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Resilience of global supply chain: Facts and implications

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ADB Working Paper Series

**RESILIENCE OF GLOBAL SUPPLY
CHAIN: FACTS AND IMPLICATIONS**

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Abstract

Global supply chains have been growing, but also evolving, for decades. The People's Republic of China (PRC) has been acquiring an increasingly central role in global value chains, but things might be starting to change. The trade war between the United States (US) and the PRC and, especially, the COVID-19 pandemic, followed by Russia's invasion of Ukraine, have been crucial shocks to the good functioning of supply chains. Companies, as well as governments, are focusing more on resilience than on efficiency, which is already bringing about some reshuffling of supply chains, according to available surveys. This paper reviews the PRC's central role in the global value chain and the consequences of this, as well as the bottlenecks created by the COVID-19 pandemic and the Russian invasion of Ukraine. Government action, including legislation, has been introduced in several countries, such as Japan, the Republic of Korea, the European Union, and the US, to increase the resilience of global value chains. That said, many of the decisions made by companies to reshuffle production away from the PRC may be incentivized by the strong need for diversification amidst the growing geopolitical turbulence and the PRC's worsening medium-term economic prospects. In other words, companies diversifying their production away from the PRC—as shown in the recent slow-down in mergers and acquisitions into the PRC and the simultaneous increase in India and Association of Southeast Asian Nations countries—might be the result of a rather rational decision based on an economic rationale and, in some cases, also on government action.

Keywords: global supply chain, supply chain resilience, international trade

JEL classification: F15, F51, F52

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1. INTRODUCTION

What we thought was an unstoppable trend, namely, globalization, has been centered on the rapid increase in trade flows across the globe; it has now halted and, worse still, may reverse. Rapid globalization has been possible thanks to rapid innovation in information technology, logistics, and transportation, which has reduced costs, accelerated the speed of communication, and cheapened the transportation of air and sea freight. Other causes are the formation of massive trade blocs such as the European Union and the liberalization of trade and investment policy. In the 1990s and 2000s, the reduction of barriers to global trade and investment created rapid de-localization and specialization of the production of parts and components, arbitrating the costs of inputs and regulation and giving rise to the complex supply chains we have today.

That process of the fragmentation of production, and of input goods traveling across global supply chains before a final good is finalized and sold to the consumer, is known as the global value chain, and it has been one of the most important revolutions in recent economic history. The ability of developing economies to tap into their comparative advantage of cheap labor markets through the liberalization of trade and investment policy, not to mention their laxer environmental and labor regulation, has allowed them to gain more productive jobs and sticky capital investment, and, most importantly, to tap into the global value chain to raise productivity and generate wealth. From Eastern Europe to the People's Republic of China (PRC), and, more recently, Viet Nam, the process has lifted millions out of poverty and generated significant wealth.

Moreover, global value chains have shaped the world beyond trade, from the increasing importance of efficiency as a key objective of the production process—and the development of new business models to accommodate this—to the surge in foreign direct investment (FDI) to set up production plants overseas to produce parts and components for the supply chain. Thus, there are a number of reasons why global value chains are important for trade.

First and foremost, they shape the role that countries may play in moving up the ladder of adding value in production. A growing role in the supply of parts and components, especially if this is accompanied by supportive innovation policies, should help countries increase the value embedded in production. This is clearly the case in the PRC. In the same way, the labor force involved in the production of such parts and components will need to accompany this move up the ladder by scaling up their capabilities. Related improvements in innovation and human capital are important positive consequences of a country's role in the global value chain.

That said, in recent years, globalization has increasingly become more contentious and it cannot be taken for granted that it will continue to prosper, as the dark side of rampant globalization and the liberalization of trade and investment has emerged. Beyond the obvious divergence in environmental and labor policies and the consequence of the asymmetric liberalization of trade and investment policy, the unevenness among the losers and winners of over-fast globalization has given rise to criticism of globalization and more protectionism and pushback against some of its shadows.

Clearly, at the center of that debate is the rise of the PRC in the global value chain (GVC). The way it has achieved this feat is increasingly contentious. Since 1978, the PRC's reform and opening up process has very much relied on trade as a key tool for economic development. The PRC's trade liberalization started well before the PRC's accession to the World Trade Organization (WTO) in 2001, but clearly accelerated thereafter. In fact, the most immediate impact of the accession to the WTO was the reduction of the PRC's import tariffs (import tariffs for PRC products to the rest of the world were already quite low because of the preferential tariffs for developing countries). This also implied a huge surge in the imports of capital goods to the PRC to increase its production capacity. The reduction in import tariffs attracted foreign investors and made it cheaper for them to produce in the PRC as the cost of importing the necessary capital goods became much lower.

The PRC's huge original comparative advantage—a close to infinite pool of cheap labor coupled with massive savings which could be deployed to invest in state-championed sectors at a relatively low cost—has made the PRC what it is today, the center of the global value chains. Both the infinite pool of cheap labor and, to a lesser extent, the savings ratio are no longer as key in the PRC's comparative advantage, but increasingly innovation and the value-added embedded in the production of goods and services play a key role. Within this process, the PRC has harnessed the power of FDI to tap into the global supply chains while keeping control of its own market. This strategy has clearly been a success in terms of the jobs and wealth created in the PRC during all these years, with the PRC expanding its global market share of manufacturing to an impressive 19% of the global total. However, the fact that foreign investors do not enjoy real market access in the PRC's domestic markets creates asymmetries, not only for the provision of final goods in the PRC but also for the functioning of supply chains.

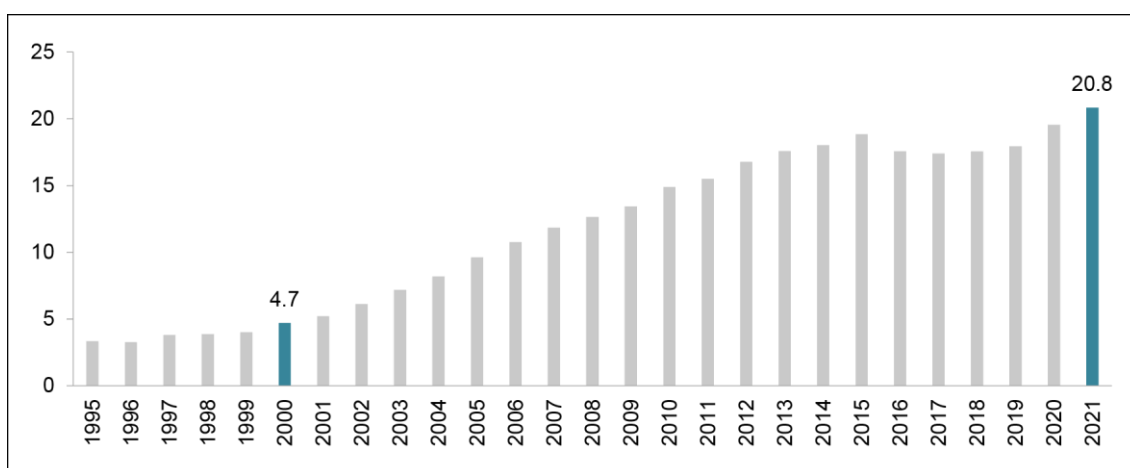
Against this backdrop, a very important shock, namely the COVID-19 pandemic, hit the global economy in 2020. The pandemic was not only a major global health issue but also put to the test global value chains across the world, creating huge bottlenecks and a scarcity of essential goods, including medical and sanitary ones, when they were most needed. Since then, the resilience of value chains has become a key topic in economics, as well as interdisciplinary research, and this paper aims to contribute to this research. The reality is that preoccupations with supply chain resilience did not start with the pandemic but were already high on the agenda of policymakers as a result of the disruptions that had already occurred because of natural shocks and policies, in particular the United States (US)–PRC trade war. In fact, the US trade war was a catalyst in the development of the idea of excessive dependence on the PRC for the sourcing of goods, which only accelerated during the pandemic. At this juncture, we find ourselves in the midst of a reshuffling of the global value chain. The aim of some of that reshuffling is to find alternative manufacturing ecosystems to the PRC, but other important considerations exist. Beyond the geopolitical reasons for political leaders pushing in this direction, this paper points to economic reasons behind the push away from a PRC-centric global value chain as a way to increase resilience and, therefore, ensure the provision of critical goods when they are most needed.

To achieve this goal, this paper first, in section 2, reviews the PRC's accession to the WTO as a key driver of global value chains. Secondly, in section 3, it explains the consequences for the rest of the world, especially as far as resilience is concerned. section 4 deals with the actions taken by some of the key governments to increase the resilience of their participation in supply chains. Finally, section 5 looks at the actions taken by companies so far in terms of supply chain reshuffling. Section 6 concludes.

2. THE PRC'S MOVEMENT FROM THE PERIPHERY TO THE CENTER OF THE GLOBAL VALUE CHAIN

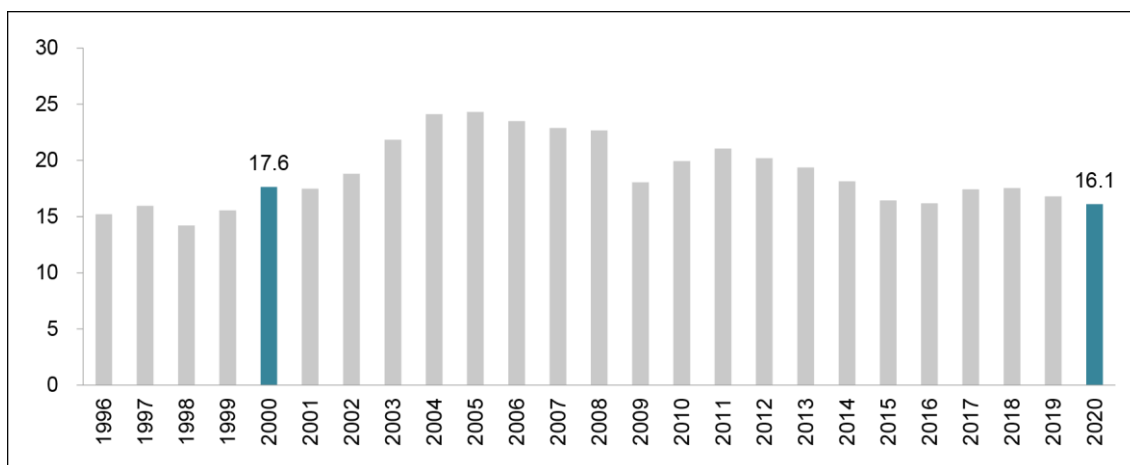
The PRC's rise began four decades ago, but its accession to the WTO punctuated its emergence. In 2000, two decades ago, the PRC's GDP per capita was only \$959, versus that of the United States, which was \$36,334. Despite being the most populous country in the world, with 1.26 billion people, the PRC's share of global output was only 4%, and manufacturing was at a meagre 4.7% (Figure 1). Moreover, it was considered a backwater for manufacturing, and its exports were mostly goods requiring low-skilled manufacturing. Labor-intensive manufactured goods made up the largest share of the export items. Despite having a low share of global exports and low value-added, the PRC's dependence on foreign intermediates for production was 17.6% (Figure 2).

Figure 1: PRC's Global Market Share of Manufactured Exports (%)



Source: Natixis, UNCTAD.

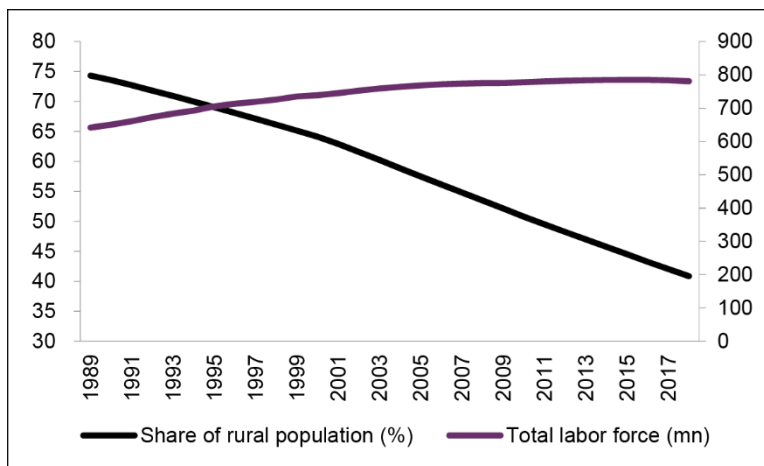
Figure 2: Share of Foreign Value-Added in the PRC's Gross Exports (%)



Source: Natixis, TIVA OECD.

Moving forward to 2021, the PRC's share of global manufactured output rose to 20.8%, and its dependence on foreign intermediates lowered to 16.1% in 2020. Even more impressive was its ability to lift 1 billion people out of poverty, with an average annual growth rate of 14.8% from 1978 to 2019 and an increase in GDP per capita in this period from \$156 to \$9,770. For the PRC, the opening to the world via trade, investment, and technology was necessary, as its main comparative advantage was its excess rural labor population (Figure 3) while its capital and technology levels were poor.

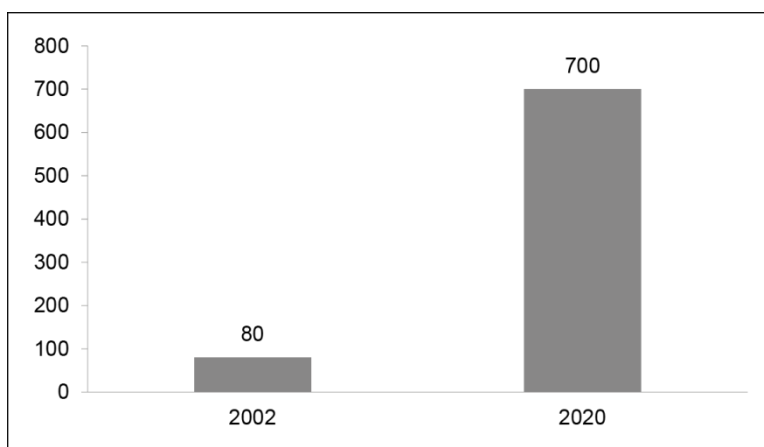
Figure 3: PRC's Total Labor Force (million)



Source: Natixis, World Bank.

It is the process of opening its economy in the past four decades that has allowed the PRC to raise its human capital and increase its technological capability, so much so that it now has 700 million middle-income people (Figure 4). Of the Fortune 500 companies, a staggering 145 are Chinese-owned as of 2022.

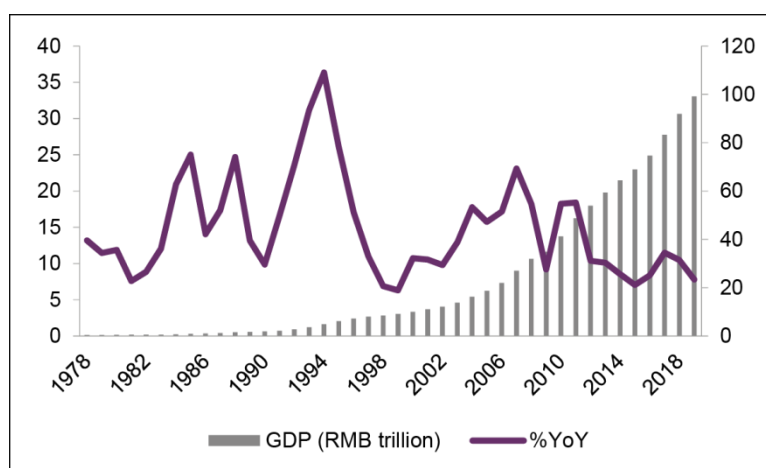
Figure 4: Middle Class Population in the PRC (million)



Source: Statista, Natixis.

The growth of the PRC’s role in the global value chain depended on the critical decision to open up and reform the economy in 1978 (Figure 5), after the unsuccessful experiment with a centrally planned economic policy. This significantly enhanced its integration with the international markets via trade, investment flows, and technology exchange. The opening-up has been progressive and has been carried out in stages. Significant efforts have also been made to liberalize FDI policies and attract FDI inflows, including gradually opening areas to FDI, promulgating regulations for foreign investment, and offering special tax incentives for foreign investors. However, the sectors opened up for investment remain limited and are concentrated in processing and manufacturing. In the second stage of opening up between 1992 and 2000, the PRC reduced its import tariffs and restrictions following a memorandum signed between the US and the PRC. Also, in a limited and experimental fashion, more regions were opened to foreign investors and service industries—such as aviation, telecommunications, banking and retail trade. A more liberalized and consistent FDI regime was established, but most sectors remained under the control of the state.

Figure 5: PRC’s GDP Growth Since 1978

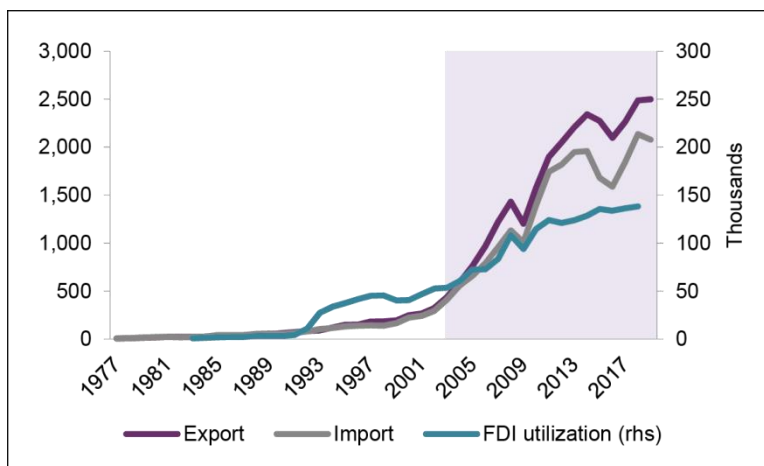


Source: CEIC, Natixis.

The PRC’s accession to the WTO in 2001 marked the third stage of the reform and opening up. To comply with the WTO’s national treatment, the PRC amended and reviewed a large number of its laws and regulations. Both tariff and non-tariff barriers were greatly reduced, and minimum law enforcement standards for the protection intellectual property were set. In terms of FDI, the PRC made greater efforts to conform to international FDI requirements and issued its “Provisions on Guiding the Orientation of Foreign Investment” which assigned FDI into “encouraged,” “permitted,” “restricted,” and “prohibited” categories to encourage FDI inflows into more industries. In effect, the PRC’s opening up was rolled out in stages with increasing speed and coverage.

Such reforms led to the PRC’s rapid integration into the international trade and capital markets. In terms of trade liberalization, the accession to the WTO in 2001 was a key milestone in the PRC’s trade integration, with reduced tariffs and favorable international policies, and it marked the beginning of the transformation of the PRC’s value chain into a more integral part of global trade. Since then, the PRC’s export and import value has taken off, with an annual growth rate of 13.8% and 12.7% for exports and imports, reaching, respectively, \$2.5 and \$2.1 trillion in 2019 (Figure 6). Additionally, FDI into the PRC also surged to \$138 billion from \$0.9 billion, representing a 19% annual growth in foreign capital attracted to the country (Figure 6).

Figure 6: PRC’s Trade and FDI Utilization Since 1978 (USD bn)



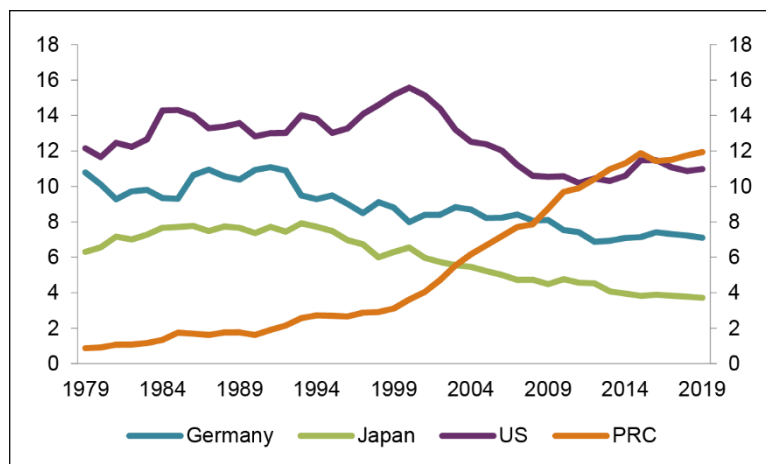
Source: CEIC, Natixis.

However, a closer look at the progress shows that the opening up is strongly biased towards trade liberalization, with a much more limited and gradual opening up in FDI. In fact, the PRC’s actions have been to open trade to global competition, and the domestic economy to foreign investment inflows, without losing control of its strategic sectors. Despite its efforts to open sectors to foreign investors, numerous sectors remain, especially strategic sectors in which the PRC seeks to protect, nurture and develop domestic companies into globally competitive cooperation, and sectors that have traditionally benefited state monopolies. Also, foreign investors in most key sectors are required to form joint ventures with local companies that maintain control, giving rise to the risk of forced tech transfer. Thus, although the PRC’s opening has been successful in bringing economic development, its progress is largely biased towards trade, and the nature of competition in the PRC market has not been fully changed.

Under its targeted liberalization policy, the PRC’s foreign trade had 42 years of rapid development. The total value of imports and exports increased from \$21 billion in 1978 to \$4.6 trillion in 2019. Exports increased from \$10 billion to \$2.5 trillion, while imports increased from \$11 billion to \$2.1 trillion. From 1978 to 2019, the average annual growth rate of the PRC’s total foreign trade was 15.4%, far higher than the global average.

Figure 7 shows the PRC’s market share in total exports in comparison to US, Germany, and Japan from 1978 to 2019. The proportion of the PRC’s exports in total global trade increased from less than 1% in 1978 to 12% in 2019. Meanwhile, the US, Japan, and Germany saw a decline in their market share and were surpassed by the PRC in terms of their global export contribution. In other words, the PRC has, at an astonishing rate, succeeded in becoming an integral part of international trade, and the world has been much more dependent on the PRC ever since the PRC’s reform and opening in 1978.

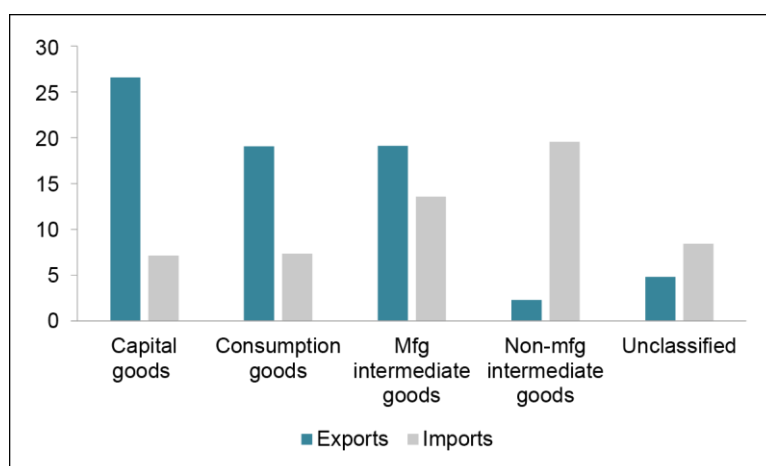
Figure 7: Share in Global Trade (%)



Source: Natixis, UNCTAD.

No longer at the periphery, the PRC has become the center of the global value chain, especially in terms of intermediate goods. In 2003, 8% of global exports in manufacturing came from the PRC, and by 2021 this had grown to a staggering 21%. Moreover, the PRC’s dominance in sectors like office machines, furniture, and apparel parts is even higher, at 50%, 60%, and 40% of the global market share, respectively. On top of gaining market share at the gross export level, at the value chain level more Chinese intermediates are used in the global value chain than in the past. What is key is that the PRC’s exports of intermediates used by the rest of the world for export inputs have risen significantly, from 24% in 2003 to 43% of the PRC’s gross exports in 2021. Figure 8 decomposes the PRC’s exports and imports, by stage of production, as a share of global trade. The PRC’s global export share is much bigger than its import share for all categories except for non-manufactured intermediates, mostly commodities (Figure 8). As a result, the PRC has captured an increasing and, by now, dominant market share in the global export of manufactured intermediates.

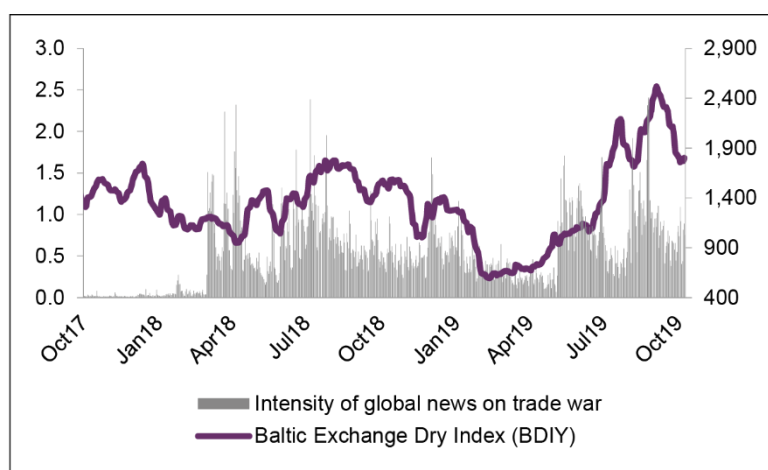
Figure 8: PRC’s Share in Global Trade by Stage of Production (%)



Source: Natixis, UNCTAD. Data as of 2021. Products classified under the Broad Economic Categories.

After an amazingly rapid rise, the PRC is today central to the global value chain, so that when the PRC shuts its factories, as happened since January 2020 during the COVID-19 outbreak, there may be global shortages of key ingredients for production, from India’s pharmaceutical products to the Republic of Korea’s automobiles and Viet Nam’s textiles. What is also increasingly clear is that the PRC’s role in the GVC is asymmetric, as the PRC continues to export more and more intermediate goods that are used for other countries’ production of exports, while it imports fewer and fewer of such products. The key question is how reliant the world is on the PRC and how much of this large share in global manufacturing is created by the PRC, in value-added terms. This consideration is especially key as the PRC has long striven not only to move up the ladder by raising the value-added of its exports but also to become more self-sufficient when serving the needs of its own market.

Figure 9: Trade Flows and Intensity of Global News on Trade War



Source: Natixis, GDELT, Bloomberg.

The PRC has made this very clear with its Manufacturing 2025 plan, which identifies key manufacturing sectors that the PRC plans to develop. One key objective is to become less dependent on the rest of the world (Garcia-Herrero and Xu 2020). The plan prompted a strong negative reaction from developed economies due to its implications for exports of intermediate goods into the PRC. The PRC’s half-hearted opening (for trade but increasingly less for goods with high added value) and the many sectors in the PRC closed for FDI have certainly not helped its relations with the US or the EU. The first major blow came from the Trump administration, which in 2018 embarked on a trade war, with retaliatory trade measures that included, but were not limited to, higher tariffs on Chinese goods (Figure 9). By contrast, Europe used the WTO toolkit while developing its own autonomous measures to respond to an increasingly asymmetric economic relationship with the PRC.¹ Within these instruments, there has been some focus on the resilience of the supply chain, as will be discussed later. While the PRC has since toned down its Manufacturing 2025 ambitions, the issue of the PRC becoming more self-reliant and less dependent on the sourcing of intermediate goods for the rest of the world, especially intermediate goods in key sectors, is important, not just for the PRC but also for the rest of the world. If the PRC were to become self-sufficient, this would imply that the rest of the world

¹ For a review of the EU’s autonomous measures, please see Storey (2022). [u4W78NC667K3FLC0nYpkhJ6VSBazOca8bX8D51RomqfK0QawczirU3R59FAuz9NjgeQMrMKT78iqn4OIIIsaW-ETUjDqKJEpToiLr8gWbk&utm_content=221526961&utm_source=hs_email](https://doi.org/10.2139/ssrn.4144444).

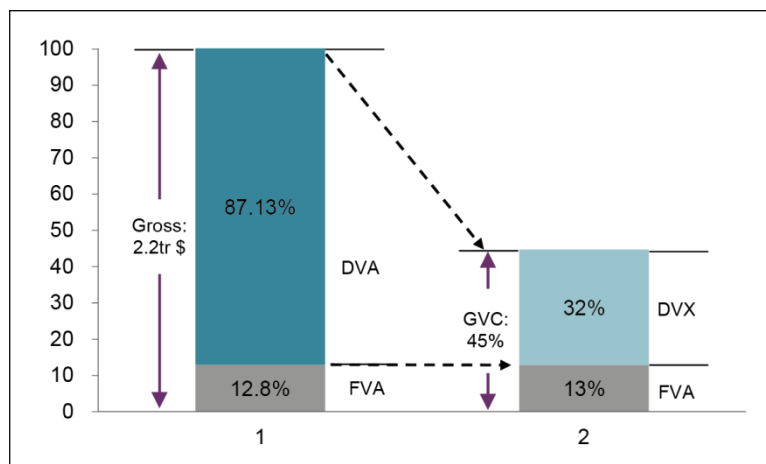
would benefit much less from the PRC's increased exports of goods. The next section discusses the PRC's increasingly central—but asymmetric—role in global supply chains, and how this situation may lie behind their reshuffling.

There are two questions regarding trade and globalization in this age of escalated tensions and nationalistic rhetoric that we would like to address in this report: a) Is globalization on the decline in terms of the integration of the supply chain in key economies? and b) What is the PRC's role in this transformation?

Before addressing these questions, the concept of the global supply chain needs to be defined more narrowly so as to create a workable measure that is comparable across countries and is easy to understand in terms of macroeconomic consequences. To that end, we will use the global value chain (GVC) concept developed by Haltmaier (2015), Koopman et al. (2010), and Hummels, Ishii, and Yi (2001). This measure allows us to gauge the international integration of a country's exports with a value-added dimension. For this, a distinction needs to be made between domestic value added (DVA) and foreign value added (FVA) (Aslam, Novta and Rodrigues Bastos 2017). A third concept is also key, namely, the domestic value added of exports (DVX), which analyzes how much of the domestic value-added export is then used by the third country as inputs for its exports. The nominal value of exports, although meaningful in showing the growth and intensity of trade activities, does not address a number of key issues for countries in terms of their global trade integration and the relative value of their export structure, or their economy, more generally. Indeed, key issues that are not addressed with gross export data are: a) the extent to which a country is capturing the gains of its exports through the domestic value added of its trade; b) how much of the domestic value added of a country's gross exports is used by other countries as inputs; and c) the share of FVA and DVA used by other countries as inputs (DVX) to determine how globally integrated the country's exports are into the production networks. The GVC, by decomposing the value added of gross exports, allows us to measure the participation of a certain economy or sector in the GVC and its determinants. We will be using 2018 input–output data, the latest available. Figure 10 shows the PRC's gross export value of \$2.2 trillion in 2018. Of this total, 13% or \$290 billion was derived from foreign value added (imports such as semiconductors would fall into this category), while the remaining 87% or \$1,900 billion was domestic value added (domestic inputs such as domestic assembling). Within domestic value added, \$700 billion, or 32% of the \$2.2 trillion, were intermediate products of the country of interest, being exported to another country which used them for its own exports.

To measure the degree of global value chain participation, we add together the percentage of foreign value-added exports or FVA (13%) and the domestic value-added intermediates that are used by third countries for exports (32%) (the DVX) to get a GVC ratio of 45% for the PRC. This basically means that 45% of the PRC's gross exports participate in the global value chain (Figure 10). This is obviously a huge proportion and points to the PRC's centrality in global supply chains.

Figure 10: Breakdown of the PRC’s Value Added of Gross Exports (2018, %)

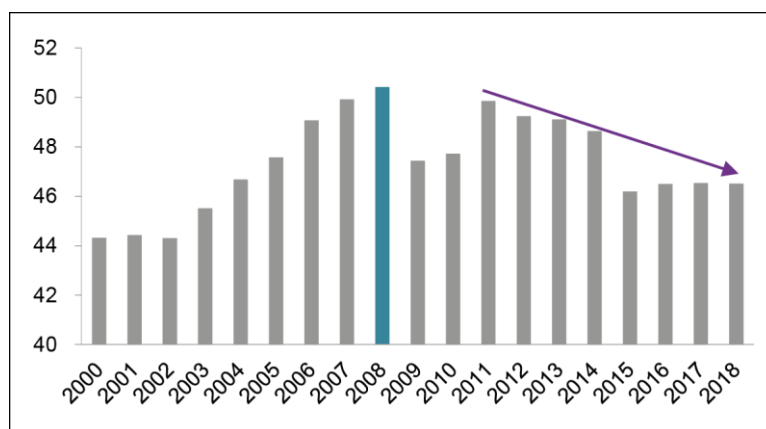


Note: The UNCTAD-EORA Global Value Chain (GVC) database offers global coverage (189 countries and a “Rest of World” region) and a timeseries from 1990 to 2018 of the key GVC indicators: foreign value added (FVA), domestic value added (DVA) and indirect value added (DVX). Results from 1990 to 2015 are generated from EORA Multi-Region Input-Output tables [MRIOs]. The results for 2016–2018 are nowcasted based on the IMF World Economic Outlook.

Source: UNCTAD-Eora database forecast, Natixis.

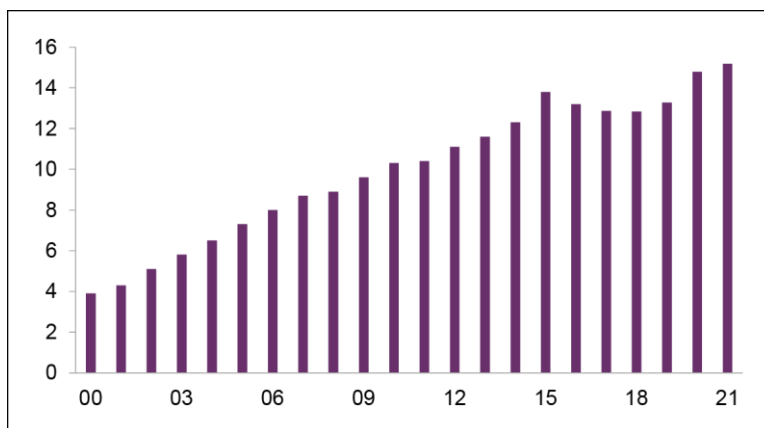
Regarding the first question above, namely whether the world is continuing to integrate in terms of the global supply chain, the chart below points to a clear reduction since 2008 (Figure 11). As for the second question, the PRC’s global market share in terms of gross exports rose quite positively until 2015, then fell and stood at about 12.9% of global exports for two years before strongly rebounding during the COVID-19 pandemic and reaching an all-time high of 15.2% as of 2021 (Figure 12). The rise of global GVC coincided with the PRC’s joining the WTO in 2001. That said, curiously, since 2008, the PRC’s rise in global market share is running alongside lower GVC participation. These two developments seem somewhat contradictory, so it is worth digging into them more deeply.

Figure 11: World GVC Participation (%)



Source: UNCTAD-Eora database, Natixis. N.B. Results for 2016–2018 are forecasted by UNCTAD-Eora.

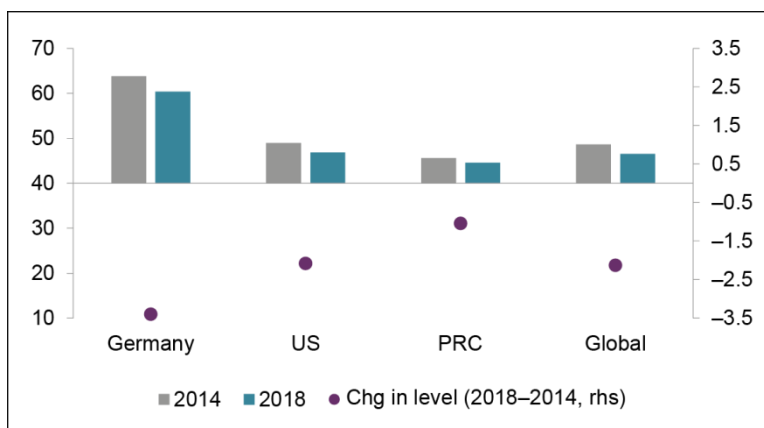
Figure 12: PRC’s Market Share in Global Gross Export (%)



Source: UNCTAD, Natixis.

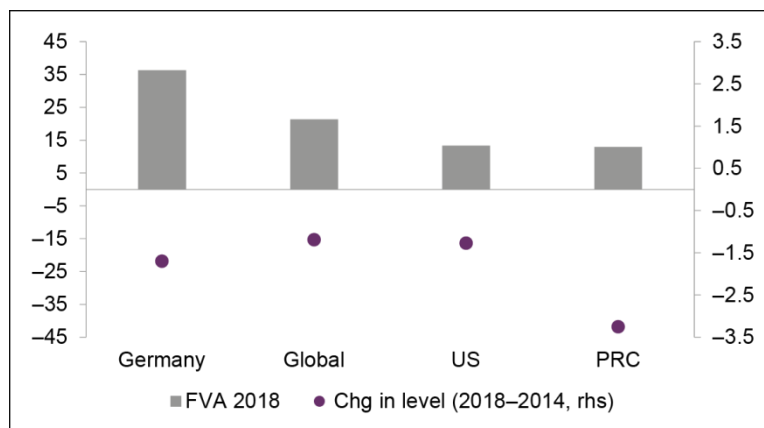
It is important to note that the PRC is not the most integrated country in the world in terms of its participation in the global supply chain. EU countries are much more integrated than the PRC, but the key question is the direction of change (Figure 13). On that front, we can see that Germany’s integration is shrinking fast, while this is much less true for the PRC. Furthermore, as shown in Figure 14, the rather small—but still negative—growth in the PRC’s participation in the GVC is explained by the smaller share of foreign inputs into the production of goods for export markets (FVA) or, conversely, a rise in the domestic value-added of exports (Figure 15). This is not the case for Germany, since the reduction in FVA is less than the overall reduction in DVA. In other words, the reduction in Germany’s participation in the GVC cannot be explained by additional vertical integration within Germany, but most of the small reduction in the PRC can. As a result, one can argue that the PRC’s vertical integration is happening much faster.

Figure 13: GVC Participation (%)



Source: UNCTAD-Eora database, Natixis. N.B. Results for 2016–2018 are forecasted by UNCTAD-Eora.

Figure 14: Foreign Value Added in Export (%)

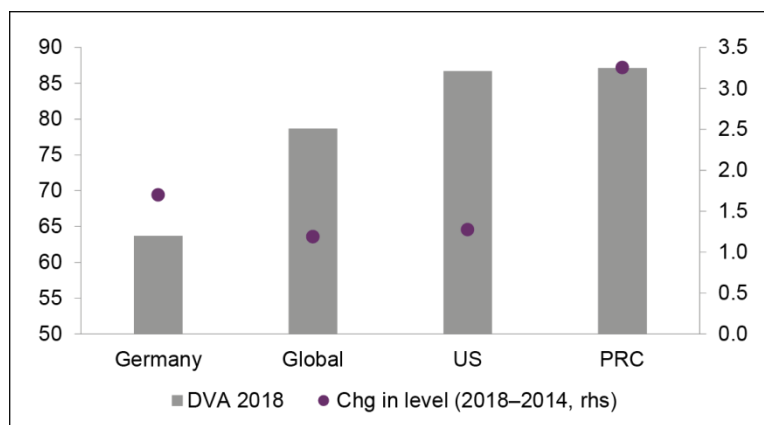


Source: UNCTAD-Eora database, Natixis. N.B. Results for 2016-2018 are forecasted by UNCTAD-Eora.

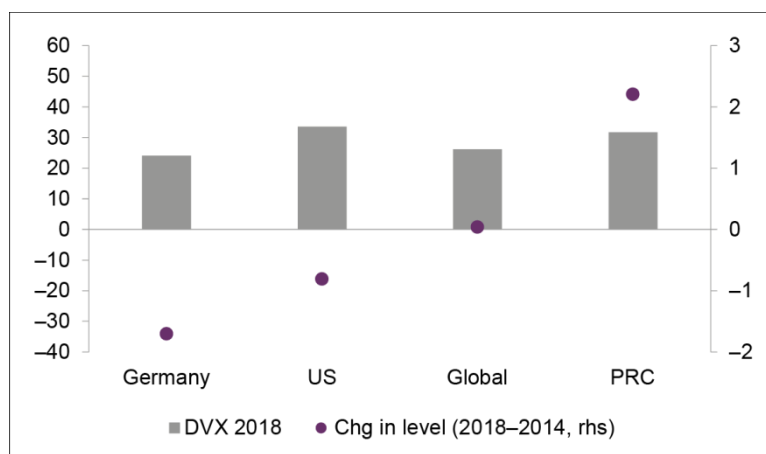
In the same vein, Germany’s decreasing integration in the global value chain is mainly driven by a sharp reduction in its domestic value added in the third country’s exports (or a very negative change in DVX in Figure 16). In other words, Germany’s exports of intermediates used by other countries for their own exports have been coming down rapidly as a share of gross German exports. This is also true for the US, although to a lesser degree. The mirror opposite has occurred in the PRC, since its contribution to other countries’ exports has increased very substantially.

In a nutshell, not only is the PRC’s integration in the global value chain coming down much more slowly than that of key economies globally but, more importantly, the reduction is mostly explained by a reduction in the foreign composition of its exports. Conversely, the PRC is pushing more and more domestic content in goods that recipient countries export themselves. One could say that the PRC is becoming more vertically integrated while also becoming an increasingly relevant provider of intermediate goods for third countries. Considering the asymmetry of the importance of backward and forward participation in determining GVC interdependence, the surge in the PRC’s forward participation may result in higher costs for other countries to diversify their production away from the PRC, as they rely on the PRC for imports of intermediate goods more than the PRC relies on them.

Figure 15: Domestic Value Added in Export (%)



Source: UNCTAD-Eora database, Natixis. N.B. Results for 2016-2018 are forecasted by UNCTAD-Eora.

Figure 16: Domestic Value Added in Third Country's Export or DVX (%)

Source: UNCTAD-Eora database, Natixis. N.B. Results for 2016–2018 are forecasted by UNCTAD-Eora.

3. EVOLVING RESILIENCE OF GLOBAL VALUE CHAINS

The PRC's rapid development in the past two decades has played an important role in global growth, but it has also created asymmetries in the way the global value chain works. More specifically, the world's dependence on the PRC's exports has only increased over time, particularly since the COVID-19 pandemic started in 2020. One of the consequences of this situation was the massive bottlenecks generated in the supply chain as Chinese factories closed during COVID-19.

The case of the European Union (EU) has been analyzed in detail. Between 2000 and 2019, the EU's imports from the PRC increased tenfold thanks to the PRC's competitive prices, which helped to raise European households' disposable income. However, this positive wealth for households did not come free. The PRC's rise as a manufacturing superpower also implies that the production of intermediate and final goods shifted to the PRC from the early 2000s onwards. Twenty years later, the PRC dominates many EU imports. A recent study by MERICS (Zenglein 2020) defines strategic dependence on the PRC for a product on the basis of two conditions: first, that at least 50% of imports of the specific product come from the PRC, and second that the PRC holds more than a 30% share in the global market for that specific product. Based on this definition, the report concludes that in 2019 the EU was strategically dependent on the PRC for 659 products, which accounted for 43% of the total value of all imports from the PRC. Among the top ten categories, six are consumer products (textiles, furniture, and toys) and consumer electronics (mobile phones, personal computers, household appliances), which are vital for retail consumption. The positive aspect, though, is that these products are not key intermediate goods, which makes this dependence less strategic than it seems. In any event, the study also finds 103 other product categories, concentrated in electronics, chemicals, minerals/metals, and pharmaceutical/medical products. Although the vast majority of these products require less sophisticated technology for their production, the EU's critical strategic dependence on the PRC may be important, since building up an alternative supply chain would be complex and expensive. In the same vein, a review by the European Commission on the EU's strategic dependence reviewed more than 2000 products and found that about a quarter of them were highly vulnerable because of the low potential for their diversification and substitution by EU-produced products, while more than half of the products on the list were from the PRC (European Commission 2021, 2022).

Viet Nam was ranked second, with 11% of the products. The report also included six in-depth reviews of supply chains in strategic areas, such as pharmaceutical ingredients, batteries for electric vehicles, hydrogen, raw materials, semiconductors, and cloud and edge technologies. The Commission estimated that, in sensitive ecosystems, the EU is less dependent on the US than vice versa, but that both have important common dependencies vis-à-vis the PRC.

The situation for the rest of the world is not too different from that of Europe, as the PRC dominates some export markets, such as office machines, telecommunication equipment, textile products, and electrical machinery, by more than 50%, according to an UNCTAD report based on SITC 2-digit product items (Table 1).²

Table 1: World's Most Dependent Goods on the PRC, With Import Value Exceeding \$100 billion

Items	ROW Imports from the PRC (\$ billion)	ROW All Imports (\$ bn)	ROW Dependency on the PRC (PRC % share of all imports)
Office machines and automatic data processing machines	363	687	52.9
Telecommunication and sound recording apparatus	357	684	52.2
Textile yarn and related products	104	267	38.8
Articles of apparel and clothing accessories	148	457	32.3
Electrical machinery, apparatus, and appliances, n.e.s.	468	1,533	30.5
Miscellaneous manufactured articles, n.e.s.	185	645	28.8
Manufactures of metal, n.e.s.	110	404	27.2

Source: Natixis, UNCTAD. The notion of "n.e.s." means "not elsewhere specified". "ROW" means "rest of the world."

In the same vein, multiple reports from the US government have pointed to the nation's heavy reliance on the PRC's supply chains, from agriculture and food to critical materials for energy transition and national defense (Zhang, Parry and Aldin 2022). Focusing on agriculture, the PRC provides more than 70% of US imports of pesticide ingredients (U.S. Department of Agriculture 2022). Besides, the PRC is a predominant supplier of processed food. US farmers and farm machinery producers also rely on the PRC for low-tech machinery parts. Another key critical dependence—as is the case for Europe—are products related to the energy transition from fossil fuels, whether that is batteries for electric vehicles, solar panels or wind turbines. According to the International Energy Agency, the PRC has invested over \$50 billion in new capacity to produce solar panels, which is ten times more than Europe's investment (International Energy Agency 2022). As a result, the PRC has the majority share in all manufacturing stages of solar panels, including wafers (96.8% of global capacity), cells (85.1%), polysilicon (79.4%), and modules (74.7%). In addition to solar, the PRC is a pioneer in the lithium battery industry, an industry that the US Department of Defense deems critical for the security of the US supply chain. The PRC's market share is massive, not only for the final product, but also across the supply chain: 94% for lithium hydroxide, 76% for cells, 76% for electrolyte, 70% for lithium carbonate, 65% for anodes, and 53% for cathodes. Finally, the PRC also controls the supply and, especially, the refining of critical materials for lithium batteries, with a 72% share for cobalt, a key input material for lithium-ion batteries. The same is true for the rare earth metals needed to produce wind turbines (which are 80% controlled by the PRC); the PRC has a 61% market share of global lithium refining, which is key for electric vehicle batteries, and an

² Data from https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx?sCS_ChosenLang=en.

astonishing 100% share of the processing of natural graphite used for battery anodes (U.S. Department of Defense 2022).

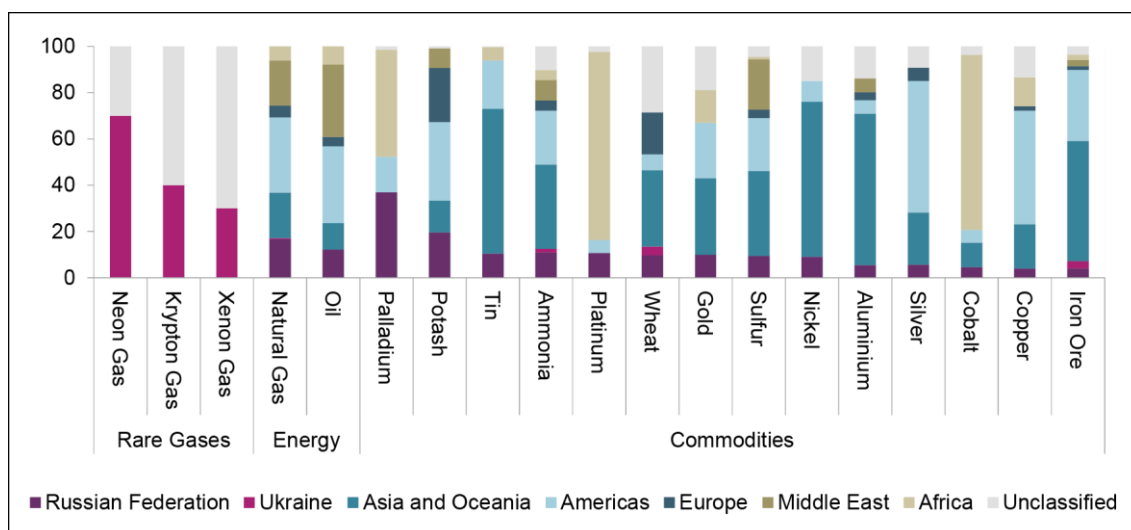
Beyond the general trend of an increasing centrality of the PRC in the global value chain, the global pandemic was a major test for the resilience of such a concentrated production. The test clearly did not work well. Most countries in the world—except for the PRC—experienced bottlenecks in deliveries, shortages of inputs to production and final goods, and inflation. As a result, senior policymakers in many of the world's leading economies, and not just those from governments associated with populist policies and economic nationalism, have drawn negative conclusions about the way in which global value chains are designed, including the PRC's centrality. In some cases, legislation has been introduced to encourage the repatriation of production or to stimulate domestic production to displace imports. One of the best-known cases, for the specific medical/sanitary sector, is Japan, but more general ones have followed and will be reviewed later (Evenett 2020).

Some might dismiss these statements by policymakers as shifting the blame. Given that it was often the same policymakers who, once the coronavirus had spread, disrupted supply chains in the medical goods and medicines sector by resorting to over 200 export controls, there may be something to this. The flaw in this argument is that the Japanese government, which did not impose any export bans, has joined those criticizing cross-border supply chains and is financially supporting Japanese firms that move production facilities out of the PRC.

While the COVID-19 pandemic certainly caused a huge negative shock to policymakers' perception of the functioning of the global value chain, the Russian invasion of Ukraine brought confidence even lower. The focus, this time round, is not so much on manufactured goods but on critical components of production. On the surface, the Russian Federation and Ukraine are not very important players in trade, with 1.6% and 0.3% of the global export share, respectively. Still, they have significant market shares of global exports in specific products, such as neon gas as well as other rare gases in the case of Ukraine (70%) (Figure 17), and palladium in the case of the Russian Federation (37%). For other commodities, the concentration is less but there are important socio-economic consequences, as is the case for natural gas and oil in the case of the Russian Federation (17% and 12%, respectively), wheat, mainly for the Russian Federation (13%), and nickel, with 9% of market share concentrated in the Russian Federation. Most of these commodities play a relevant role in upstream sectors and, thus, in global value chains, or are, like wheat, basic staples affecting food prices (Table 2). More specifically, rare gases, palladium, and nickel from the Russian Federation and Ukraine are key for the production of semiconductors and electric vehicle batteries. Neon gas is a rare gas that is used in the lithography process for chips (Garcia Herrero and Ng 2021a), palladium is important for memory chips and sensors (Garcia Herrero and Ng 2021c), and nickel is at the core of ternary lithium batteries (Garcia Herrero and Ng 2021b), so a price surge may accelerate the shift towards lithium iron phosphate (LFP) batteries, which is a cheaper option that does not require nickel.

The sanctions imposed on the Russian Federation, as well as the Russian Federation's own retaliation, have disrupted supplies of these critical components, with negative consequences, once again, for the functioning of the global supply chain.

Figure 17: Key Commodities: Production by Country (% of Global Market Share)



Source: Natixis, United States Geological Survey, United States Department of Agriculture, British Petroleum, TrendForce, Techcet, Bloomberg.

Table 2: Impact of the Russian Invasion of Ukraine on Asia

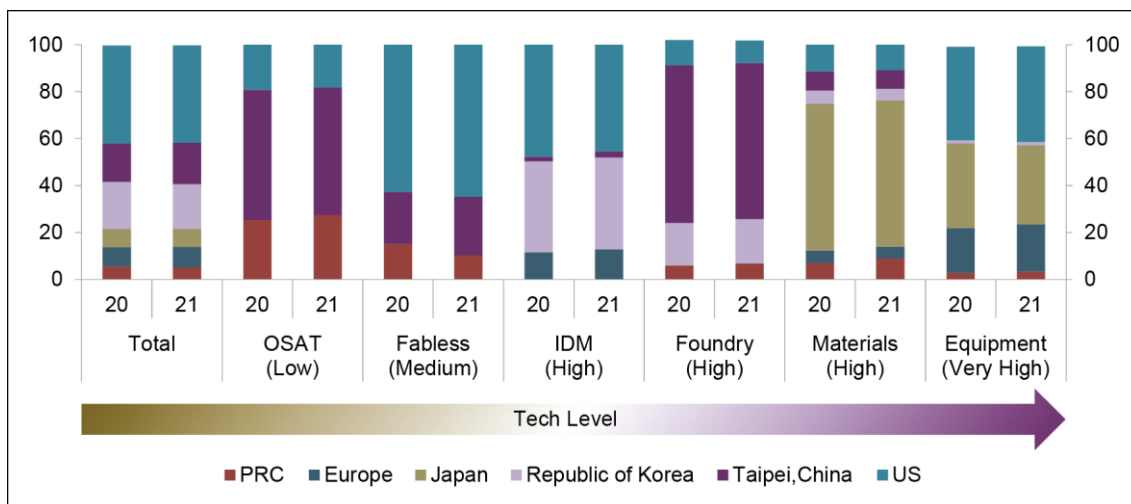
Sector	Sub-sector	Key Implications for Asia
Energy	Oil	Oil and gas prices will surge because of the concern for future supplies
	Natural Gas	
Technology	Palladium	Palladium is used in making memory chips (DRAM, NAND Flash) and sensors
	Nickel	Nickel is used in ternary lithium batteries for electric vehicles
	Rare Gases	Neon gas, krypton gas and xenon gas are used in lithography processes for semiconductors
Agriculture	Wheat	Food prices may surge
Shipping	–	Sea and air routes affected

Source: Natixis.

Finally, another huge shock to the functioning of global supply chains could come as Taipei, China accumulates the bulk of the production of advanced semiconductors (Figure 18 and Figure 19). It is interesting to note that a natural disaster could also create havoc; this is not impossible, given both climate change and the high frequency of earthquakes on the island.

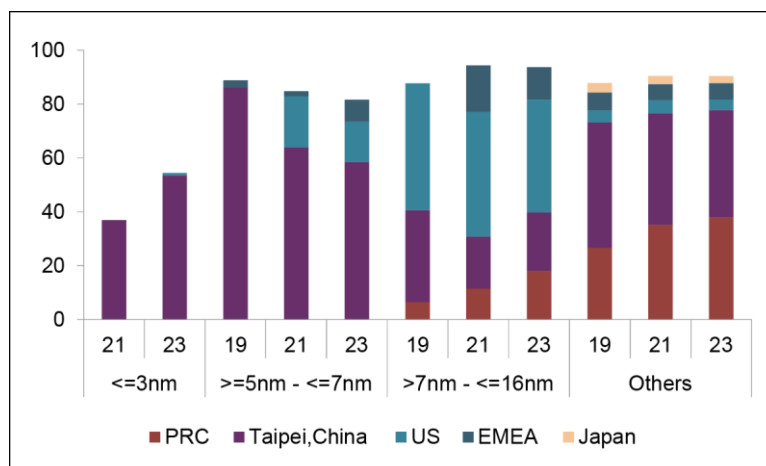
All in all, one could argue that full supply chain resilience is more of an aspiration than an achievable objective, as over-dependence on a specific geography is not uncommon and is related to many different factors, and building supply chain resilience usually implies high costs. However, such reliance is becoming increasingly risky and the economic trade-off between resilience and efficiency is being altered as geopolitical tensions and unanticipated public events (such as the COVID-19 pandemic) can magnify the vulnerabilities of GVC participants (global supply chain disruptions). The PRC’s centrality in the global value chain has been very important and has triggered actions from other countries to reduce their dependence on the PRC. In particular, the emergence of an increasingly harsh rivalry between the US and the PRC has pushed companies towards diversification. The Russian invasion of Ukraine, and the related sanctions on the Russian Federation, have also been instrumental in influencing companies’ views of the merits of diversification, given the high concentration of advanced semiconductors in Taipei, China, which remains a key risk.

Figure 18: Semiconductor Supply: Global Market Share by Sub-sector (%)



Source: Natixis, Financial Statements, TrendForce, IC Insights, Gartner, Bloomberg. N.B. Including foundries.

Figure 19: Global: Share of Fabrication Capacity of Foundries by Location and Node Process (%)



Source: Natixis, SEMI, Bloomberg.

4. WHAT ARE THE OPTIONS TO INCREASE SUPPLY CHAIN RESILIENCE?

In this section, we summarize the major strategies to enhance supply chain resilience that could be (or are being) adopted by companies. In response to an increasingly complex global economic environment, global corporations are taking certain measures to reduce supply chain risk. A number of strategies are being considered and, in some cases, executed. These include reshoring, near-shoring, friend-shoring, and diversification, with policies such as the so-called PRC+1 policy (Suzuki 2021). It should be noted that such strategies are usually more costly than the scenario in which no action is taken, at least *ceteris paribus*. However, one important variable we must account for in the decision-making process is the higher risk of future supply chain disruptions, given the US–PRC strategic competition, which does not bode well for

supply chain resilience. We limit this discussion to what companies can do, and ignore the question of what they should do, as this is beyond the scope of this paper.

Starting with reshoring, this basically consists of redirecting manufacturing operations back to the home market. This trend has been evident since 2019, particularly in the United States, because of tariff increases in the wake of the US–PRC trade conflict that has caused the US manufacturing import ratio (imports as a percentage of total domestic manufacturing output) to fall for the first time in almost a decade. However, policymakers are fully aware that reshoring entire supply chains is not practical because of the additional labor and overhead costs, so reshoring is only meant to be applied to strategic sectors for national security reasons. Near-shoring is a strategy to restructure supply chains in the same region as a major consumer market, such as Mexico and Central American countries for the US market and Central and Eastern European and North African countries for the European market. Regionalization is expected to facilitate communication by reducing the distance between markets and the risk of being drawn into trade wars and protectionist policies through strengthening political, social, and cultural ties among regional neighbors. This brings us to the concept of friend-shoring, which means focusing on like-minded countries when deciding where to offshore the production of intermediate or final goods within the supply chain but also where to source the necessary raw materials and critical components.

Secondly, the PRC+1 strategy aims to increase trading with other countries in addition to the PRC, to dilute the now very high concentration of production in the PRC. In other words, it is a diversification strategy to reduce the risk of overdependence on the PRC. This trend was also evident before the COVID-19 pandemic because of the growing trade friction between the United States and the PRC. In fact, in 2019 imports of electronics from the PRC to the United States declined, while imports from suppliers in Viet Nam, Malaysia, and Taipei, China increased. Other countries, such as the Republic of Korea, have also embarked on PRC +1 policies. It goes without saying that diversification cannot happen fast even if governments introduce incentives, and the reason for this goes back to the very high concentration of production in the PRC. In the industries related to green technology, where the concentration is very high, and even in more mature, lower-end sectors where one could imagine that diversification would be easier, the PRC dominance in production is astounding. For example, the PRC share of global exports in the machinery and electrical equipment sector is over 20%, and the PRC's share in the garment sector is over 40%—larger than the combined export shares of the next five countries (Bangladesh, Viet Nam, India, Germany, and Italy).

Beyond reshoring and diversification, one should not forget that there are smaller scale policies that can increase supply chain resilience. In fact, we can focus on the more technical aspect embedded in the concept of supply chain resilience, which is the ability of a given supply chain to prepare for and adapt to unexpected events; to quickly adjust to sudden disruptive changes that negatively affect supply chain performance; to continue functioning during disruption; and to recover quickly to its pre-disruption state. To enhance this, certain measures can be taken, such as rapid detection, response, and recovery. To do this, end-to-end and data-driven supply chain control is key. Being able to view raw materials, semi-finished goods, and finished products, starting from your “suppliers’ suppliers” and ending with your “customers’ customers” is more important than ever. In other words, it is key to develop the data analytics that will give information about potential supply chain disruptions before they occur. This is clearly happening in many industries, which will result in an important improvement compared to the situation prior to the COVID-19 pandemic. In the same vein, another important

action is stockpiling to ensure business continuity in the event of a shock. Huge stockpiling has been another feature in the aftermath of the COVID-19 pandemic, and it is only now starting to unwind, especially in the ICT and semiconductor sectors (Lakovou and White III 2020).

Another tool under discussion is the novel supply chain insurance, which extends coverage from traditional business property damage to a wider range of events including political upheaval, public health emergencies and regulatory action (Insurance Information Institute n.d.). Conglomerates such as Aon have been offering such new products, but the market is still small and capacity is low.³ In fact, although the financial coverage such insurance provides for contingencies may help relieve some of the stress for a company affected by supply chain shocks, the compensation is essentially a transfer on the monetary front which has few implications for the real economy. As such, the constrained supply chain will not be eased and the aggregate supply will still be subdued. In the longer term, supply chain insurance may not serve well to foster the resilience of global supply chains.

Except for supply chain insurance, the above mentioned options are not only available for companies but also may form part of governments' actions to enhance the resilience of their supply chains. Some governments have used window guidance to guide their companies away from the risks of excessive concentration in their supply chains, while others have preferred fully-fledged legislation.

The below section goes through the actions taken by the Japanese and the Republic of Korea's governments, as well as the actions by the European Union (EU) and the United States (US).

Japan

Japanese businesses, even before those of the EU and the US, significantly expanded their supply chains in the PRC from the 1980s onwards, but the US–PRC trade war and, most importantly, the COVID-19 pandemic have had profound consequences for the way in which Japanese businesses think about their participation in supply chains and also for government actions. The Japanese government acted very quickly to address supply chain bottlenecks during the COVID-19 pandemic, especially in the medical/sanitary sector. As early as April 2020, the program for Promoting Investment in Japan was announced to strengthen supply chains. This program consists of a generous JP¥108.2 trillion (\$700 billion) stimulus package, covering 300 firms. The intention is to support companies to move their supply chains back to Japan or to countries within the Association of Southeast Asian Nations (ASEAN), reinforcing a trend which started before the pandemic. The key sector for reshoring is the medical and sanitary one, given the consequences arising from the COVID-19 experience. These funds are meant to be used to cover costs for feasibility studies, the introduction of equipment, or the construction of new facilities. Apart from reshoring/near-shoring, the second edition of the program aims to enhance the viability of industries by subsidizing equipment and companies' facility costs. The impact of these measures has been limited so far, since only 8% of Japanese companies operating in the PRC have declared their intention to leave or to limit their activity there in the future.

³ See details at <https://www.aon.com/insights/articles/2022/mitigate-supply-chain-risk-with-trade-disruption-insurance>.

Finally, in October 2021, Japan hit the headlines by establishing the world's first economic security ministry. This ministry aims to develop strategies and a legal framework to enable Japan to boost its economic security. The framework will encompass supply chains, resources, innovative technologies, and relevant infrastructure. Finally, the semiconductor sector has been identified by this ministry as key for such initiatives.

Republic of Korea

The Republic of Korea was the first country outside the PRC to experience a factory shutdown due to the coronavirus. The supply bottlenecks that the PRC experienced were important not only in the medical and sanitary sector, but also for manufacturing. Given the Republic of Korea's key role in the fabrication of semiconductors, geopolitical considerations became essential in this equation. It should also be noted that the Republic of Korea has had a reshoring strategy since 2014. Companies looking to relocate are eligible to have their corporate taxes waived for the first five years, with an additional 50% cut offered for two consecutive years thereafter. The results of this strategy have not been very promising so far. According to the Ministry of Trade, Industry, and Energy, only around ten companies, on average, reshored part of their production to the Republic of Korea each year between 2014 and 2018. In fact, the Republic of Korea's reliance on external supply chains has only deepened since 2013, especially with the PRC.

Apart from this long-standing strategy, the COVID-19 pandemic was a wake-up call for the Republic of Korea, as it was for other countries. In July 2020, the Ministry of Trade, Industry, and Energy issued its Materials, Parts, Equipment 2.0 Strategy. Under the strategy, the government of the Republic of Korea will allocate ~~KRW~~1.5 trillion (\$1.3 billion) over five years to develop new materials, parts and equipment technologies. As under Japan's strategy, the government offers ~~KRW~~20 billion (\$16.8 million) to cover relocation and facility costs for firms relocating to regions outside Seoul, and up to ~~KRW~~15 billion (\$4.2 million) to high-tech firms relocating to the Seoul region. For smart factories and the deployment of industrial robots, the amounts are higher (from ~~KRW~~300 million to 500 million). The aims of the initiative are to pre-emptively address the shift in global supply chains in the post-coronavirus world and to deal with the fall-out from the export restrictions introduced by Japan, whose trade and economy is closely linked with the Republic of Korea's while diplomatic relations remain characterized by persisting difficulties.

The European Union

The notion of the resilience of supply chains had already been widely discussed before the pandemic, in the context of ensuring the availability of the resources necessary for the twin—green and digital—transition. The 2020 Trade Policy Review stated that strengthening the resilience and sustainability of the EU economy and its supply chains was a pillar of the European Union's drive towards the key strategic concept that the Commission had published, namely open strategic autonomy (Szczepański 2021). The strategic framework that has been developed by the European Commission to increase the resilience of value chains has several tools. The first one is to move away from the absence of an industrial policy to the introduction of a policy for key strategic sectors. A good example is the EU Chips Act, which pulls together over €40 billion to enhance the EU's role in this key sector. More generally, the European Union sets up projects, called Important Projects of Common European Interest (IPCEIs), which are aimed at ensuring the good functioning of certain key sectors of European industry. A good example of an industrial alliance is the European Raw Materials Alliance (ERMA),

which was launched in October 2020 to specifically address the numerous challenges faced by raw materials value chains. The March 2020 Industrial Strategy called for the creation of such industrial alliances and complete industrial ecosystems to achieve the EU's green and digital transition. In the same vein, sectoral policies developed by the EU Commission now also have dedicated chapters on enhancing supply chain resilience, as is the case for the Pharmaceutical Strategy for Europe published in 2020.⁴ Furthermore, the Commission sees potential in using public procurement to increase resilience. Finally, the EU is moving towards a mandatory system of due diligence for supply chains, to curb human rights and environmental abuses.⁵ According to the OECD, such due diligence would be expected to build up more long-term value and resilience.⁶

The second channel is to diversify external trade to cushion possible shocks and disruption. On that front, the EU has accelerated its negotiations on free trade agreements with other areas of the world, including Australia and New Zealand, and is also in negotiations with India. Beyond its own legislation, the EU Commission is pursuing multilateral cooperation and coordination mechanisms at the G20, WTO and other relevant venues.

The United States

As early as March 2020, the US administration brought in a series of measures to protect supply chains. Under the \$2.2 trillion stimulus package, the Coronavirus Aid, Relief, and Economic Security (CARES) Act, special funding was provided for medical supply chains and air cargo. The government also reverted to applying the Defense Production Act—which gives the president sweeping authority over the private sector in times of emergency—to increase domestic capacity and significantly boost the production of necessary medical goods and vaccines. A series of important executive orders on US medical supply chains followed, with subjects ranging from direct funding to reducing dependence on foreign sourcing.⁷ A major step taken by President Biden in his first week in office was to launch a comprehensive review of critical supply chains, cutting across all branches of the administration and the relevant stakeholders. The goal was to identify risks, address vulnerabilities and develop a strategy to promote resilience. The result was a review of supply chains in four key areas: semiconductors; large capacity batteries; critical minerals and materials; and pharmaceutical ingredients (The White House 2021). As is the case for the EU, the PRC is the main source of dependencies for the US in these four areas. Shortly after this evaluation, in February 2022, the White House issued its summary reports on domestic supply chains, with proposals to increase resilience. The report also offers some solutions to the over-dependence on the PRC. One is to build strong relationships with allies and partners who share US values, which has been dubbed “friend-shoring.” So far, the US has started supply chain partnerships with Japan, the Republic of Korea, and the EU.

⁴ See details at https://health.ec.europa.eu/medicinal-products/pharmaceutical-strategy-europe_en.

⁵ See details at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022PC0071>.

⁶ See details at <https://www.oecd.org/coronavirus/policy-responses/covid-19-and-global-value-chains-policy-options-to-build-more-resilient-production-networks-04934ef4/>.

⁷ See details at <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/02/24/executive-order-on-americas-supply-chains/>.

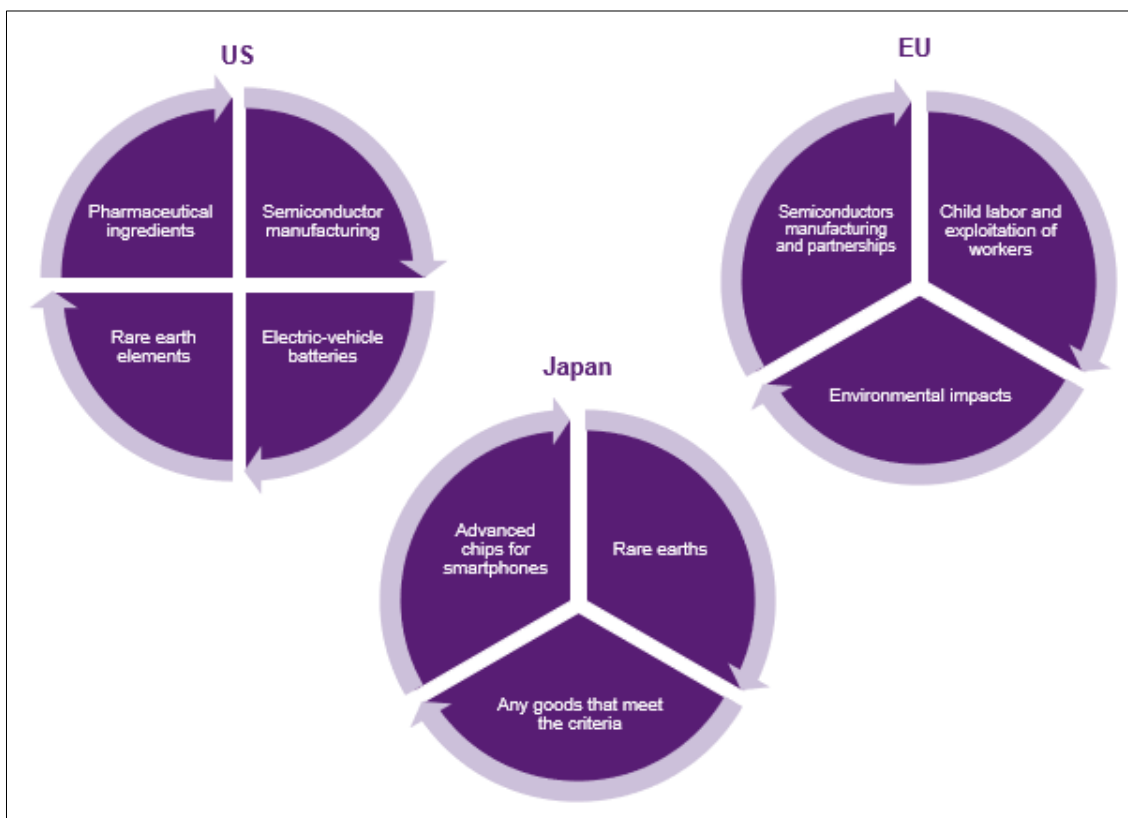
Beyond these actions, the administration has established that it is a policy priority to reduce US dependence on the PRC, especially in these critical industries. Legislation like the America COMPETES Act and the US Innovation and Competition Act are already increasing investment in some of these sectors. The semiconductor industry is a case in point.

Table 3 below shows a summary of the key legislation passed and in the pipeline by the countries under discussion, as well as an infographic with the key issues covered in this legislation for the US, the EU, and Japan.

Table 3: Key Legislation in the US, the EU, Japan, and the Republic of Korea

Country	Name	Last Update	Status
US	Executive Order on America’s Supply Chains	24 Feb 2021	Signed
	Bipartisan Infrastructure Law	15 Nov 2021	Passed
	United States Innovation and Competition Act of 2021	28 Mar 2022	Passed
EU	Directive on corporate sustainability due diligence	23 Feb 2022	Passed
	European Chips Act	12 May 2022	In progress
Japan	Act for the Promotion of Economic Security by Integrated Implementation of Economic Measures	11 May 2022	Passed
The Republic of Korea	Act on Supporting the Return of Overseas Korean Enterprises	27 Jun 2013	Passed

Source: White House, European Commission, Cabinet of Japan, Korean National Assembly. Compiled by the authors.



Source: White House, European Commission, Cabinet of Japan. Compiled by the authors.

5. WHAT HAS HAPPENED SO FAR IN TERMS OF SUPPLY CHAIN RESHUFFLING?

It is clearly still too early to measure the degree to which supply chains are being reshuffled. Information is scant and fragmented, but a general assessment of the different surveys produced by consultancy companies and chambers of commerce operating in the PRC can be summarized as follows. Reshuffling of supply chains away from the PRC has clearly started, but it is slow. In addition, the PRC is still attracting new investments from companies, although in smaller amounts than before. The bulk of the investment consists of retained earnings, which means that it is mainly companies that already operate in the PRC that are staying, while new ones are looking for other venues in which to operate. Among the existing ones, the more recently established companies may find it easier to set up operations elsewhere.

To be more specific, the results of a survey run by EY in September 2020 shown in Table 4 were that 53% of respondents had already near- or re-shored part of their operations in the previous 24 months, and 44% were planning new or additional near-shoring activities in the next 24 months (Knizek, Jenner, and Dharmani 2022). The percentages were even higher for US companies, which are more concerned about US–PRC strategic competition. On the new investment front, 57% of the respondents had established new operations in one or more additional countries in the previous 24 months and 53% were planning to do so in the next 24 months. The survey responses from companies based in Germany, France, Spain, Italy, and the UK show similar trends to those from companies based in the US, with 55% saying they had engaged in near- or re-shoring in the previous 24 months. The European respondents were also likely to have made supplier base changes, with 61% saying they had done so in the last 24 months. These results may understate the degree of reshoring, as the survey was conducted before the Russian invasion of Ukraine. Given the extensive challenges related to everything from component availability (e.g., lack of automotive wire harnesses from Ukrainian suppliers) to logistics (e.g., Asia–Europe cargo routes disrupted by the Russian airspace closure), European companies have probably moved even faster than planned with their reshuffling, whether this is reshoring or near-shoring.

The other important actors in reshoring are Chinese companies themselves. In addition to cost reasons, the US trade war has resulted in a huge surge of Chinese companies moving to Viet Nam, Cambodia, and other destinations, in order to avoid the US import tariffs. In fact, as many as 65% of the Chinese respondents to the EY survey said they had near- or re-shored their operations in the previous 24 months. In the same vein, 75% said they had made significant supplier base changes over the same period.

All in all, companies appear to be seeking diversification of their plant locations to increase the resilience of their supply chains, but changes are also observed at a more granular level, with 62% of the respondents having made significant changes in their supplier base in the previous 24 months, and 55% planning significant changes in the next 24 months. For the respondents, a key incentive was to increase the proximity to their customers from the perspective of consequentialism, as 47% of the respondents had reported such outcomes. It should also be mentioned that not every company considered these actions to be very costly. In fact, only 22% of the companies expected costs to increase because of these actions in the short term, while the percentage increases to 37% in the medium term.

Sectoral aspects of supply chain reshuffling are also important. Given the sensitive nature of defense technologies, aerospace and defense companies are somewhat ahead of the curve, with shorter, domestically oriented supply chains. However, they continue to shift production closer to demand hubs to improve resilience, while employing technologies like additive manufacturing and automation to preserve margins. In the same vein, automotive companies are shortening their supply chains by sourcing from local suppliers and building battery plants closer to US and European markets. Many automotive manufacturers have also shifted some production and raw material sourcing out of the PRC in favor of North America, Europe, and other parts of Asia to keep production lines moving, despite higher costs. Chemical companies are diversifying supplier bases and expanding capacities closer to demand hubs. This means that they are investing heavily in the PRC via joint ventures, partnerships, and capacity expansions to ensure country-wide positioning, as the PRC constitutes 50% of the global market, but, at the same time, are adding capacity in the US, India and other countries in Asia to reduce risk.

Moving to the surveys from chambers of commerce in the PRC, the most recent one, published by the American Chamber of Commerce in Shanghai, shows a sharp increase in the number of companies planning to redirect their investments to other countries (The American Chamber of Commerce in Shanghai 2022). In fact, as many as a third of the 307 companies surveyed were planning to do so. In addition to geopolitical reasons, it is important to note that more than 50% of the companies did not expect any growth in revenue, compared to only 18% in the previous year. The European Union Chamber of Commerce Business Confidence Survey in 2022 clearly points to the growing challenges of doing business in the PRC, and pays special attention to the mobility restrictions which severely constrain the ability to attract talent into the PRC (European Union Chamber of Commerce in China 2022). In addition, the respondents expressed severe concern about growing geopolitical tensions and the increasing risks of decoupling, which had forced many companies to develop two separate supply chain, information technology (IT) system and data storage infrastructures—one for the PRC and one for the rest of the world—to buffer potential disruptions in the future, leading to much higher costs. Even in the September 2020 report by the European Chamber in Beijing, nine different layers of decoupling were considered. As many as 85% of the companies and experts interviewed were negative about the increasing risk of decoupling for the digital and telecom industries, and a smaller percentage about the risk for data governance. Even for standards, 68% of the respondents were worried about decoupling (European Union Chamber of Commerce in China 2021).

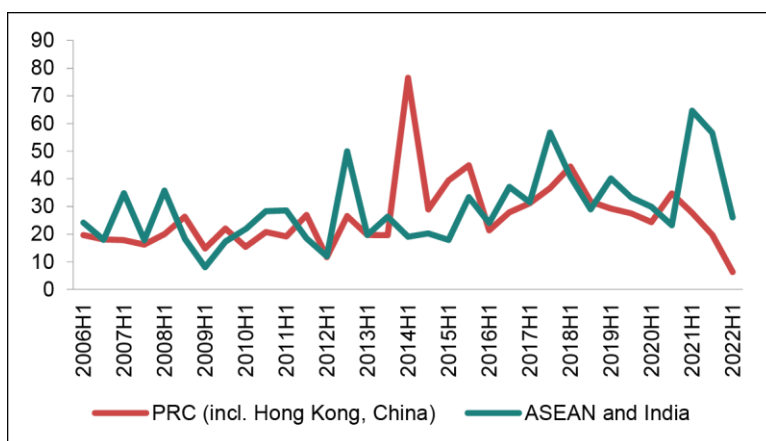
Table 4: European Chamber Survey on Decoupling (%)

	All Negative (Significant Negative) in %	No Impact in %	All Positive in %
Digital/telecoms	85 (34)	12	0
Data Governance	76 (24)	16	4
Financial	70 (23)	23	1
Supply Chains	68 (23)	23	6
Standards	68 (15)	22	5
Self-sufficiency	64 (15)	26	6
Political	59 (12)	34	0
Critical Inputs	49 (15)	42	3

Source: Natixis, European Chamber survey on decoupling conducted in September 2020.

Beyond surveys, it is important to look at the latest trends in cross-border mergers and acquisitions (M&A) into the PRC, and compare them with those into the rest of Emerging Asia, including India. Based on a detailed analysis of M&A deals, a significant drop in cross-border M&A deals into the PRC can be found, especially in 2021 and 2022 (Figure 20). This development does not seem surprising against the backdrop of zero-COVID-19 policies, regulatory restrictions, and the real estate demise. Meanwhile, although the figures were still down, the ASEAN countries, India, and Australia have attracted significantly more capital since 2020. Flows were reshuffled to reflect the rising need for the diversification of supply chains, changes in demand and energy source security. The ASEAN countries and India attracted 56% of total inbound flows, giving them the largest share in Asia, with Indonesia punching above its weight and receiving twice as much as the PRC in completed deals (Garcia Herrero, Nguyen, and Xu 2022).

Figure 20: Completed M&A Deals by Recipient (USDbn)



Source: Natixis, Mergermarket.

6. CONCLUSIONS

Over the decades of the growth and reshaping of global supply chains, the PRC has acquired an increasingly central role, but some adverse signs are also emerging. The US–PRC trade war and, especially, the COVID-19 pandemic, followed by the Russian invasion of Ukraine have been crucial shocks to the good functioning of supply chains and have resulted in higher food and fuel inflation which have wounded households and hurt the profitability of businesses. In reaction, many companies are, so surveys suggest, now focusing on the resilience rather than efficiency of supply chains, as the higher risks of production disruption are tilting the balance in favor of a reshuffling of their supply chains. Meanwhile, government action, including legislation, has been introduced in several countries including Japan and the Republic of Korea, but also the European Union and the US; this legislation is all aimed at improving the resilience of global value chains, and promotes relevant business plans in the private sector. That said, the decision by many companies to reshuffle production away from the PRC may still be incentivized by the stronger needs of diversification amidst growing geopolitical turbulence but also by the PRC’s worsening medium-term economic prospects. In other words, companies diversifying their production away from the PRC—as shown in the recent slow-down in mergers and acquisitions into the PRC accompanied by an increase into India and the ASEAN countries—might be a rather rational decision based on an economic rationale and also, in some cases, government action.

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