> Angus Loten, "Businesses Expected to Lean on Automation for Recovery," *Wall Street Journal*, May 20, 2020.

<sup>16</sup> G. Dautovic, "Automation and Job Loss Statistics in 2020 – The Robots Are Coming," *Fortunly*, June 30, 2020, and James Manyika et al., "A Future that Works: Automation, Employment, and Productivity," McKinsey Global Institute, January 2017.

Whether a policy that is good for U.S. businesses is also good for the United States as a whole depends on a number of factors, including the

- distribution of profits;
- composition and degree of specialization of the workforce;
- extent to which the value generated by segments of the value chain takes place in the United States; and
- effect that supply chain relationships have on the amount and composition of U.S. trade and jobs.

When deciding whether to establish or become part of a supply chain, firms must contemplate several questions. First, what are the core competencies of the firm? What tasks or business functions should the firm carry out domestically or regionally, and what can and should be contracted out or performed globally? In addition, where should production, assembly, and packaging take place, and how can any of these decisions help overcome the challenges in accessing major markets abroad? Finally, should the firm invest in manufacturing facilities and own the process or rely on partners?

The answers to these questions help determine the shape, location, and operation of supply chains, as well as the interconnections within them. In addition, production decisions are affected by cost and risk calculations, economic conditions, government policies, and regulations. For example, in deciding whether to assemble a product abroad, firms consider various risks, such as exchange rate fluctuations, inflation, shipping disruptions, political turmoil, natural disasters, regulatory uncertainty, terrorism, trade barriers, and the ability to control and ensure product quality and safety.

### **Small and Mid-Sized Enterprises (SME), GVCs, and Trade Finance**

According to the World Trade Organization (WTO) and International Finance Corporation (IFC) of the World Bank, up to 80% of trade is financed by credit or credit insurance, but the availability of finance varies across regions.<sup>17</sup> GVCs are often the easiest path for SMEs to grow and reach outside markets, especially for those located in developing countries. Many SMEs rely on trade finance to ensure their cash flow and engage in international trade. For example, a large importer may use its bank to provide a letter of credit to an SME exporter's bank that pays the exporter once it shows documents (e.g., bill of lading) that prove the shipment occurred. By introducing banks as third parties, trade finance reduces the risk for both the importer and the SME exporter.

Research shows that default and loss rates for trade finance are generally low.<sup>18</sup> Despite these low rates, the availability of trade finance has been falling, especially in developing markets. The WTO/IFC report shows the unmet demand for trade finance is \$1.5 trillion annually.

Local banks rely on international correspondent banks to confirm and clear payments. However, in recent years, many large banks have been cutting their correspondent banking relationships in an effort to de-risk. Large international banks cite strict regulatory and compliance requirements (e.g., anti-money laundering and customer due diligence rules) that increase costs and deter them from offering trade finance services in perceived risky markets.<sup>19</sup> To address the gap in trade finance availability, the WTO and other institutions have begun conducting capacity building and training to disseminate guidance and best practices in an effort to lower the risk profiles of local banks in developing countries. Furthermore, some banks and brokers are using new technologies like blockchain to extend trade finance services to SMEs and to build new customer relationships. The shift to greater

<sup>17</sup> World Trade Organization (WTO) and International Finance Corporation (IFC), "Trade Finance and the Compliance Challenge," 2019, [https://www.wto.org/english/res\\_e/booksp\\_e/tradefinance19\\_e.pdf](https://www.wto.org/english/res_e/booksp_e/tradefinance19_e.pdf).

<sup>18</sup> International Chamber of Commerce Trade Register, <https://iccwbo.org/publication/icc-trade-register-report/#155048592348-add1690e-dfc3>.

<sup>19</sup> For more information on correspondent banks and de-risking, see CRS In Focus IF10873, *Overview of Correspondent Banking and "De-Risking" Issues*, by Rena S. Miller.

use of technology has become especially important to extend trade finance and supply chain credit during the COVID-19 pandemic, as restrictions limit in-person interactions and economic hardship increases the importance of providing credit to bridge gaps.

## Reconsidering Traditional Statistics of International Trade

The growth of GVCs, intra-firm trade, and trade in intermediate goods means that traditional accounting methods may not fully reflect the source of inputs used in producing goods and services, a limitation that may ultimately distort trade data tallied using such methods.<sup>20</sup> As more products are effectively made globally, concepts such as country of origin and bilateral trade imbalances may take on different meaning.<sup>21</sup> This shift makes it increasingly difficult to understand and interpret the implications of trade data trends for the U.S. economy. In addition, conventional data that often drive policy discussions may underestimate trade in services, because the data do not attribute any portion of the traded value of manufactured and agricultural products to services inputs. As mentioned above, intermediate services such as transportation and distribution, R&D, and design and engineering are embedded within a value chain as inputs and thus are often not visible in the data. Moreover, these data are not disaggregated enough to identify trends in GVCs or their impact on the U.S. economy.

China is an example of this phenomenon. Since opening up its economy to global trade and investment in the 1980s, China has emerged as a major manufacturing/production center for GVCs (see “Regional Specialized Value Chains: ICT Goods”). Because of China’s large pool of relatively low-cost labor, in the 1990s many export-oriented multinational corporations (MNCs) moved production from other countries (primarily in Asia) to China. This production typically involved importing key components and intermediate goods for minimal processing in China before reexporting them. The value-added gains that occurred in China were often small relative to the total value of the finished product when it was exported to the United States and elsewhere. A significant amount of the profits made from the sale of a product is estimated to have been accrued to the MNC that owned the brand. This trend, however, has been shifting over the past decade, as MNC suppliers in China have further developed their capabilities and as Chinese government policies have pushed for local content requirements, particularly in strategic sectors such as ICT. As labor and other input costs have been rising, MNCs, as well as Chinese companies, have been shifting production farther inland in China and, more recently, offshore to other lower-cost destinations.

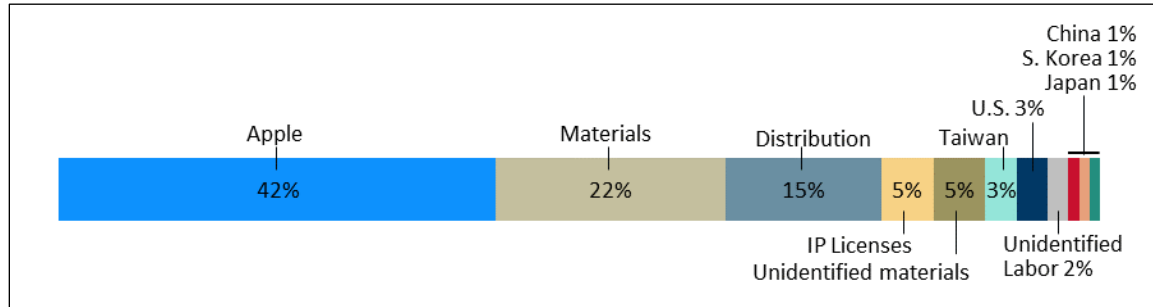
To illustrate, when the United States imports such products as iPhones and iPads, it attributes the full value of those imports as occurring in China, even though the value added there is quite small (**Figure 2**). Apple Inc., the U.S. firm that developed these products, is the largest beneficiary in terms of the profits generated by the sale of its products, and most of its product design, software development, product management, marketing, and other high-wage functions and employment occur in the United States. Some partners have a larger value-added role in the Apple GVC than others; for example, Taiwan-based Foxconn handles the sourcing, manufacturing, and logistics. In other words, U.S. trade data may show from where products are being imported, but they often do not reflect the country or countries that ultimately benefit from that trade. In many instances, U.S. imports from China are really imports from many countries. Yet, the full value of the final imported product is attributed to China, which results in what some might consider to be an inflated trade deficit figure.

<sup>20</sup> OECD, *Trade in Value-Added: Concepts, Methodologies, and Challenges* (Joint OECD-WTO Note), 2010.

<sup>21</sup> WTO, *Trade Patterns and Global Value Chains*, p. 94.

**Figure 2. Value Capture for iPhone 7**

Chinese firms contribute 1% of the finished product's value, while Apple captures 42%



**Source:** CRS, with data from Jason Dedrick and Kenneth L. Kraemer, "Intangible Assets and Value Capture in Global Value Chains: The Smartphone Industry," WIPO Economic Research Working Paper No. 41 (2017).

**Note:** Excludes Apple's contribution.

Measuring trade in value-added terms can mitigate these problems by enabling domestic content embedded in exports to be assigned to each country that participated in the production of the final good. In contrast to traditional trade statistics, measuring trade this way can provide a more detailed picture of the location where value is added during the various stages of production.<sup>22</sup>

### Trade in Value-Added (TiVA)

International and domestic efforts to collect data on trade in value-added (TiVA) have measured the way value is added through the various parts of the supply chain and stages of production. In particular, TiVA identifies the origin of the value added of goods and services in cross-border trade according to the country and industrial sector where that value was added.<sup>23</sup> This data measurement contrasts with traditional merchandise trade data, which attributes the value of an import or export to a single country. The Organization for Economic Co-operation and Development (OECD) and the WTO developed a TiVA database, considered to be the most comprehensive and widely used trade database that provides insight into domestic and foreign value-added content of gross exports by exporting industries.<sup>24</sup> Despite a significant time lag, such statistics provide a detailed picture of inter-industry relationships in the supply and uses of goods and services between sectors of the economy. In other words, TiVA data provide a better indication not only of the production and movement of goods and services, but also of where they are being consumed.

<sup>22</sup> A joint study by the OECD and the WTO estimated that the U.S. trade deficit with China in 2009 would have been reduced by 25% if bilateral trade flows were measured according to the value-added that occurred in each country before it was exported (OECD and WTO, "Trade in Value-Added [TiVA] Database: China," January 16, 2013). In addition, another study estimated that 25% of U.S. imports from Canada and 40% of U.S. final merchandise imports from Mexico consist of value added from the United States (Robert Koopman, William Powers, Zhi Wang, and Shang-Jin Wei, "Give Credit Where Credit Is Due: Tracing Value Added in Global Production Chains," National Bureau of Economic Research Working Papers 16426, October 2011).

<sup>23</sup> TiVA data are generated by industry-by-industry input-output tables created by OECD and the WTO. The dataset covers 64 economies and 36 unique industrial sectors, including agriculture, mining, manufacturing, construction, and business services, from 2005 to 2016. The OECD expects to release an update providing data for the period 1995-2018 in fall 2020.

<sup>24</sup> Given the level of aggregation among the TiVA input-output tables, much of the extensive inter-industry trade that occurs among the United States and its trading partners, especially in complex sectors such as motor vehicles or semiconductors, may not be fully captured.

Most economists recognize that traditional trade statistics do not accurately reflect the true content of trade relationships because they represent the gross value of trade (see **text box**).<sup>25</sup> The gross value of trade, however, may be misleading because it can (1) distort bilateral trade balances, resulting in double counting trade flows; (2) attribute production to the wrong geographical locations; (3) incorrectly specify the technological content of exports at the national level; and (4) misrepresent the true relationship between imports and exports.<sup>26</sup> Given the multistage, cross-border nature of GVCs, various inputs can be counted multiple times, thereby inflating the true value of trade occurring at both the national and global levels.

**Difference Between Gross and Value-Added Trade Flows:  
A Simplified Example**

Suppose that Country A ships \$100 worth of raw materials to Country B, and Country B further processes them into \$120 worth of goods. Country B then ships these goods to Country C.

**Gross Trade Flows**

Although Country B added only \$20 of value, traditional trade measures would conclude that Country B exported goods worth \$120 to Country C.

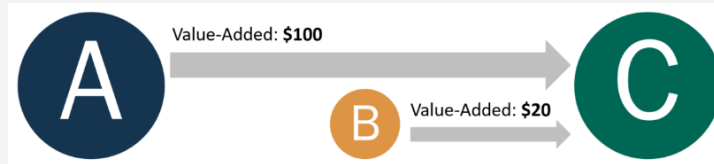
Using gross trade flows, Country C would run a \$120 trade deficit with Country B but would not have had a trade deficit with Country A.



**Value-Added Trade Flows**

On the other hand, value-added trade would count only the value each country uniquely added in the production process. Country A would have exported \$100 worth of goods to Country C, and Country B would have exported \$20 worth of goods to Country C.

Under value-added trade, Country C would have a \$100 trade deficit with Country A and a \$20 trade deficit with Country B.



Note that Country C's global trade deficit (i.e., the sum of the trade deficits with Country A and B) is the same under both accounting systems.

**Source:** Adapted from Federal Reserve Bank of St. Louis, "Is Value-Added Trade a Better Measure of Global Trade?" (2019).

The rapid growth of GVCs and intra-industry trade (i.e., importing and exporting goods in the same industry) has significantly increased the amount of trade in intermediate goods, in some ways blurring the distinction between domestic and foreign firms and goods. Trade in

<sup>25</sup> The gross value of trade is the cost of the inputs of goods and services plus the value added by each country every time these goods and services cross a border.

<sup>26</sup> Nadim Ahmad, "Estimating Trade in Value: Why and How," in *Global Value Chains in a Changing World*, Deborah K. Elms and Patrick Low, WTO, 2013, pp. 87-89.

intermediate goods and services may involve suppliers that provide semi-processed intermediate goods (that in some instances are imported) that eventually are incorporated into finished exports. Such trade may also involve forward links or downstream user industries, with production activities incorporating exported intermediate goods used in the production of finished goods somewhere else.

As a result, cross-border production and trade in intermediate goods have increased the number of jobs that are tied directly and indirectly to international trade in ways that are not captured fully by traditional trade data. As noted previously, trade in intermediates can also lead to productivity gains in domestic industries, increased sophistication of production, and higher overall economic activity.

In addition, GVCs challenge traditional trade concepts of production. Such concepts typically centered on the national level by emphasizing production segmented into discrete units or tasks. As a result of this segmentation, the growing complexity and cross-border activities of value chains have focused attention on the way trade data are collected and reported, raising related questions about the distribution of the costs and benefits of international trade.<sup>27</sup> Moreover, the array of cross-border transactions that occur through GVCs fundamentally alters the nature of trade data and challenges the use of bilateral trade balances as an indicator of a nation's trade performance.

#### **Accounting for Value-Added in Exports**

Statistics collected or estimated on value-added terms attempt to account for the value in exports that consists of inputs derived from production abroad, and the value of exports used as inputs in the production of finished products by other countries. The United Nations uses a number of terms to describe these different types of value added:

- **Foreign value added:** share of a country's gross exports that is composed of inputs produced in other countries.
- **Domestic value added:** share of inputs in a country's exports that originates within that country and is counted as part of its gross domestic product (GDP).
- **Value-chain participation:** share of a country's exports that is part of a multistage trade process that includes the foreign value added used in a country's own exports and the value added supplied to other countries' exports. It indicates the extent to which a country's exports are integrated into international networks.

**Source:** United Nations Conference on Trade and Development, *World Investment Report* (2013).

For example, some U.S. exports contain parts, components, and services that originated outside the United States, while some U.S. imports may contain parts, components, and services from many countries (including the United States)—not just from the country from which they are being imported. **Figure 3** shows the components of the total value of U.S. gross exports under the OECD TiVA database in 2011 and 2016.<sup>28</sup> In 2016, the largest share of the total value of U.S. exports was *domestic value added*, both direct and indirect, which accounted for 87% of the total value added.<sup>29</sup> *Foreign value added*, or the value of a finished export derived from imported

<sup>27</sup> Avraham Ebenstein, Ann Harrison, Margaret McMillan, and Shannon Phillips, "Estimating the Impact of Trade and Offshoring on American Workers Using the Current Population Surveys," *The Review of Economics and Statistics*, October 2014.

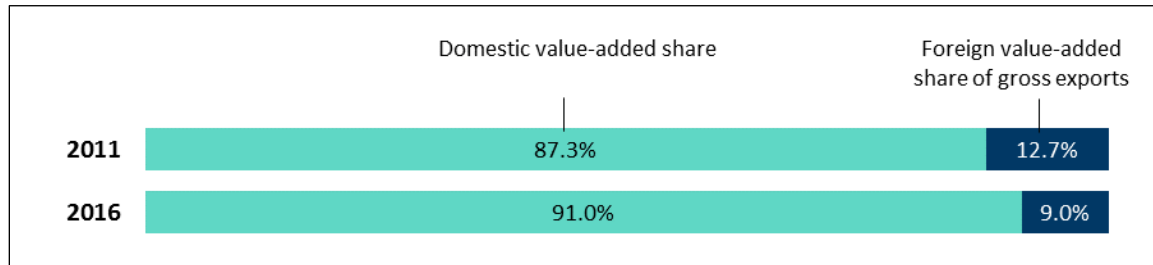
<sup>28</sup> The database provides a general sense of the trend, but the lack of detail limits the usefulness of the TiVA data in explaining a recent decrease in the U.S. value-added content, or as an indicator for developing policy prescriptions.

<sup>29</sup> The domestic value-added share of U.S. exports can be segmented further into three components associated with producing goods for export: (1) activities directly involved in production (which accounted for more than half of the value added of U.S. exports); (2) activities indirectly involved in production; and (3) domestic value added exported in



intermediate goods and services, accounted for 13% of U.S. exports by value added. (See **text box** for definitions.)

**Figure 3. Value Added in U.S. Gross Exports**



Source: Compiled by CRS with data from OECD Data.

## Examining Industry GVCs: Select Case Studies

Supply chain complexity tends to vary by industry. For example, on average, an auto manufacturer has approximately 250 tier-one suppliers but over 18,000 across the entire value chain, whereas an aerospace manufacturer may have an average of 200 tier-one suppliers and 12,000 suppliers in total.<sup>30</sup> Examining specific supply chains illustrates how domestic policies, trade liberalization measures, and advances in services and technology have shaped GVCs and the varied impacts across different sectors.

### Complex Distributed Value Chain: Nike

A global value chain of one company, or even a single product, can cross several countries. As discussed above, in addition to the raw materials and intermediate inputs that go into the production of a final good, a GVC may include R&D, management and administrative functions, freight transport, distribution warehouses, and brick-and-mortar stores before the good reaches the final customer.

NIKE, Inc. (Nike) is a classic example of how a multinational company operates with a global value chain. Although Nike is the “largest seller of athletic footwear and apparel in the world,” the company’s core business is in the design, development, marketing, and sale of Nike products, which are the highest value-added activities along the global value chain.<sup>31</sup> Most Nike jobs are in its global U.S. headquarters, located in Beaverton, OR; the company has regional offices located around the world that perform other administrative and sales activities.<sup>32</sup> The company primarily contracts with independent manufacturers for its footwear and sports apparel manufacturing, most of which are located outside the United States. According to Nike, many of the independent contract manufacturers often operate multiple factories and source raw materials locally where

goods and services that were subsequently used to produce imports of intermediate goods and services that, in turn, were exported as final products (less than 1% of the value added).

<sup>30</sup> Thomas Baumgartner et al., “Reimagining industrial supply chains,” *McKinsey and Company*, August 11, 2020.

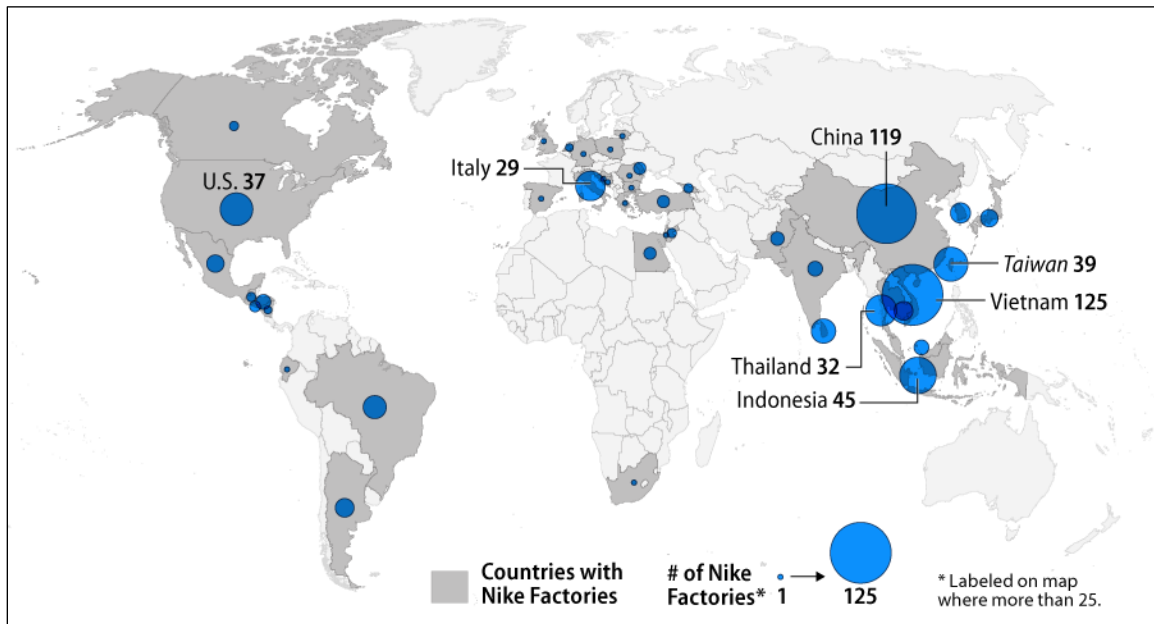
<sup>31</sup> NIKE, Inc., “2019 Annual Report,” March 2019, [http://s1.q4cdn.com/806093406/files/doc\\_financials/2019/annual/nike-2019-form-10K.pdf](http://s1.q4cdn.com/806093406/files/doc_financials/2019/annual/nike-2019-form-10K.pdf).

<sup>32</sup> *Ibid.*; international branch office locations include, but are not limited to, Argentina, Australia, Belgium, China, Croatia, Denmark, France, India, Italy, Korea, Malaysia, South Africa, and Turkey.

manufacturing takes place.<sup>33</sup> Several contractors also have their own subcontractors.<sup>34</sup> Nike uses third-party air and sea freight companies to transport its products from factories to distribution centers around the world. The distribution centers then ship Nike products to Nike-owned and third-party retail stores worldwide. Nike also operates e-commerce platforms in the United States and 45 other countries.

As of February 2020, 600 factories manufacture Nike products. Together, they employ over 1.1 million people, located in 41 countries. Roughly 40% of the factories are in Vietnam (125) and China (119) (see **Figure 4**).<sup>35</sup> Factories in Vietnam, China, and Indonesia produced approximately 96% of Nike brand footwear and 63% of Nike brand apparel in FY2020.<sup>36</sup>

**Figure 4. Geographical Distribution of Nike’s Suppliers**



**Source:** NIKE Manufacturing Map as of February 2020.

Nike, along with other large apparel brands, has started to promote environmental sustainability, potentially in response to factors such as changing environmental regulations or pressure from stakeholders and consumers. According to Nike’s sustainability website, the company’s footwear and apparel currently uses various recycled materials, including plastic, leather, and polyester. In addition, the company has pledged to use 100% sustainable cotton by 2020. Creating a more sustainable supply chain may lead companies to find new suppliers or to work with existing suppliers that can meet their sustainability goals.

## Regional Specialized Value Chains: ICT Goods

The electronics value chain, which includes consumer electronics and ICT products, has become regionalized over the years, and China has emerged as a major global production center for microelectronics. Global trade in semiconductors involves cross-border design and manufacturing

<sup>33</sup> Ibid.

<sup>34</sup> Nike Manufacturing Map, February 2020, at <http://manufacturingmap.nikeinc.com/#>.

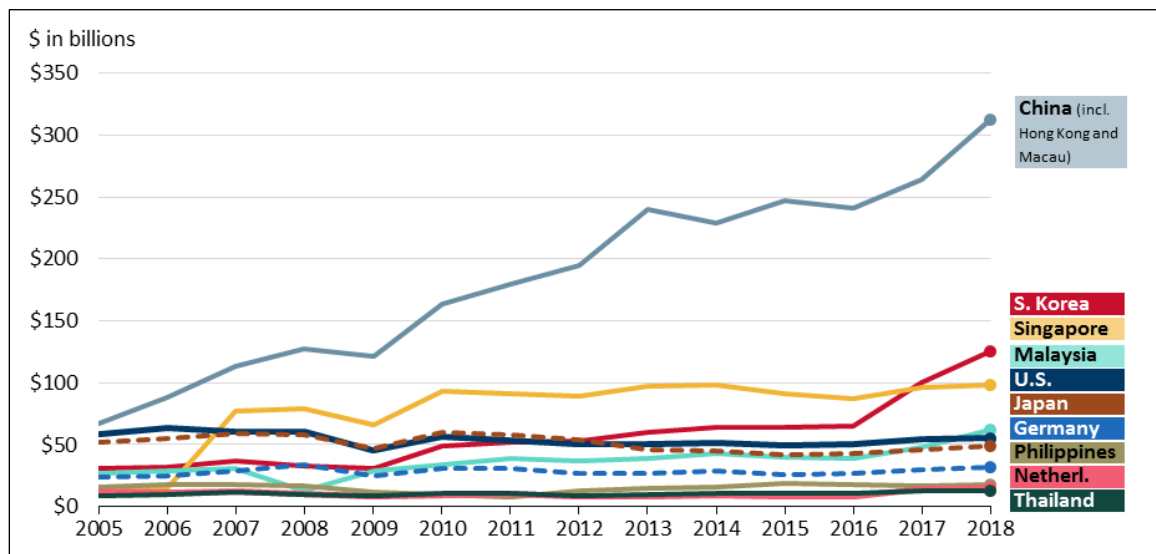
<sup>35</sup> Ibid.

<sup>36</sup> NIKE, Inc., “2020 Annual Report,” July 24, 2020, p. 5.

processes, and such trade can involve a chip crossing national borders several times in the product development cycle. For example, Taiwan and South Korea have significant fabrication capacity, while several East Asian economies have strong roles in assembly, testing, and packaging. Multiple East Asian economies are major exporters of key intermediate ICT components. In 2018, exports from Asia of integrated circuits/semiconductors, which are used in almost every electronic product, accounted for roughly 70% of total export value, compared with around 50% in 2005 (see **Figure 5**).<sup>37</sup> As noted above, intermediate and end products may cross borders multiple times before final export, which may skew the trade data (see earlier discussion on trade data and value added). Out of the top 10 exporters for these components, seven are from Asia, with China (including Hong Kong and Macau) being the largest exporter, followed by South Korea and Singapore. Some of the biggest integrated circuits/semiconductors firms are located in a small number of countries, which may contribute to the concentration of manufacturing activities and exports in certain countries.<sup>38</sup>

**Figure 5. Top 10 Exporters of Integrated Circuits/Semiconductors**

In current U.S. dollars



**Source:** CRS, based on data from U.N. Comtrade Database.

**Note:** The top integrated circuits/semiconductor firms are concentrated in a small number of countries, which may contribute to the concentration of manufacturing activities and exports in certain countries.

China is becoming a major manufacturing hub of key electronic components (see **text box** below). Between 2005 and 2018, China's global share in total value exported of printed circuits and semiconductors increased from 16% to 33%. Although its share in total value exported has increased, most of China's value-added share is from printed circuit boards. However, trade data suggest that some GVC production in China may be shifting to other locations, potentially in response to rising costs in China and U.S. tariffs imposed on Chinese imports since 2018.<sup>39</sup>

<sup>37</sup> CRS analysis of export data from U.N. Comtrade Database. Data are shown up to 2018 because 2019 export data for China are not yet available on U.N. Comtrade. Trade data classifications of integrated circuits are listed in "Table A-3-1" seen here: Stacey Frederick and Joonkoo Lee, *Korea and the Electronics Global Value Chain*, September 2017.

<sup>38</sup> For a list of major firms, see Stacey Frederick and Joonkoo Lee, "Table 3-7," *Korea and the Electronics Global Value Chain*, September 2017.

<sup>39</sup> Katherin Hille, "China's Share of Global Exports Falls in Supply Chains Rethink," *Financial Times*, August 17,

Analysis shows that China's share in global exports of consumer electronics decreased between 2018 and 2019. During that time, China's share of global exports of phones decreased by three percent and the share of computer and tablets exports decreased by four percent. Some countries that saw an increase in total export value for finished consumer electronics include Vietnam, United States, and Mexico.<sup>40</sup> In addition, although India's share of global export value for consumer electronics is still relatively small, its total value exported increased from \$2.7 billion in 2018 to \$4.9 billion in 2019.

Multinational companies use contract manufacturers and suppliers that often have their own production networks, which contributes to the regionalization of the value chain.<sup>41</sup> As mentioned above, Apple, a U.S.-based company, contracts with Taiwan-based Foxconn, which handles the sourcing, manufacturing (mainly in China), and logistics.<sup>42</sup> One of Apple's major supplier of memory chips and display panels for its iPhones is South Korea-headquartered Samsung, which is also a major competitor in the smartphone market.<sup>43</sup> Both Foxconn's specialization in electronics manufacturing, and Samsung's investment in R&D of electronic components, make the Asia region's strong production networks attractive to multinational companies.

#### **China's Role in Global Value Chains<sup>44</sup>**

China is a top global trader and central production point in global supply chains in a range of sectors, from raw material processing and chemicals to industrial intermediates and consumer goods, including microelectronics. China's emergence as this central node is due to a confluence of factors that have played out over time: global offshoring of lower-end manufacturing to markets with cheaper labor and production costs; Chinese trade, investment, and tax incentives; and general global trade liberalization, including China's accession to the WTO in 2001 and the lowering of global technology tariffs through additional WTO agreements. China's creation of industrial and trade zones to support domestic manufacturing's role in GVCs and foreign companies' efforts to push into China's domestic market have been mutually reinforcing as multinationals have played a leading role in building Chinese supplier capabilities and distribution and logistics networks. Chinese market access barriers—including policies that require localization of foreign production in order to sell in China and that make direct imports difficult or more expensive—have also driven the location of manufacturing in China. They are also now driving the relocation of higher value-added activities, particularly in technology, advanced manufacturing, and research and development.<sup>45</sup> While many firms initially sought out manufacturing opportunities in China because of perceived lower costs, investments in China can be more expensive, time- and management-intensive, and challenging than companies initially anticipate. There are also potential hidden risks and costs such as labor issues, business disputes, and IP theft.<sup>46</sup>

Since joining the WTO in 2001, China has sought to advance its position in the global value chain. Initially serving as a final point of assembly for semi-finished goods that were then mostly reexported, China now has an economy in which many intermediate inputs are increasingly sourced from China and finished goods (and services) are directed to both export and domestic consumption. Responding to this evolving business environment, multinational firms in China have repositioned to focus increasingly on the domestic market for sourcing and

2020, and CRS Report R45949, *U.S.-China Tariff Actions by the Numbers*, by Brock R. Williams and Keigh E. Hammond.

<sup>40</sup> CRS analysis of export data from U.N. Comtrade based on trade data classification of consumer electronics listed in "Table A-3-1" of Frederick and Lee (see footnote 38).

<sup>41</sup> Stacey Frederick and Joonkoo Lee, *Korea and the Electronics Global Value Chain*, September 2017.

<sup>42</sup> *Ibid.*, p. 28.

<sup>43</sup> John Kang, "Samsung Will Be Apple's Top Supplier For iPhones Again In 2017," *Forbes*, December 2016.

<sup>44</sup> Section contributed by Karen M. Sutter, CRS Specialist in Asian Trade and Finance.

<sup>45</sup> For a good overview of these trends, see Joe Studwell, *The China Dream: The Quest for the Last Great Untapped Market on Earth* (Grove Press, 2003), and Daniel H. Rosen, *Behind the Open Door: Foreign Enterprises in the Chinese Marketplace* (Peterson Institute for International Economics, 1998).

<sup>46</sup> "Doing Business in China," Wolters Kluwer, December 11, 2019.

sales.<sup>47</sup> The Chinese government has enacted tax, trade, investment, and industrial policies designed to position Chinese firms to be globally competitive and to encourage or require the transfer of foreign technology and capabilities to accelerate this advancement.<sup>48</sup> China's policies feature a heavy government role in directing and funding Chinese firms to obtain foreign expertise and intellectual property in areas where the United States has strong comparative advantages (e.g., aerospace, semiconductors, microelectronics, and pharmaceuticals).<sup>49</sup>

## Managing Tiered Supply Chains: Boeing 787 Dreamliner

As of October 2020, Boeing employed around 145,000 employees in over 65 countries, including the United States, and contracts with over 20,000 suppliers and partners globally.<sup>50</sup> Regional offices around the world allow the company to be closer to local markets, as well as build stronger relationships with its suppliers, which are important in ensuring the company meets production goals. An often-studied case is Boeing's production plan for the 787 Dreamliner. The 787 Dreamliner was the company's first commercial plane built with a tiered supply chain, using external supply chains for the more labor-intensive production activities in an attempt to reduce manufacturing time and costs (see **Figure 6**).<sup>51</sup> Boeing contracted with about 50 tier-one suppliers that were responsible for assembling sub-assemblies manufactured by tier-two suppliers. Final assembly would be completed by Boeing in its plant in Everett, Washington. In 2004, Boeing launched production for the 787 with a target delivery date for the first of 50 planes to All Nippon Airlines in May 2008. Three years after the original date, the first 787 was delivered in September 2011.

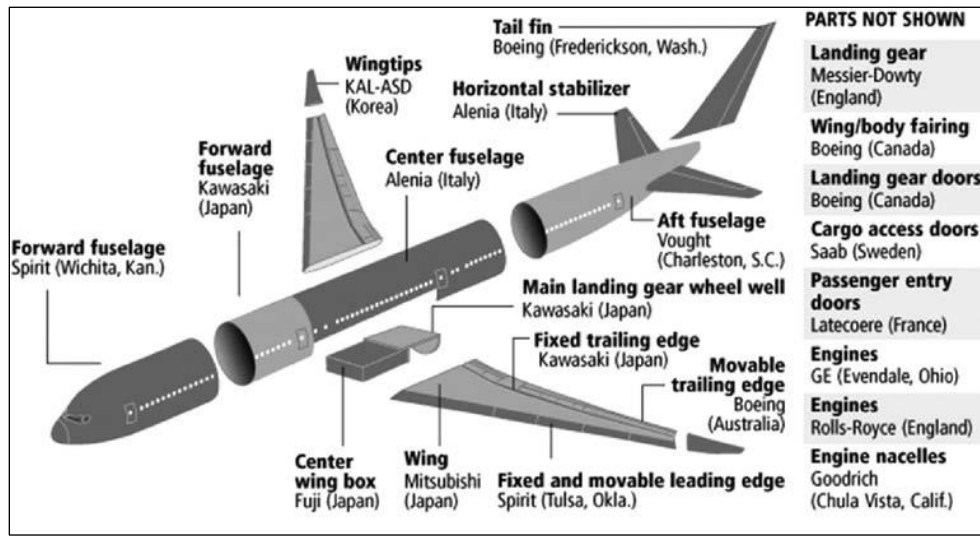
<sup>47</sup> Simon Zhang, "China's Rising Costs," *China Business Review*, July 1, 2012.

<sup>48</sup> For a discussion of these issues, see James McGregor, *China's Drive for "Indigenous Innovation: A Web of Industrial Policies* (U.S. Chamber of Commerce and APCO, 2009).

<sup>49</sup> For further context, see Barry Naughton, "China's Economic Policy Today: The New State Activism," *Eurasian Geography and Economics*, 52(3):313-329, May 2011, and Cong Cai, Richard P. Suttmeier, and Denis Fred Simon, "China's 15-Year Science and Technology Plan," *Physics Today*, December 2006.

<sup>50</sup> Boeing, Accessed November 5, 2020, <https://www.boeing.com/company/key-orgs/boeing-international/index.page>.

<sup>51</sup> Christopher S. Tang, Joshua D. Zimmerman, and James I. Nelson, "Managing New Product Development and Supply Chain Risks: The Boeing 787 Case," *Supply Chain Forum: An International Journal*, vol. 10, no. 2 (2009), p. 77.

**Figure 6. Supply Chain for the Boeing 787 Dreamliner**

Source: Tang, Zimmerman, and Nelson, 2009, p. 78.

The new tiered supply chain model took years for Boeing to optimize by working with its suppliers to address risks and develop the necessary technology to meet production goals. Analysts point to several reasons for the delay, including Boeing's lack of experience in global supply chain management and technological challenges from scaling up composite materials previously used for small-scale manufacture of aircraft parts.<sup>52</sup> In response to those issues, Boeing worked with its suppliers to develop new equipment and manufacturing processes to build parts, as well as to readjust aspects of its supply chain, including increasing production and assembly processes in its Everett plant. Despite the three-year delay and scaling back the scope of outsourcing, Boeing continues to use the tiered supply chain model with final assembly of new 787 planes taking place in Everett or North Charleston, South Carolina.<sup>53</sup> In October 2020, Boeing announced plans to consolidate final assembly of 787s at the South Carolina campus, beginning in mid-2021.<sup>54</sup>

## Regional GVC Integration: North American Motor Vehicle Supply Chain

The integration of the North American motor vehicle industry began with the Canada-U.S. Auto Pact of 1965, which eliminated tariff barriers between the United States and Canada on motor vehicle and parts trade for specific manufacturers.<sup>55</sup> The Auto Pact was later integrated into Canada-U.S. Free Trade Agreement (CUFTA) that went into force in January 1989. The North American Free Trade Agreement (NAFTA) among the United States, Canada, and Mexico, which entered into force in January 1994, incorporated CUFTA provisions, eliminating all tariffs and

<sup>52</sup> Ibid. Rebecca Slayton and Graham Spinardi, "Radical Innovation in Scaling Up: Boeing's Dreamliner and the Challenge of Socio-technical Transitions," *Technovation*, (2016), p. 53.

<sup>53</sup> Boeing, "Boeing South Carolina," Accessed November 6, 2020, <https://www.boeing.com/company/about-bca/south-carolina-production-facility.page>.

<sup>54</sup> Eric M. Johnson, "Boeing to Move 787 Production to South Carolina in 2021," *Reuters*, October 1, 2020.

<sup>55</sup> For a more detailed overview of the North American motor vehicle industry, see CRS Report R44907, *NAFTA and Motor Vehicle Trade*, by Bill Canis, M. Angeles Villarreal, and Vivian C. Jones

most nontariff barriers among all three countries, provided uniform rules of origin provisions, and added new rules and disciplines such as strengthening intellectual property rights protection.<sup>56</sup>

NAFTA was highly instrumental in the integration of the North American motor vehicle industry. As manufacturers in each country participated in production sharing, notably along the U.S.-Mexico border, bilateral merchandise trade significantly increased, creating vertical supply relationships. During the production process of a motor vehicle, parts from multiple suppliers in the region are shipped back and forth across borders numerous times before final assembly.<sup>57</sup> NAFTA was recently replaced by the United States-Mexico-Canada Agreement (USMCA), which went into effect in July 2020.

U.S. and non-U.S. automakers own assembly or parts plants in the United States, Canada, and Mexico.<sup>58</sup> Since 1994, the United States has produced a majority of motor vehicles in North America (64.8% in 2019), although Mexico's share has increased (from 7.1% in 1994 to 23.8% in 2019) (**Figure 7**). Between 1997 and 2019, bilateral trade in motor vehicles and parts between the United States and Canada was relatively constant, while U.S.-Mexico bilateral trade increased in nominal terms (**Figure 8**). Bilateral trade data may provide some insight on the level of GVC integration, but will not capture the value-added as each part or subassembly moves along the supply chain (see "Trade in Value-Added (TiVA)").

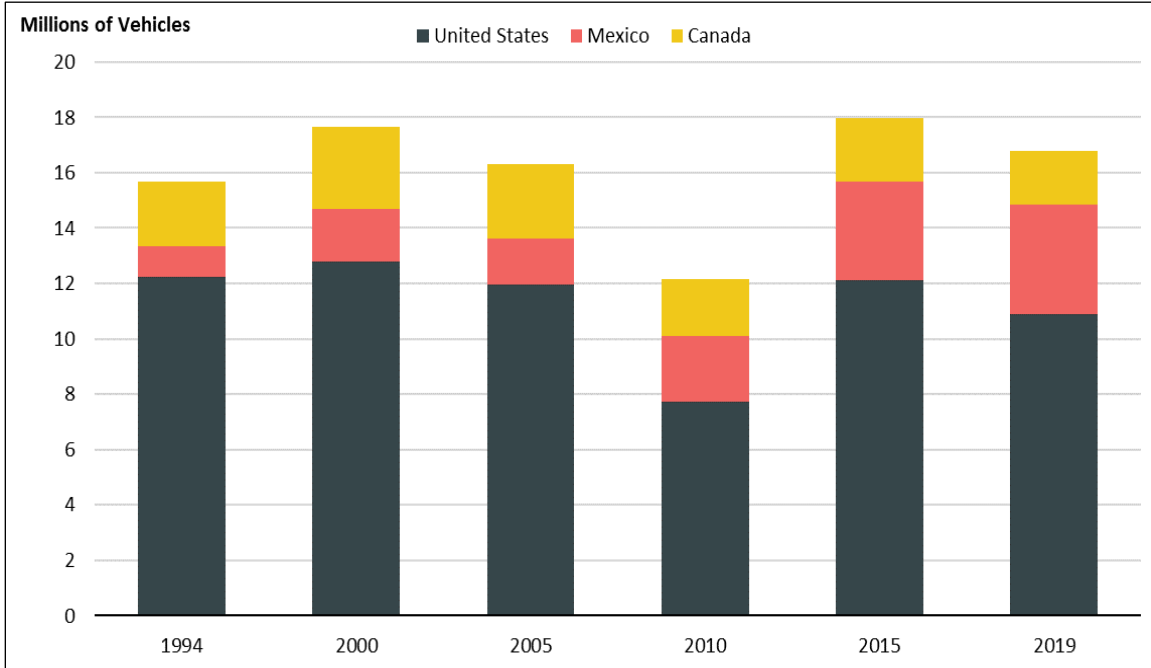
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<sup>56</sup> For more information on NAFTA and U.S.-Mexico economic relations, see CRS Report R42965, *The North American Free Trade Agreement (NAFTA)*, by M. Angeles Villarreal and Ian F. Fergusson, and CRS Report RL32934, *U.S.-Mexico Economic Relations: Trends, Issues, and Implications*, by M. Angeles Villarreal.

<sup>57</sup> CRS In Focus IF11387, *USMCA: Motor Vehicle Provisions and Issues*, by M. Angeles Villarreal, Bill Canis, and Liana Wong.

<sup>58</sup> Bernard Swiecki and Debbie Menk, *The Growing Role of Mexico in the North American Automotive Industry*, July 2016, p. 7. Timothy Sturgeon, Johannes Van Biesebroeck, and Gary Gereffi, "The North American Automotive Value Chain: Canada's Role and Prospects," *International Journal of Technological Learning Innovation and Development*, February 2009, pp. 27-30.

**Figure 7. North American Motor Vehicle Production, Select Years**  
Total Passenger and Commercial Vehicles Produced

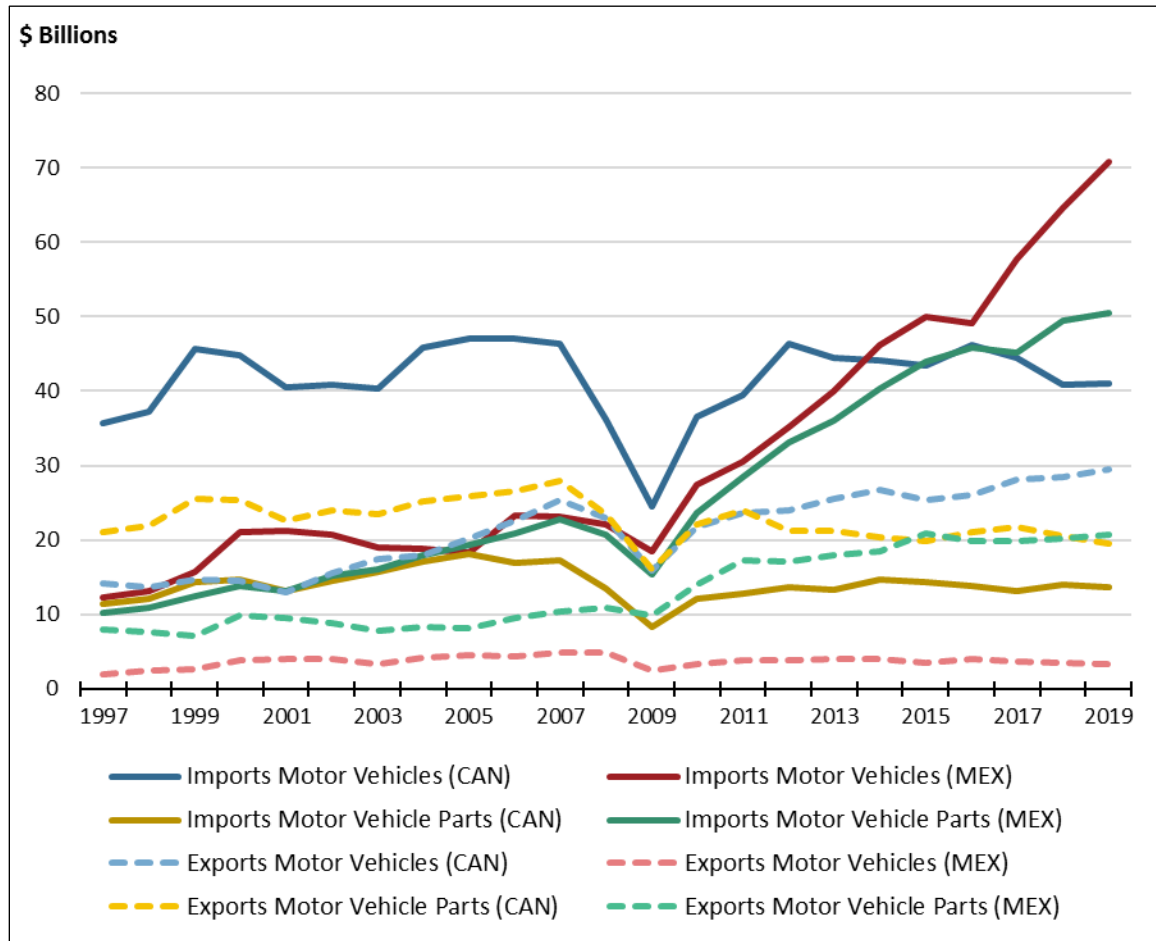


**Source:** U.S. Department of Transportation, Bureau of Transportation Statistics.

**Note:** Country of production is determined by the country where final assembly occurs.



**Figure 8. U.S. Imports and Exports of Motor Vehicles and Parts, 1997-2019**  
In current U.S. dollars



**Source:** CRS using trade data from USITC Dataweb.

**Notes:** Product categories based on the North American Industrial Classification System (NAICS); 3361 for motor vehicles and 3363 for motor vehicle parts.

## Current Trends and Outlook

Various trends and policies impact the structure and use of GVCs. Some firms are reviewing the advantages, disadvantages and risks they incur by using a GVC as well as the foreign and domestic policies that influence how companies shape of those GVCs. As a result, some government and private sector leaders are reevaluating their use of and reliance on GVCs.

### GVC Risks

Although using GVCs can offer significant benefits, as discussed above, doing so can create additional costs. Some of the costs are obvious, such as shipping and transporting raw materials and intermediate goods for final assembly. Other costs may not be so obvious, such as the resources needed for a firm to manage, coordinate, track, and communicate with its GVC partners. In forming its GVC, a company typically weighs the risks and costs associated with each step of its operations, and each potential partner, and configures its GVC accordingly.

When electing to use a GVC, a firm accepts a certain level of risk and loss of control over different stages of production that its supply chain partners, in turn, accept. For example, a firm's consumer reputation often relies, in part, on the quality of suppliers' intermediate products or services. Changes in the quality or reliability of a supplier's product or service could disrupt a GVC. In addition, GVCs are potentially at greater risk of IP theft and diversion of capabilities through licensing and subcontracting arrangements. They also often depend on the ability of contractors to manage labor and other issues, which can pose additional risks. A company may use contracting terms (e.g., reporting requirements, operational standards, or manufacturing specifications), technologies (e.g., RFID sensors to track intermediate parts), or strong relationships (e.g., long-term partnerships) to increase visibility into their supply chain and help minimize risk.

Certain GVC risks and costs are external and may be beyond a single company's control. However, firms must account for them when planning and operating a GVC. Such risks and costs may require temporary changes, such as those due to local supply shocks, whereas others may indicate long-term shifts in market conditions. Potential risks and costs associated with GVCs include the following examples:

- a cybersecurity attack on a supplier may impair a partner's operations or a firm's ability to track or manage overseas operations;
- a natural disaster, such as a flood or tornado, or health crisis, may render a foreign partner unable to fulfill its contract for a period of time, disrupting other parts of the value chain that are not directly affected by the disaster;
- a transportation strike by workers in one country may mean that suppliers in another cannot receive raw materials in a timely manner;
- regulatory changes where a partner is located, such as new environmental or labor requirements, or changes in component prices (e.g., raw materials, energy) could increase overall GVC costs;
- losing visibility into the downstream supply chain if a supplier or other partner uses unidentified subcontractors could hamper a firm's ability to plan or fully secure its supply chain;
- new tariffs or duties may raise costs for the importing firm, making foreign partners no longer as economical; or
- new free trade agreements (FTAs) or trade preference programs may make other potential partners more cost effective or strengthen competitors.

Some analysts note that certain GVC risks may increase in the future because of growing geopolitical tensions that lead to abrupt policy shifts, or the impact of climate change causing more frequent and severe natural disasters.<sup>59</sup> Furthermore, costs may increase when a firm depends on a single supplier or partner for a given value chain link, which can become a choke point in case of disruption. Diversifying sources and partners can strengthen a company's GVC resilience but may require a firm commit extensive resources to manage and oversee the larger partner network. Firms may increasingly need to have alternate contingency or back-up plans for such events, identifying substitute sources or suppliers if the current or first-choice partner is unable to effectively fulfill a contract for a period of time. (See "Reevaluating GVCs" for more discussion on diversification and other options.)

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<sup>59</sup> EIU, "The Great Unwinding COVID-19 and the Regionalisation of global Supply Chains," *The Economist*, 2020.

## Select Policies Shaping GVCs

Although technological advances and economic factors have enabled GVCs to spread across the world, government policy is increasingly shaping GVCs. FTAs, preferential trade programs, and import programs (e.g., free trade zones) offer reduced-tariff benefits to imports that meet certain requirements. In particular, U.S. import policy may support GVCs by facilitating trade efficiently, but it may also require importers to exercise responsibility over their supply chains. In addition, unilateral trade restrictive measures, data flow limitations and national security concerns may hinder GVCs. Selected policy issues of interest to Congress are discussed below.

### Free Trade Agreements (FTAs) and Trade Preference Programs

FTAs shape GVCs by establishing lower trade barriers and harmonizing cross-border policies, such as those on investment and rules of origin (ROO) that facilitate cross-border trade in parts and components. Although WTO agreements have lowered tariffs for many goods over the past decades, FTAs widen the scope of products that may receive duty-free or reduced duty benefits between trading partners. Some studies have shown that FTAs that cover more policy areas, such as investment, intellectual property rights (IPR), and competition policy, have a positive impact on the quantity of components traded and GVC integration.<sup>60</sup> The North American auto industry, discussed above, is an example of GVC integration largely as a result of NAFTA, which was recently replaced USMCA.<sup>61</sup> In addition to removing tariffs on goods produced and traded between North American countries, NAFTA included provisions for uniform ROO requirements, lower investment barriers, and stronger IPR protection.

ROO provisions in FTAs may particularly influence how firms decide to organize their supply chains. Each FTA has its own set of ROO requirements, which are laws, regulations, and procedures used to determine the country of origin of imported products.<sup>62</sup> Such requirements apply to FTAs to ensure that only eligible trading partners receive the tariff benefits and to prevent third-party countries from taking advantage of the duty benefits within a free trade area.<sup>63</sup> Depending on the FTA and product, conferring origin may require the imported product to meet a regional value content (RVC) threshold, which requires a minimum percentage of the value-added of parts, labor costs, and manufacturing process to originate in the FTA region. RVC requirements encourage manufacturers to source parts and labor within the FTA region. USMCA's auto ROOs were negotiated with the goal of incentivizing U.S. manufacturers to source more U.S. parts and increase U.S. production, but analysis on the possible impact on North American auto supply chains has shown mixed outcomes.<sup>64</sup>

When compliance costs outweigh the benefits, U.S. importers and manufacturers may choose to import under general normal trade relations tariffs under WTO rules. For example, the Congressional Budget Office estimated higher tariff revenue and lower duty-free imports from

<sup>60</sup> Michele Ruta, *Preferential Trade Agreements and Global Value Chains: Theory, Evidence, and Open Questions*, World Bank Group, WPS8190, September 2017.

<sup>61</sup> For more information on the North American auto industry, see CRS Report R44907, *NAFTA and Motor Vehicle Trade*, by Bill Canis, M. Angeles Villarreal, and Vivian C. Jones.

<sup>62</sup> See CRS Report RL34524, *International Trade: Rules of Origin*, by Vivian C. Jones and Liana Wong.

<sup>63</sup> This may happen when the third-party country exports to the FTA partner country with the lowest external tariffs and then moves the goods duty-free to another partner country where it is ultimately sold to consumers.

<sup>64</sup> CRS In Focus IF11387, *USMCA: Motor Vehicle Provisions and Issues*, by M. Angeles Villarreal, Bill Canis, and Liana Wong; William Alan Reinsch, Jack Caporal, Madeleine Waddoups, et al., *The Impact of Rules of Origin on Supply Chains: USMCA's Auto Rules as a Case Study*, Center for Strategic & International Studies, April 2019.

Canada and Mexico under USMCA as a result of the strict auto ROO provisions. Under the provisions, automakers can choose pay a relatively low tariff (e.g., 2.5% for passenger vehicles) rather than incur the various compliance costs, such as relocating manufacturing facilities and buying more expensive parts.<sup>65</sup> To be effective, U.S. trade policy and trade negotiating objectives would need to find a careful balance between the costs and benefits of ROOs.

Preferential ROOs also apply to certain programs that provide nonreciprocal, duty-free treatment for certain U.S. imports from eligible developing countries. U.S. trade preference programs like the Generalized System of Preferences (GSP), African Growth and Opportunity Act (AGOA), and certain Caribbean-focused programs aim to promote sustainable economic growth through trade.<sup>66</sup> Specifically, ROO for eligible textile and apparel products under AGOA and the Caribbean programs has specific sourcing and assembly requirements that influence how textiles and apparel supply chains are formed in the region. Each trade preference program is drafted and approved by Congress and subject to regular reauthorizations.

Environmentalists have raised concerns that FTAs, particularly those between developed and developing countries, may negatively affect the environment.<sup>67</sup> Manufacturers may move their supply chains to a developing country FTA partner to take advantage of lower trade barriers and supposedly lax environmental regulations. In recent years, FTAs have increasingly included environmental provisions. One study suggested that environmental policies have limited effects on GVCs and overall trade patterns but may have significant effects on specialization.<sup>68</sup> For example, a country's stringent environmental policies may lead to development of sustainable industries and goods. FTAs that enforce uniform environmental policies across a free trade area may facilitate knowledge sharing or the transfer of clean technologies, leading to more sustainable GVCs.

Some trade policy observers have noted that trade facilitation at the multilateral and national level is important to support GVCs.<sup>69</sup> Trade facilitation includes policies and regulations that simplify customs procedures and increase transparency so that goods can flow across borders more efficiently and lower the cost of trade. The United States is in compliance with most of the WTO Trade Facilitation Agreement (TFA), which went into force on February 22, 2017, and is involved in capacity-building efforts in other countries to help them meet their obligations.<sup>70</sup>

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<sup>65</sup> Congressional Budget Office, "CBO Estimate for H.R. 5430," December 16, 2019, <https://www.cbo.gov/system/files/2019-12/H.R.5430.pdf>.

<sup>66</sup> For more information, see CRS In Focus IF10149, *African Growth and Opportunity Act (AGOA)*, by Brock R. Williams, and CRS Infographic IG10018, *Generalized System of Preferences (GSP): 2019 Overview*, by Liana Wong. The Caribbean-focused programs include the Caribbean Basic Economic Recovery Act (CBERA, P.L. 98-67), Caribbean Basin Trade Partnership Act (CBTPA, P.L. 106-200), and the Haitian Hemispheric Opportunity through Partnership Encouragement Act of 2006 (HOPE, Title V of P.L. 109-432). The Caribbean programs have been amended and expanded several times since they were first authorized.

<sup>67</sup> Mehdi Nemati, Wuyang Hu, and Michael Reed, "Are Free Trade Agreements Good for the Environment? A Panel Data Analysis," July 2016.

<sup>68</sup> Tomasz Kozluk and Christina Timiliotis, *Do Environmental Policies Affect Global Value Chains? A New Perspective on the Pollution Haven Hypothesis*, OECD, Economics Department Working Papers No. 1282, March 2, 2016.

<sup>69</sup> Antoni Estevadeordal, *Why Trade Facilitation Matters Now More Than Ever*, Brookings Institution, April 2017, p. 6, [https://www.brookings.edu/wp-content/uploads/2017/04/global\\_20170405\\_trade-facilitation.pdf](https://www.brookings.edu/wp-content/uploads/2017/04/global_20170405_trade-facilitation.pdf).

<sup>70</sup> See CRS Report R44777, *WTO Trade Facilitation Agreement*, by Rachel F. Fefer and Vivian C. Jones.

## U.S. Import Policies

Certain U.S. import policies and initiatives exist to support trade facilitation and global supply chain security of U.S. imports.

The U.S. Customs and Border Protection (CBP) agency is responsible for trade facilitation, among other duties. CBP employs a “shared responsibility” approach in which it informs importers and exporters of their rights and responsibilities under customs laws and regulations. U.S. importers are expected to exercise reasonable care over imports, including the products’ supply chains, to comply with U.S. customs laws and regulations. For example, Section 307 of the Tariff Act of 1930 prohibits imports that were mined, produced, or manufactured by forced labor.<sup>71</sup> To ensure that imports comply with Section 307, U.S. importers exercising reasonable care regarding compliance are responsible for auditing the supply chain to check for products that may be produced by forced labor.<sup>72</sup>

CBP also oversees the Customs Trade Partnership Against Terrorism (CTPAT) program, which was established under the Security and Accountability for Every Port Act of 2006 (SAFE Port Act) to “strengthen and improve the overall security of the international supply chain and United States border security.”<sup>73</sup> CTPAT allows eligible private sector entities to voluntarily partner with CBP as long as they meet the minimum requirements, including an assessments of their supply chain based on established security criteria.<sup>74</sup> Eligible entities include importers, customs brokers, forwarders, contract logistics providers, and others in the international supply chain system. Participants are identified as low risk and receive a variety of benefits, including reduction in the score assigned under CBP’s Automated Targeting System, reduced examinations of cargo, priority searches of cargo, expedited release of cargo, and inclusion in joint incident management exercises.<sup>75</sup>

## Free Trade Zones

Free trade zones are designated areas, typically located at or near sea, air, or land ports that house production facilities and related infrastructure. There are roughly 5,300 zones located in 140 countries, including the United States.<sup>76</sup> Free trade zone programs differ among countries; however, zones are generally treated as being outside the customs territory despite being physically located inside the geographic boundaries of countries. Thus, as part of its GVC, a company may ship components into one zone and then shift production from zone to zone around the world for different stages of the process. As a result, the company benefits from duty savings and, often, streamlined customs procedures as long as the goods stay within the zone system. Duties are paid and full customs procedures are applied when the products leave the zones and enter a customs area for consumption.

In 1934, Congress passed the Foreign-Trade Zones Act to establish the United States’ free trade zone program, called the Foreign-Trade Zones (FTZ) program.<sup>77</sup> Today, 195 active FTZs operate

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<sup>71</sup> See CRS In Focus IF11360, *Section 307 and Imports Produced by Forced Labor*, by Christopher A. Casey, Cathleen D. Cimino-Isaacs, and Katarina C. O’Regan.

<sup>72</sup> CBP, “Reasonable Care,” *Informed Compliance Publication*, September 2017, p. 14.

<sup>73</sup> P.L. 109-347; 6 U.S.C. §961, as amended.

<sup>74</sup> 6 U.S.C. §963, as amended.

<sup>75</sup> 6 U.S.C. §§964-966, as amended.

<sup>76</sup> UNCTAD, “Special Economic Zones,” *World Investment Report 2019*, June 2019.

<sup>77</sup> P.L. 73-397, 19 U.S.C. §§81a-81u, as amended. For more information on the U.S. FTZ program, see CRS Report

in all 50 states and Puerto Rico. The program is administered by the FTZ Board, which is chaired by the Secretary of Commerce with the Secretary of the Treasury serving as the Board's executive officer. Zones are primarily used for production activities (63%), although they may also be used for warehousing and other logistical activities (37%), both of which require approval from the FTZ Board and CBP. Both domestic and foreign status inputs may enter an FTZ, where they are combined during the manufacturing process to make other products. Around 37% (\$297 billion) of goods entering zones are foreign status goods, whereas domestic status goods make up 63% (\$407 billion).<sup>78</sup> A wide variety of industries participate in the U.S. FTZ program for production purposes, including U.S. automakers, oil refineries, textile and apparel companies, and pharmaceutical firms. Some companies have production operations in multiple FTZs across the United States; for example, General Motors is authorized by the FTZ Board to manufacture at 16 FTZs across 11 states.<sup>79</sup> Goods that are produced in FTZs and eventually enter the U.S. customs territory for consumption have to pay applicable import duties.

While most U.S. FTAs extend preferential treatment to goods produced in U.S. FTZs when they enter the U.S. market for consumption as long as the ROO requirements are met, NAFTA contained a provision that did not extend the benefit to FTZ users.<sup>80</sup> The provision was not included in the USMCA implementing legislation, which replaced NAFTA, and was welcomed by FTZ interest groups that have advocated for the removal of the NAFTA provision.<sup>81</sup> U.S. Trade Representative Lighthizer has been asking Congress to reinstate the provision in a technical corrections bill.<sup>82</sup>

## Digital Trade and Data Flow Limitations

“Cross-border data flows” refer to the movement or transfer of information between computer servers across national borders. Cross-border data flows are part of, and integral to, GVCs because they facilitate the movement of goods, services, people, and finance. For example, e-commerce relies on cross-border data flows to enable international online payments. Emerging technologies such as blockchain rely on global data flows to enable firms to track the flow of intermediate or finished products, customs documentation, certifications, or electronic payments as they move along the GVC.<sup>83</sup> Artificial intelligence (AI) or automated decision-making relies on collecting and analyzing data that may originate from multiple countries involved in a GVC.

Policies that impede cross-border data flows may decrease efficiency and reduce other GVC benefits. For example, some policymakers seek to restrict the flow of data beyond a country's borders to limit access to online information, protect personal privacy and national security, or pursue other policy objectives. Policies may act as protectionist measures, such as those requiring

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R42686, *U.S. Foreign-Trade Zones: Background and Issues for Congress*, by Liana Wong.

<sup>78</sup> Numbers and data in the paragraph are from *80<sup>th</sup> Annual Report of the Foreign-Trade Zones Board to the Congress of the United States*, November 2019.

<sup>79</sup> FTZ Board, “FTZ Production Approvals by Industry,” updated July 14, 2020, <https://enforcement.trade.gov/ftzpage/letters/szindustry.html>.

<sup>80</sup> Section 202 of the NAFTA Implementation Act (P.L. 103-182).

<sup>81</sup> National Association of Foreign-Trade Zones, “Rules of Origin for Products Manufactured in a U.S. Foreign-Trade Zone,” <https://www.naftz.org/wp-content/uploads/2020/08/USMCA-Fact-Sheet-re-Rules-of-Origin-for-FTZs-2020.06.24.pdf>.

<sup>82</sup> Doug Palmer, “Lighthizer's USMCA Backtrack Irks U.S. Foreign Trade Zone Manufacturers,” *Politico Pro*, November 12, 2020.

<sup>83</sup> For more information on cross-border data flows, see CRS Report R45584, *Data Flows, Online Privacy, and Trade Policy*, by Rachel F. Fefer.

domestic data storage and processing to support local industry or to deter foreign competitors from entering the market. As a result, data localization policies that restrict cross-border data flows may limit the growth of individual companies or their ability to participate in GVCs.<sup>84</sup>

The United States has traditionally supported open data flows, with additional regulations (e.g., privacy) at the sectoral level. The lack of multilateral rules governing data flows has led, on the one hand, to countries creating diverging national data policies and, on the other hand, to efforts to establish common global rules or norms that may be of interest to Congress (see “Issues for Congress”).

## National Security-Related Controls

Countries often restrict the export of defense-related items, as well as dual-use goods such as commodities, software, and technologies with both civilian and military applications. Multinational corporations seeking to export dual-use items, software, and technology to incorporate into their supply chains may need to apply for licenses to export those goods to certain destinations, which can add delay and administrative burden to GVC operations. In the United States, dual-use export licenses are administered by the Department of Commerce.<sup>85</sup> This issue is especially manifest in terms of exports of sensitive goods, such as semi-conductor technology or avionics, to China.<sup>86</sup>

Foreign direct investment (FDI) transactions, such as a multinational firm seeking to build operations in a certain country, or to merge with or acquire a GVC partner, may also raise national security concerns. Traditionally, the U.S. approach to international investment has sought to establish an open and rules-based international economic system consistent across countries. The rationale for this approach is that FDI has positive net benefits for the U.S. and global economy, except in cases in which national security concerns outweigh other considerations. The interagency Committee on Foreign Investment in the United States (CFIUS) advises the President on the national security aspects of FDI in the U.S. economy. CFIUS’s purview includes a broad focus on (1) the national security implications of individual foreign investment transactions and (2) the cumulative effect of foreign investment on certain sectors of the economy or by investors from individual countries, both of which could inhibit some FDI by GVC partners.<sup>87</sup> For example, in September 2017, President Trump blocked the \$1.3 billion proposed acquisition of Lattice Semiconductor by the Chinese investment company, Canyon Bridge Capital Partners due to national security concerns.

## GVCs and COVID-19

The initial impact of COVID-19 on GVCs became apparent before the official declaration of a global pandemic. Carefully calibrated just-in-time supply chains began to strain as China initiated

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<sup>84</sup> According to the OECD, “data localization” refers to a mandatory legal or administrative requirement directly or indirectly stipulating that certain data be physically stored or processed, exclusively or nonexclusively, within a specified jurisdiction.

<sup>85</sup> For more information on export controls, see CRS Report R41916, *The U.S. Export Control System and the Export Control Reform Initiative*, by Ian F. Fergusson and Paul K. Kerr.

<sup>86</sup> CRS In Focus IF11627, *U.S. Export Control Reforms and China: Issues for Congress*, by Ian F. Fergusson and Karen M. Sutter.

<sup>87</sup> For more information on CFIUS, see CRS Report RL33388, *The Committee on Foreign Investment in the United States (CFIUS)*, by James K. Jackson, and CRS In Focus IF11334, *CFIUS: New Foreign Investment Review Regulations*, by Cathleen D. Cimino-Isaacs and James K. Jackson.

internal lockdowns that affected GVC partners. Several U.S.-based multinational companies, including Apple Inc. and General Motors, warned of supply chain disruptions and revenue declines when some of their suppliers or stores in China closed.<sup>88</sup> With many complex supply chains based in the Wuhan region, where the outbreak began, the technology sector was hit especially hard, leading to lengthy delays in product shipments and higher costs.<sup>89</sup>

The transport sector on which GVCs depend declined across the globe. Without goods to send abroad, empty container ships piled up in Chinese ports, transport costs for voyages to China rose dramatically as available ships dwindled, and U.S. and other foreign ports suffered from cancelled or “blank” sailings and overcapacity.<sup>90</sup> As the pandemic spread across the globe, some transport lines practiced “slow steaming,” or sailing at reduced speed to help absorb capacity and save costs.<sup>91</sup> For ships that did sail, crews were often left stranded, whether at sea, in port, or at home because of travel restrictions. As a result, many seafarers worked beyond their contract terms and often beyond regulatory safety limits, posing a potential humanitarian crisis, according to international organizations.<sup>92</sup>

While air cargo does not represent a majority of GVCs, it often carries perishable or time-sensitive goods such as medical supplies. In 2018, American Airlines moved two billion pounds of cargo and saw revenues of \$1 billion from air cargo.<sup>93</sup> As the COVID-19 pandemic spread geographically, travel restrictions and fear of the virus kept many airline passengers away, leading to sharp declines in the number of flights and air cargo space, raising prices for what limited space remained. By May 2020, airlines had grounded roughly three-quarters of their capacity.<sup>94</sup> Some firms looked to express carriers such as UPS and FedEx for extra capacity to transport goods, and some airlines reconfigured their planes to hold cargo instead of passengers.

Over three-quarters of U.S.-Mexico trade occurs on the highways, and trucking companies attempted to adapt to the pandemic by switching customers and cargo, focusing on the delivery of medical supplies or food in high demand.<sup>95</sup> In some places, such as Europe, trucks that crossed national borders were subject to health inspections and other screenings, leading to further delivery delays.

The overall impact of the pandemic on GVCs has varied by sector. One survey found that total travel and transport costs for shipping pharmaceuticals to the United States increased on average

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<sup>88</sup> Chuin-Wei Yap and Jon Emont, “World Economy Shudders as Coronavirus Threatens Global Supply Chains,” *Wall Street Journal*, February 23, 2020.

<sup>89</sup> IPC, “The Impact of the Coronavirus (COVID-19) on Epidemic on Electronics Manufacturers,” February 2020. For deeper discussion, see CRS Report R46304, *COVID-19: China Medical Supply Chains and Broader Trade Issues*, coordinated by Karen M. Sutter, and CRS In Focus IF11434, *COVID-19: U.S.-China Economic Considerations*, by Karen M. Sutter and Michael D. Sutherland.

<sup>90</sup> Jesse Newman and Jennifer Smith, “Coronavirus Snarls Trans-Pacific Shipping and Ripples Through U.S. Business,” *Wall Street Journal*, March 5, 2020.

<sup>91</sup> Michael Pooler, “Shipping lines face formidable foe in pandemic,” *The Financial Times*, June 8, 2020.

<sup>92</sup> “Enough is enough: World’s seafarers will now exercise right to leave ships amid COVID-19 failures,” International Transport Workers’ Federation (ITF), June 15, 2020, and Secretary-General Kitack Lim, “Operational challenges from the COVID-19 reality, to sustainability considerations and new challenges on ship safety, security and human resources,” International Maritime Organization (IMO), June 16, 2020.

<sup>93</sup> Leslie Griffin, “Global Cargo is Leaving on a Jet Plane,” *Trade Vistas*, March 26, 2020.

<sup>94</sup> Scott McCartney, “Why Empty Planes Keep Flying Through the Pandemic,” *Wall Street Journal*, May 6, 2020.

<sup>95</sup> Sabrina Rodrigues, “U.S., Mexico trucking companies struggle to keep it moving amid pandemic,” *PoliticoPro*, May 7, 2020.



224%.<sup>96</sup> GVCs of medical products have come under scrutiny during the pandemic (see **text box**). In August 2020, the chairs of both the House Ways and Means and Senate Finance committees asked the U.S. International Trade Commission (USITC) to conduct an investigation into pharmaceuticals and other COVID-related industry sectors to understand domestic production, challenges, and other factors affecting U.S. supply chain resilience, including foreign trade barriers.<sup>97</sup> The report was due December 15, 2020.

### Critical Medical Supply Chains<sup>98</sup>

The COVID-19 pandemic has exposed vulnerabilities associated with the concentration of manufacturing in China and the United States and global dependence on China for critical inputs and products. China is a major U.S. and global supplier of medical personal protective equipment (PPE), medical consumables, and active pharmaceutical ingredients. The spike in PPE and pharmaceutical demands due to the COVID-19 pandemic highlighted the potential risks of these dependencies on China. According to U.S. trade data, in 2019, China supplied almost 72% of U.S. imports of textile face masks, 55% of U.S. imports of protective eyewear, and 55% of U.S. imports of protective garments for surgical and medical use.

The pandemic also highlighted China's ability to mobilize and nationalize its industry on a global scale, raising new concerns. For example, in January and February 2020, at the height of the COVID outbreak in China, the Chinese government organized the large-scale purchase of PPE for China on the global market, adding to depletion of existing supplies in the United States and other countries such as Australia and Canada.<sup>99</sup> The Chinese government nationalized control of the production and distribution of medical supplies in China, to include PPE.<sup>100</sup> China's nationalization efforts and de facto export restrictions, while understandable as part of its response to address its COVID-19, may have denied the United States and other countries timely access to critical medical supplies.

Critical medical supply chains were also impacted when various countries placed temporary export restrictions on medical goods in response to the COVID-19 pandemic.<sup>101</sup> According to the WTO, around 39% of restrictive trade measures put in place in response to the pandemic has been repealed by mid-October; the number of measures still in place on medical goods were not specified.<sup>102</sup> WTO stated that the measures reduce total global supply and limit access of essential goods for importing countries as well as more countries to increase domestic production, usually at higher prices.<sup>103</sup>

The global nature of the COVID-19 pandemic highlights the exposure risks inherent in GVCs. During the pandemic, companies have found their GVCs disrupted when manufacturers in different regions closed and reopened at different times, interrupting previously smooth flows of intermediate and final goods. The Global Services Coalition and others appealed to governments to minimize delays and facilitate supply chains of essential goods and services.<sup>104</sup> The United

<sup>96</sup> Association for Accessible Medicines, "Pharmaceutical Shipping Costs Spike in Response to Global COVID-19 Pandemic," AAM press release, April 30, 2020.

<sup>97</sup> Letter from Chairman Neal and Ranking Member Brady, Committee on Ways and Means, and Chairman Grassley, Committee on Finance, to Chairman Kearns, U.S. International Trade Commission, August 13, 2020.

<sup>98</sup> Section contributed by Karen M. Sutter, CRS Specialist in Asian Trade and Finance.

<sup>99</sup> Ministry of Commerce of the People's Republic of China, "General Office of the Ministry of Commerce Issued the Circular on Actively Expanding Imports to Combat against Novel Coronavirus Epidemic," press release, February 6, 2020 and Phillip Coorey, "China Spree Sparks FIRB Crackdown," *Financial Review*, March 29, 2020, <https://www.afr.com/politics/federal/china-spree-sparks-firb-crackdown-20200329-p54exo>.

<sup>100</sup> Zhang Pinghui and Zhou Xin, "Coronavirus: China Shifts Responsibility Over Medical Supplies Amid Mask Shortage, Rising Death Toll," *South China Morning Post*, February 3, 2020, updated on February 14, 2020.

<sup>101</sup> See CRS In Focus IF11551, *Export Restrictions in Response to the COVID-19 Pandemic*, by Christopher A. Casey and Cathleen D. Cimino-Isaacs.

<sup>102</sup> WTO, *Overview of Developments in the International Trading Environment*, November 30, 2020, p. 4.

<sup>103</sup> WTO, *Export Prohibitions and Restrictions*, April 23, 2020.

<sup>104</sup> The CityUK et al., "Ensuring Resilience of Global Supply of Essential Services in Combatting COVID-19," April 1,

Nations Conference on Trade and Development (UNCTAD) issued recommendations for governments to facilitate the logistics of trade, from maintaining open ports to digital processing of pre-arrival documentation.<sup>105</sup> The G-20 Ministers reaffirmed their “determination to cooperate and coordinate,” both on short-term responses to mitigate the impact of COVID-19 and longer-term efforts to build resilience in global supply chains.<sup>106</sup> The G-20 statement endorses measures that, among others, facilitate trade, promote connectivity, and do not create unnecessary trade barriers or disrupt GVCs.

## Reevaluating GVCs

In response to the Trump Administration’s recent unilateral tariff actions,<sup>107</sup> and in light of the COVID-19-related risks described above, many companies are reevaluating their GVCs and seeking ways to build greater resilience and increase their capacity to deal with potential disruptions. In assessing its value chain, a firm may examine risk exposure, lack of sufficient diversification, scenario analyses should a disruption occur, and potential contingency or back-up plans. In weighing the added costs and benefits of each link along its chain, a firm would determine at what point the costs of an additional partner outweigh the benefits that the individual partner brings. When does a firm reach the point of diminishing returns by further extending and/or diversifying its value chain? Are the higher costs of one potential partner offset if that vendor’s location offers greater certainty or access?

As firms analyze their use of GVCs, stakeholders may consider various options to reconfigure or reinforce their value chain (see **Figure 9**). Some of these options, while not mutually exclusive, may include the following:

- **Exiting certain markets.** With the increased tariffs on Chinese imports to the United States, and increased restrictions on doing business with China, some firms are choosing to leave China and move to other locations for certain lower value-added manufacturing, without otherwise changing their GVC configuration—for example, by substituting a China-based manufacturer for one in Vietnam.<sup>108</sup> An EU Chamber of Commerce survey found that 11% of respondents were considering shifting their investments out of China; of those, 45% were considering moving to other markets in Asia.<sup>109</sup> An earlier American Chamber of Commerce survey found that 9% of respondents had started to leave China, with another 8% considering such a move.<sup>110</sup> Seeking to capitalize on these changes, Mexico’s “relocation strategy” aims to attract firms who seek to shift production out of China.<sup>111</sup>

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2020.

<sup>105</sup> UNCTAD, “COVID-19: A 10-point action plan to strengthen international trade and transport facilitation in times of pandemic,” April 2020, <https://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=2713>.

<sup>106</sup> G-20, “G20 Trade and Investment Ministerial Meeting,” Ministerial Statement, May 14, 2020.

<sup>107</sup> For more information, see CRS Report R45529, *Trump Administration Tariff Actions: Frequently Asked Questions*, coordinated by Brock R. Williams.

<sup>108</sup> J.R. Reed, “President Trump ordered US firms to ditch China, but many already have and more are on the way,” *CNBC*, September 1, 2019.

<sup>109</sup> Scott Kennedy and Shining Tan, “Decoupling Between Washington and Western Industry,” CSIS, June 10, 2020.

<sup>110</sup> *Ibid.*

<sup>111</sup> Kevin Sieff, “As U.S.-China rift grows, Mexico tries to lure American businesses to move operations closer to home,” *Washington Post*, August 13, 2020.

Similarly, a company that currently relies on a vast network of partners across multiple countries or regions may want to reduce the number of partners or countries involved in its supply chain. For example, a firm may want to identify and strengthen its relationship with key strategic suppliers while reducing the number of tier-two, -three, or -four suppliers.

- **Diversification and redundancy.** Firms that currently have key suppliers in one geographic location may seek to diversify and use suppliers in multiple countries or regions. Diversifying a firm’s value chain partners does not necessarily require a firm to exit any particular market. For some firms with key Chinese suppliers, this has been referred to as the “China + 1” strategy. Diversifying and using multiple suppliers may increase costs (e.g., more management teams or different transport modes and vendors), lead to a decline in efficiency, and increase “waste” due to redundancy and excess capacity. On the other hand, a firm may be able to reduce costs by shifting to a country with lower wage or regulatory costs. In addition, a company may gain resiliency and long-term sustainability through its ability to respond to changes in supply, demand, and other circumstances. One survey found that over 67% of senior executives in the Asia-Pacific region are considering diversifying their supply chains to be less concentrated in China and to increase their range of suppliers.<sup>112</sup> Another recent survey in Japan found that 57% of companies plan to diversify sources and no longer rely on a single country.<sup>113</sup>

For example, Swedish truck maker Scania aims to have at least two sources for most of its 21,000 components, thereby providing the company with flexibility should one vendor become unavailable. However, with 35 unique components sourced only in France, disruptions there during the COVID-19 pandemic shutdown resulted in Scania closing its operations globally for an extended period.<sup>114</sup>

- **Regional supply chains.** By selecting partners within a certain geographic region, a company may minimize the impact of global shocks, reduce transportation costs and lead times with shortened supply chains, and take advantage of trade preferences in regional trade agreements (e.g., USMCA or the Comprehensive and Progressive Agreement for Trans-Pacific Partnership). A regional value chain could be a hub-and-spoke or a vertically integrated system. The owner of such a chain may increasingly decide to have more than one region (e.g., in Southeast Asia and Latin America) to serve different parts of the world and allow for redundancy. Although a regional supply chain may offer certain efficiencies, a firm using such a chain might not be able to take advantage of lower cost or better-qualified suppliers outside a given region. In addition, the firm would still be potentially vulnerable to disruptions from regional events.

As noted above, policies such as trade preferences and tailored subsidies or

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<sup>112</sup> Huileng Tan, “China is producing higher value goods—even as factories are shifting away from the mainland,” May 14, 2020.

<sup>113</sup> Eiki Hayashi, “70% of Japan execs plan changes to supply chain: Nikkei survey,” *Nikkei*, June 1, 2020.

<sup>114</sup> Paul Hannon and Stu Woo, “Steep Drop in Trade Flows Shows Pitfalls of Cross-Border Supply Chains,” *Wall Street Journal*, May 25, 2020.

incentives (e.g., infrastructure investments, tax breaks) can help foster regional supply chains. For example, Japan's government has actively encouraged Japanese firms to pursue a "China+1" strategy and to decrease Chinese dependency.

Swedish firm Ericsson, for example, has shifted part of its 5G GVC to Eastern Europe, including Estonia and Poland, to support European customers.<sup>115</sup> As mentioned above, the integration of the North American motor vehicle industry expanded under NAFTA and may consolidate further under the rules of the updated USMCA.

- **Stockpile.** GVCs enable just-in-time inventory and supply systems. Companies that do not want to move or adjust their current GVC may increase warehousing to stockpile excess inventory at different points along the supply chain, thereby providing a cushion in case of unexpected events. Stockpiling can be an effective strategy for industries where demand for products is stable and for firms with sufficient resources to store excess materials and products. For other industries, such as apparel, stockpiling is not a tenable option because fashion and consumer preferences change relatively quickly, or it may not be economically competitive due to added costs.

As a result of the COVID-19 pandemic, several governments are considering plans to stockpile essential medical supplies in preparation for a future epidemic.

- **Vertical production.** A firm may want to bring more activities in-house and limit outsourcing to external partners. This strategy may involve a firm investing in new capacities, from manufacturing specialty parts to final assembly and packing. Such vertical approaches could concentrate all steps in the home market, or some activities could be done abroad. Either way, value chain links would be under a single corporate structure. While this arrangement provides greater control, it can be a costly, onerous, and potentially risky strategy as the firm may need to invest significant resources to develop the full set of required capabilities and would lose the advantages of risk diversification and efficiency through specialization. This process may be best suited for a firm that serves only customers in a single market such as the United States or North America.
- **Reshore.** Some observers and policymakers voice support for reshoring GVCs to their home country, including the United States. A few companies have opted to do so, seeking to lower corporate risk exposure and complexity, and to obtain greater policy certainty and domestic support (potentially both financial and popular opinion support). Reshoring, however, may lead to higher costs and create risks associated with a lack of diversification. Some governments have implemented or are considering policies to actively promote or incentivize reshoring, sometimes targeting certain industries deemed critical to national security.

In April 2020, Japan announced that \$2.2 billion of its pandemic-related economic stimulus would help Japanese firms manufacturing certain high-value-

<sup>115</sup> Ericsson, "Ericsson ramps up digitalization and production at European factories," press release, September 25, 2019.

added items shift supply chains out of China back to Japan or to other Southeast Asian countries.<sup>116</sup> The U.S. International Development Finance Corporation is reportedly in talks with some U.S. firms about the possibility of reshoring manufacturing in select industries.<sup>117</sup> The agency has added staff to focus on domestic reshoring and is to jointly administer a \$100 million supply chain reshoring fund with the Department of Defense.<sup>118</sup> In addition, the Trump Administration issued executive orders that incentivize companies to relocate to the United States by limiting waivers that would allow government purchases of foreign goods.<sup>119</sup>

- **Remain in place.** A firm's management may elect to maintain production abroad if they are assembling or manufacturing certain products in a country to serve the local regional market or meet localization requirements set by the government. Another reason may be high sunk costs or investments the firm may not be able to recapture. Because 96% percent of consumers are outside of the United States, many U.S. firms want to establish local relationships to be closer to their end consumers, deterring them from relying only on a U.S.-based GVC.<sup>120</sup>

Localization policies force a firm to choose whether to locate in a certain country to access the local market or to forgo serving that market. For example, India, China, Argentina, and Nigeria are among the countries that impose local content requirements for domestic sale of certain goods and service sectors.<sup>121</sup>

- **No change.** Firms may choose to accept the risks inherent in their GVC and stay in the foreign market(s). This option may be more feasible for sectors with multiple potential sources or vendors around the globe, making it relatively easy to switch between partners without friction (e.g., apparel production). This path may a good fit for firms that can stockpile goods as a safeguard in case of disruptions or that has multiple separate product lines and is willing to halt, temporarily or permanently, production of some items.

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<sup>116</sup> "Exclusive: New U.S. Development Agency Could Loan Billions for Reshoring, Official Says," *Reuters*, June 24, 2020.

<sup>117</sup> *Ibid.*

<sup>118</sup> For example, see Andrea Shalal et al. "U.S. mulls paying companies, tax breaks to pull supply chains from China," *Reuters*, May 18, 2020.

<sup>119</sup> White House, "Executive Order on Maximizing Use of American-Made Goods, Products, and Materials," press release, July 15, 2019, and White House, "Executive Order on Ensuring Essential Medicines, Medical Countermeasures, and Critical Inputs Are Made in the United States," press release, August 6, 2020.

<sup>120</sup> U.S. Small Business Administration, *A World of Opportunity*, [https://www.sba.gov/sites/default/files/articles/US\\_SBA\\_WorldOp.pdf](https://www.sba.gov/sites/default/files/articles/US_SBA_WorldOp.pdf).

<sup>121</sup> U.S. Trade Representative, "2020 National Trade Estimate," March 31, 2020, [https://ustr.gov/sites/default/files/2020\\_National\\_Trade\\_Estimate\\_Report.pdf](https://ustr.gov/sites/default/files/2020_National_Trade_Estimate_Report.pdf).

### Case Study: Pursuing Multiple Supply Chain Strategies<sup>122</sup>

South Korea's Samsung has embraced multiple strategies for producing its smart phones and personal computers after initially concentrating manufacturing in China. The company has recently announced changes as part of its "ongoing efforts to enhance efficiency across our global production bases." Samsung announced it has

- **Exited** China, closing its smartphone plants and halting production of its computers.
- **Diversified and created redundancy** by opening new plants in Vietnam and India.
- **Vertically integrated** to make all components and assemble smartphones in-house.
- **Stayed** in China to produce lower-end smartphones through contract manufacturing, to conduct R&D, and to manufacture other products such as LCD screens and memory chips.

Advanced and emerging technologies, as discussed above, can help decentralize and diversify supply chains by automating and digitizing complex decision-making processes. These technologies can also help increase productivity for manufacturing and services links in a value chain.

Automation or reshoring may be more feasible for certain industries than others. According to one study, 67% of workers in the technology sector are concerned about losing their jobs due to AI, machine learning, and robotic software.<sup>123</sup> In other industries, such as apparel, replacing labor with automation may not reduce expenses enough to offset other costs related to reshoring. For example, footwear manufacturer Adidas built "speed factories" in Europe<sup>124</sup> and the United States<sup>125</sup> that applied advanced technologies such as 3D printing techniques to shorten production times, require fewer workers, and be located closer to the end customers. After operating for a couple of years, the company closed the new factories in favor of concentrating its production in Asia, where it had previously established the majority of its manufacturing and where costs were lower.<sup>126</sup> In contrast to Adidas' speed factories, as discussed, Nike depends on a vast network of contract manufacturers (see "Complex Distributed Value Chain: Nike").

<sup>122</sup> Song Jung-a, Yuan Yang, Tim Bradshaw, "Samsung's departure is new blow to Chinese manufacturing," *Financial Times*, October 17, 2019, and Zhou Xin and Cissy Zhou, "Samsung to halt PC production in China in latest blow to manufacturing sector," *South China Morning Post*, July 31, 2020.

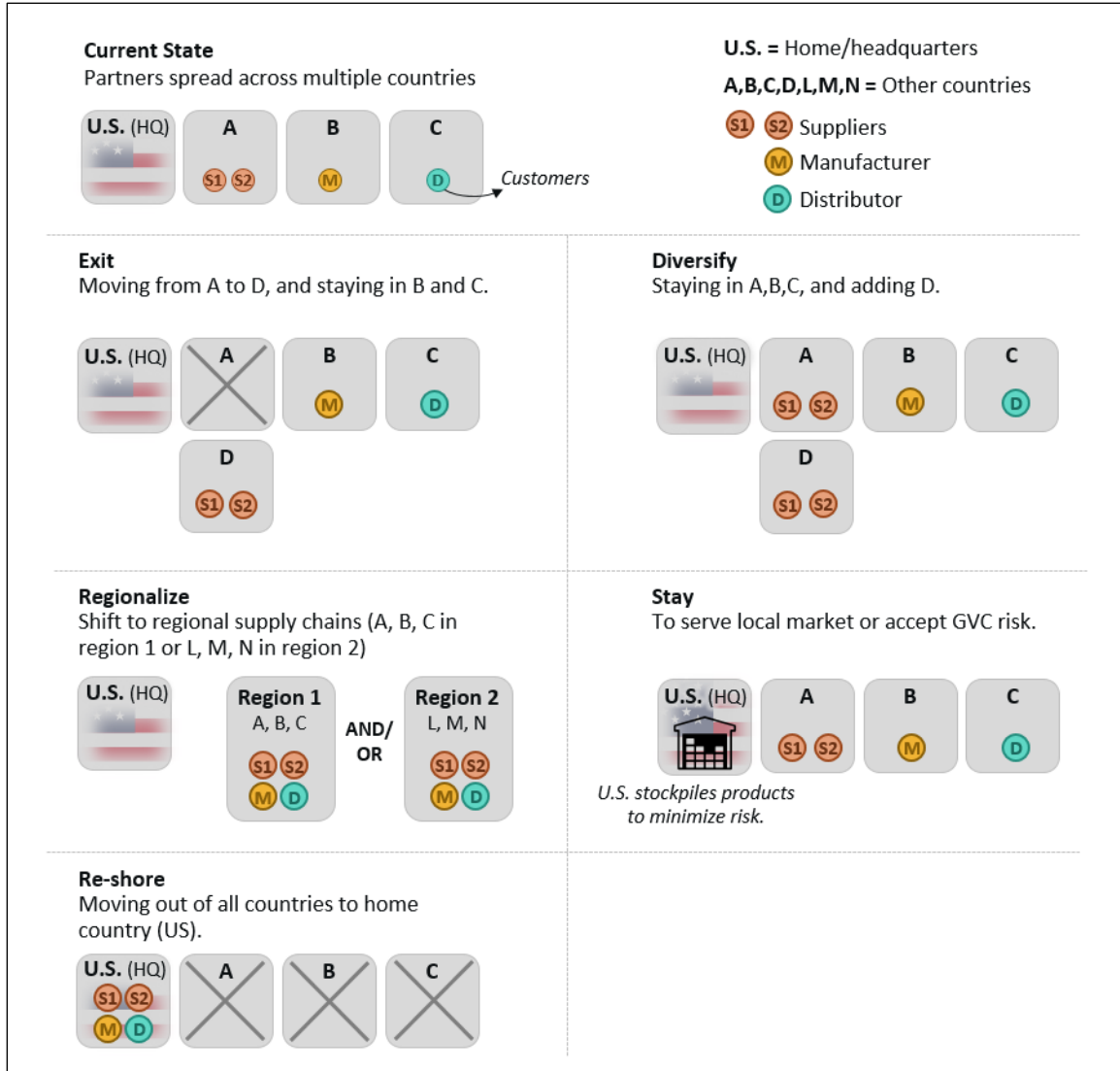
<sup>123</sup> Angus Loten, "Tech Workers Fear Their Jobs Will Be Automated in Wake of Coronavirus," *Wall Street Journal*, May 27, 2020.

<sup>124</sup> Beth Wright, "Adidas Unveils First Speedfactory Running Shoe," *JustStyle*, September 24, 2016.

<sup>125</sup> Beth Wright, "Adidas Names Atlanta Location for its Speedfactory," *JustStyle*, August 14, 2016.

<sup>126</sup> Adidas, "Adidas Deploys Speed Factory Technology at Asian Suppliers by End of 2019," press release, November 11, 2019.

**Figure 9. Rethinking GVC: Potential Options**



Source: CRS.

## Issues for Congress

Global value chains provide the structure for a significant portion of global trade and investment. The changing composition of international trade with GVCs as a central aspect of the trading system raises a number of complicated and evolving issues for firms, workers, and policymakers. For a given policy, policymakers face consideration of where the policy will have the greatest effect—whether on the headquarters, on the overseas operations, or on domestic and foreign companies’ operations in the United States. Conversely, policies could produce results that may not achieve intended objectives. Selected policy areas that may affect GVCs and possible questions for congressional consideration are discussed below.

## Investment and Business Climate

A core issue for Congress is how to create conditions that make the U.S. economy more attractive for establishing U.S.-based supply chains, as well as for segments of both U.S. and foreign-parented supply chains. In general, when more value is added domestically, more domestic jobs are created, along with more opportunities for positive spillover effects—both direct and indirect—from greater domestic economic activity.

Public policy has a significant impact on the business and investment climate—that is, the economic, political, and social conditions in which firms operate. The investment climate “shape[s] the opportunities and incentives for firms to invest productively, create jobs, and expand,” and it is affected by the interplay of key policy areas.<sup>127</sup> These areas include public governance, human capital and innovative capacity development, the financial system, physical and digital infrastructure development, tax policy, corporate governance, investment policy, competition policy, and trade policy. In addition, public policy can affect the cost of production and profitability of firms. Its impact can be direct and indirect (e.g., through taxes, tariffs, labor and environmental regulations, accounting and reporting rules, and health and safety requirements). Other policies affecting the general investment climate, such as energy costs and subsidies for research and development, also affect firms’ costs and profits.

Public policy may provide incentives or deterrents for GVC parent companies to establish and retain their headquarters in the United States. This influence applies to both U.S.-based and foreign companies that may locate regional headquarters in the United States. Policies favorable to businesses in the United States may also induce U.S. and foreign-owned supply chains to locate more segments of their production in and related service activity in the United States. Improvements in U.S. seaports, airports, and other freight-handling infrastructure, and certain tax provisions, among other things, may increase the incentive to source from abroad or to invest in business operations in the United States.

In considering GVCs, Congress may examine the following:

- What are the costs and benefits of GVCs for U.S. workers and firms and how do U.S. investment and economic policies shape and impact GVCs?
- How can these policies encourage U.S. and foreign investment into U.S. communities that have lost jobs due to offshoring, automation, or other economic forces?

## International Trade

Trade policy (e.g., ROO, import rules, investment policy) may impact the formation and shape of GVCs in a number of ways. Trade liberalization, through free trade agreements, reciprocal or unilateral reductions in tariff and nontariff barriers, and regulatory cooperation may increase U.S. exports, improve the overall profitability of a U.S.-parented GVC, and enable U.S. businesses to leverage their supply chain operations to access foreign markets.

Looking forward, future free trade agreements, whether involving the United States or other parties, may influence how firms structure their value chains. Ongoing negotiations at the WTO could further support the growth of GVCs. For example, in 2019, over 80 countries, including the United States, initiated WTO e-commerce negotiations, which aim to establish a global framework and obligations to enable nondiscriminatory digital trade. Digital trade issues such as

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<sup>127</sup> World Bank, *World Development Report*, 2005.



e-signatures, e-contracts, and related e-commerce measures would build on the commitments in the WTO Trade Facilitation Agreement to smooth the flow of goods and services across borders.

In considering GVCs, Congress may examine the following:

- Should Congress revise existing trade negotiating objectives to better balance facilitating GVCs with maintaining U.S. domestic competitiveness and economic growth?
- Should future FTAs use rules of origin to encourage and support stronger regional value chains, as seen with the North American motor vehicle industry?
- Does the federal government have sufficient data on trade, and what, if any, additional resources should be devoted to collecting data and analyzing the role of GVCs in the U.S. economy? Should federal agencies measure trade in value added terms? In addition to TiVA, are there other approaches that the United States should examine and support to enable U.S. policymakers to understand the interplay of domestic and global developments, measure and manage supply chain dependencies and risks, assess overall production capabilities of U.S. firms' GVCs in sectors of concern, and better prepare for—and respond to—future crises?

## Supply Chain Security and Resilience

Supply chain security and transparency can help governments and companies build resilience against internal and external shocks along global supply chains. Increased transparency may also help customs agencies, like CBP, facilitate legitimate trade and support national security more efficiently. Public-private partnership programs, like the CTPAT, may encourage U.S. importers to be more conscious when managing their GVCs. That said, supply chain transparency remains limited. Increasing trade volume, especially in a growing e-commerce market, introduces enforcement challenges for CBP, which may result in counterfeit and other illicit goods entering the U.S. market. To improve CBP's efforts in trade facilitation and enforcement, the Department of Homeland Security (DHS), which oversees CBP, has advocated leveraging new technology to increase supply chain transparency.<sup>128</sup> Congress may consider supporting and funding the adoption of new technology to improve CBP's responsibilities.

As discussed above, the COVID-19 pandemic has highlighted the need for resilient supply chains, so GVCs are less sensitive to sudden disruptions. Some policy experts have suggested that companies implement stress tests to assess the resilience and potential risks of their GVCs, similar to stress tests conducted in the financial sector.<sup>129</sup> To identify supply chain vulnerabilities, a GVC stress test could examine certain supply chain characteristics: geographic concentration of suppliers, supplier interconnectivity, depth of lower-tiered suppliers, supplier dependency and substitutability, and supply chain transparency.<sup>130</sup>

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<sup>128</sup> Department of Homeland Security, "Written testimony of S&T Cybersecurity Division Director Douglas Maughan," House Committee on Science, Space, and Technology, Subcommittee on Oversight, and Subcommittee on Research and Technology hearing titled "Leveraging Blockchain Technology to Improve Supply Chain Management and Combat Counterfeit Goods," May 2018.

<sup>129</sup> Following the Great Recession, Congress passed the Dodd-Frank Act, which required banks to conduct stress tests and to report results to the Federal Reserve. The Federal Reserve evaluates the financial institutions' capital adequacy and internal assessment process, among other things, and publishes the results annually, as required under the Dodd-Frank Act.

<sup>130</sup> Thomas Baumgartner, Yogesh Malik, and Asutoshi Padhi, *Reimagining Industrial Supply Chains*, McKinsey &

Congress may consider policies that identify strategic supply chains for essential goods, such as certain medical and ICT goods, and that implement certain stress tests to identify risks to those supply chains. The Trump Administration has begun identifying certain goods and services in this area. On August 5, 2020, the Department of State announced the Clean Network program, which identifies ICT networks as a critical infrastructure for U.S. businesses and aims to secure companies' "sensitive information from aggressive intrusions by malign actors."<sup>131</sup> The program requires all 5G network traffic of U.S. diplomatic facilities to not use any ICT products (e.g., transmission, computing, or storage equipment) from companies such as Huawei and ZTE. ICT services, such as cellular networks and cloud services, are essential services for companies managing GVCs.

In considering GVCs, Congress may examine the following:

- Should policymakers consider new approaches to trade negotiations or forms of cooperation with other countries to increase supply chain resilience in certain sectors?
- How should policymakers identify supply chains that are important to national security and public health, and what steps should be taken to increase the transparency and security of those supply chains?

Congress and the Executive Branch may further examine economic policy and measures to minimize the impact of future global shocks on the U.S. economy, maintain U.S. global leadership in GVCs, and ensure that GVCs benefit U.S. workers and firms. Members may take into account not only the immediate static effects of greater global economic integration and GVCs, but also the long-term, dynamic effects, which could play an important role in evaluating their contribution to the U.S. economy.

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Company, August 2020, p. 8.

<sup>131</sup> U.S. Department of State, "Announcing the Expansion of the Clean Network to Safeguard America's Assets," Press Statement, August 5, 2020, <https://www.state.gov/announcing-the-expansion-of-the-clean-network-to-safeguard-americas-assets/>.

## Appendix. Glossary of Acronyms

<b>AGOA</b>	African Growth and Opportunity Act
<b>AI</b>	artificial intelligence
<b>CBP</b>	U.S. Customs and Border Protection
<b>COVID-19</b>	Coronavirus Disease 2019 (COVID-19) Pandemic
<b>CTPAT</b>	Customs Trade Partnership Against Terrorism
<b>CFIUS</b>	Committee on Foreign Investment in the United States
<b>CUFTA</b>	Canada-United States Free Trade Agreement
<b>FDI</b>	foreign direct investment
<b>FTA</b>	free trade agreement
<b>FTZ</b>	foreign-trade zone
<b>GSP</b>	Generalized System of Preferences
<b>GVC</b>	global value chain
<b>ICT</b>	information and communications technology
<b>IFC</b>	International Finance Corporation
<b>IoT</b>	Internet of Things
<b>IPR</b>	intellectual property rights
<b>MNC</b>	multinational corporation
<b>NAFTA</b>	North American Free Trade Agreement
<b>OECD</b>	Organization for Economic Co-operation and Development
<b>R&amp;D</b>	research and development
<b>ROO</b>	rules of origin
<b>RVC</b>	regional value content
<b>SME</b>	small and mid-sized enterprises
<b>TiVA</b>	trade in value-added
<b>USMCA</b>	United States-Mexico-Canada Agreement
<b>WTO</b>	World Trade Organization

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