

MORE RESILIENT SUPPLY CHAINS AFTER COVID-19 PANDEMIC

Guillaume Derrien, Raymond van der Putten

The Covid-19 pandemic has laid bare weaknesses and vulnerabilities in global supply chains. It has increased calls for making global value chains (GVCs) more robust and resilient, and reducing the dependence on East and Southeast Asia. Enterprises are in the process of improving the resilience of their supply chains by improving the transparency of their value chains, and building more redundancy in supplier networks, and transportation and logistics systems. At the macro-level, both the United States and the European Union have been updating their industrial strategies to increase their autonomy in strategic sectors. However, we should not forget that GVCs in itself is not the problem. On the contrary, during the Covid-19 crisis, GVCs have often been a solution, as it has helped to smooth shocks to supply of globally-consumed products.

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The Covid-19 pandemic has laid bare weaknesses and vulnerabilities in global supply chains. First, during the “Great Lockdown” in 2020, supply was affected by border restrictions and containment measures that resulted in the closure of many production sites. Manufacturers of respirators and personal protection equipment, mostly based in China, could not cope with the sudden surge in demand for these items as many countries tried to get hold of them. Emergency stocks of facemasks turned out to be insufficient and were sometimes even outdated. The closures of restaurants, hotels and shops led to a shift in household demand, from services to goods consumption, which created tensions on the supply of certain consumer products.

The second stage, in which the world economy is today, is the difficulty for GVCs and transport logistics to keep up with the sharp recovery in global demand, particularly from developed economies. Some industrial sectors have reported severe shortages of intermediate products, with significant impact on their production. For instance, activity in the car industry has been hampered by the shortage of semi-conductors, causing the temporary closure of plants¹. The construction sector has been facing a shortage of wood, while food manufacturing is lacking packaging. These problems have been compounded by unprecedented tensions on transport logistics. Due to the collapse in world trade, the normal flow of containers was disrupted, and a scarcity of containers emerged when demand rebounded. Ports have been overwhelmed by the arrival of container ships and waiting time for their handling have been increasing to record levels². The problems were exacerbated by the grounding of one of the world’s largest ships in the Suez Canal in March 2021, and more recently by disruptions in Chinese ports caused by a resurgence in Covid-19 contaminations. In addition, a shortage of truck drivers is delaying deliveries in Europe and North America.

To resolve these problems, the OECD urges economic recovery packages to be designed to “build back better”. Policy makers should not only concentrate on simply getting the economies back on their feet, but also on assuring that they are more resilient to future shocks. Central to this approach is a focus on well-being and inclusiveness. Other key dimensions include alignment with long-term emission reduction goals, factoring in resilience to climate impacts, slowing biodiversity loss and increasing circularity of supply chains.

Having learned from the 2008 global financial crisis, each country or economic bloc has shown its ambition to become more proactive during the pandemic. The Biden administration in the US puts the emphases on national security, economic security and technological leadership³. In its opinion, the US has become too dependent on foreign suppliers in many areas, and in particular vis-à-vis China, because of a policy that has prioritised efficiency and low costs. The government would like to

strengthen the US manufacturing base, diversify international suppliers, and step up investment in infrastructure. These objectives are part of the USD 1 tn infrastructure bill approved in November 2021. The European Union has updated its industrial strategy to increase the bloc’s autonomy in strategic sectors, which may result in the reshoring of key activities, including the production of semi-conductors and pharmaceuticals.

In this study, we will be focussing on the state of GVCs in the manufacturing sector; the effects of the Covid-19 pandemic on them, as well as future directions for GVCs. Environmental aspects, even though important, fall largely outside the scope of this study.

The golden age of globalisation

The 1990s marked the beginning of a significant phase of expansion of international trade and interlinkages in the production process between countries. During this decade world exports in values nearly doubled. Since 2000 the pace accelerated further until the 2008 global financial crisis halted abruptly this dynamic⁴. World exports, as a share of world GDP, climbed from 15% in the late 1980s to 25.5% in 2008 (see Chart 1). Three key factors have been behind these developments. The first is the “disintegration” of production (i.e. the splitting of production processes in several stages), which has allowed companies to achieve substantial cost savings by choosing the cheapest providers⁵. This trend was underpinned by the rapid growth of the trade in intermediate goods – both for OECD and non-OECD countries – which far outpaced world GDP growth, particularly from the late 1990s until 2008 (see Chart 2 and Chart 3).

WHAT ARE GLOBAL VALUE CHAINS?

The fragmentation of production processes and the international dispersion of tasks and activities within them have led to the emergence of borderless production systems – which may be sequential chains or complex networks and which may be global, regional or span only two countries. These systems are commonly referred to as global value chains. The concept of global supply chain focuses on transporting of materials and products between locations in different countries, often including change of ownership of those materials and products. For the purpose of this study, the concept global value chains is used synonymously with the term global supply chains.

See: Antràs, P. (2020). Conceptual aspects of global value chains. *The World Bank Economic Review*, 34(3), 551-574.

4 World exports rose by 92% between 1990 and 2000, followed by an increase of 150% between 2000 and 2008 (source: IMF Direction of Trade Statistics).

5 Richard Baldwin calls this the second decoupling. The first unbundling took place from roughly 1850 to 1914 and from the 1960s onwards. It is the spatial separation between the place of production and the point of consumption. This was made possible thanks to the fall in transportation costs. In the second unbundling, also made possible by declining transportation costs and improved communication, production stages have been separated. See R. Baldwin (2012), *Global supply chains: why they emerged, why they matter, and where they are going*, CEPR Discussion Papers.

1 See for example, *Chip shortage drags on as plant closures hit carmakers*, Financial Times, 14 September 2021.

2 See for example, *Covid casts light on port infrastructure crisis*, Financial Times, 11 August 2021.

3 The White House. *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth*, June 2021.



The second development is the growing integration of world markets. In many regions, customs barriers have come down (see Chart 4). In the European Union, the single market was created in 1993. In North America, the US, Canada, and Mexico signed the North American Free Trade Agreement that came into force on 1 January 1994. In 2011, a group of countries in East and Southeast Asia and the Pacific signed the Regional Comprehensive Economic Partnership. Another major step was the integration of China and the former communist countries in Central and Eastern Europe in the world trade system. Thirdly, transportation costs have fallen over time, partly thanks to the widespread use of container transport.

From the 1990s to the financial crisis of 2008, GVCs – both backward and forward participations – expanded significantly, which coincided with a period of rapid trade liberalisation (see Box 1). New export powerhouses emerged, first China, but also countries in Southeast Asia (Vietnam, Thailand, Malaysia), central and eastern Europe (Bulgaria, Czech Republic, Hungary, Poland and Slovakia), while manufacturing hubs such as South Korea and Taiwan strengthened their position.

However, this process has stalled since the global financial crisis of 2008. World exports, as a share of world GDP peaked in summer 2008 and has been on a downward trajectory since then (see Chart 1). Other indicators such as intermediate goods exports, FDI flows, and GVC participation have been trending down since that time¹.

The rapid expansion of internal trade has drastically changed the world economy. Since David Ricardo developed the theory of the comparative advantage in the early part of the 19th century, economists agree that international trade can be advantageous for all countries. Countries will thus benefit from lower prices for imported goods, technological spill-overs, economies of scale (on goods where they have a comparative advantage) and productivity gains. Moreover, thanks to the splitting up of production processes, the developing countries could more easily participate in the global production process, particularly by using their comparative advantages on costs in labour-intensive activities. This process has had a positive impact on the productivity and income per capita in developing countries². The global income distribution has become unipolar again, as was the case until the 1950s (see Chart 5).

WORLD EXPORTS, AS A SHARE OF WORLD GDP

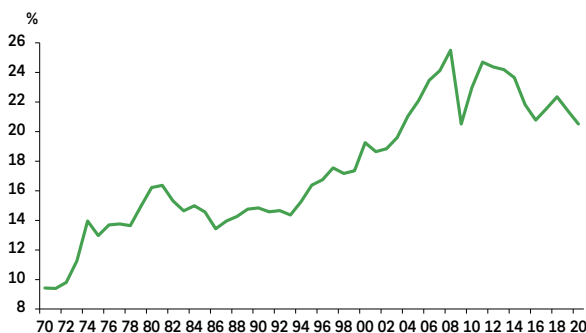


CHART 1

SOURCE: IMF, WORLD BANK, BNP PARIBAS

¹ See for example, *Globalisation has faltered*, The Economist, 24 January 2019. See also *Sustaining Global Value Chains*, Asian Infrastructure Investment Bank, 2021.

² See Ignatenko, Raeli and Mircheva (2019), *Global Value Chains: What are the Benefits and Why Do Countries Participate*, IMF Working paper.

INTERMEDIATE GOODS EXPORTS & WORLD GDP

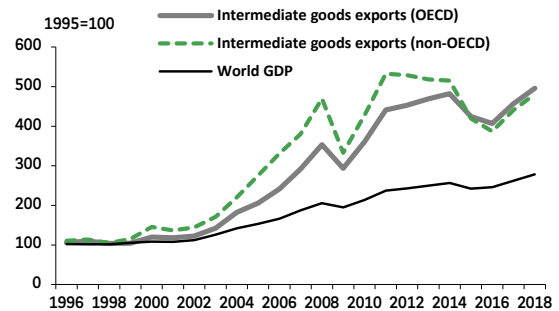


CHART 2

SOURCE: OECD, WORLD BANK, BNP PARIBAS

IMPORTS OF OECD COUNTRIES

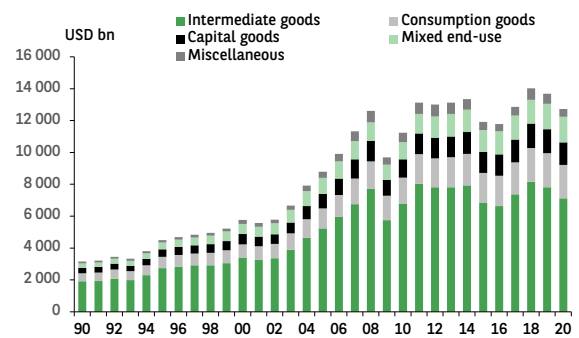


CHART 3

SOURCE: OECD, BNP PARIBAS

TARIFFS APPLIED TO THE VALUE OF IMPORTS, WORLD AVERAGES

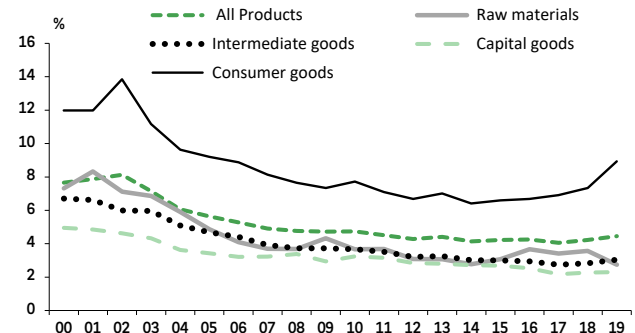


CHART 4

SOURCE: WORLD BANK, WITS



Moreover, income inequality between countries has been reduced; the corresponding Gini coefficient has declined in 2000 for the first time in several decades (see Chart 6).

For developed countries, the results have been mixed. Although a disintegrated production process has fostered the creation of highly-qualified employment on the domestic market as well as lower prices for consumers, it has also led to more offshoring of activity, with negative consequences on employment, especially for the less skilled⁸. As a result, the level of inequality within countries has worsened (see Chart 6). Although trade liberalisation is not the only factor for rising inequality in the developed world, this has been an important contributor. At the political level, it has created a polarisation between those in favour of globalisation and those who fear to be the victim of offshoring, fuelling in part the rise of populist parties⁹.

GLOBAL INCOME DISTRIBUTION (US DOLLARS AT 1990 PPP)

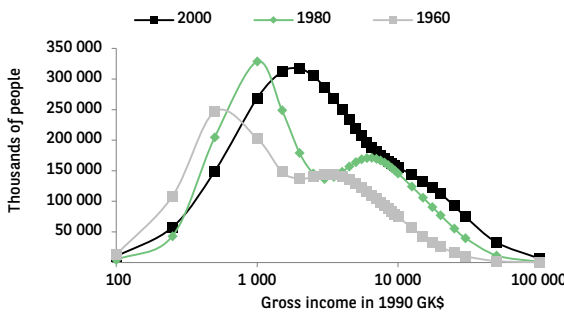


CHART 5

SOURCE: HOW WAS LIFE? GLOBAL WELL-BEING SINCE 1820, OECD 2014, BNP PARIBAS

GINI COEFFICIENTS

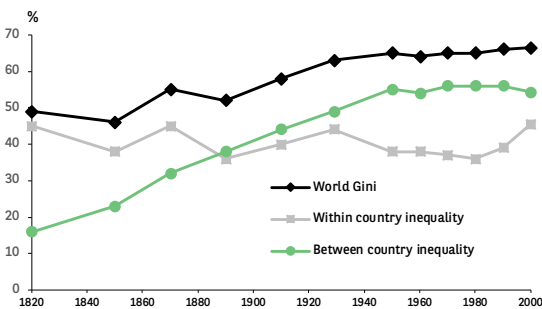


CHART 6

SOURCE: IMF, WORLD BANK, BNP PARIBAS

⁸ For the case of the US, see for example, D. Autor et al. (2013), *The China Syndrome: Local Labor Market Effects of Import Competition in the United States*, *American Economic Review*. For the case in Europe, see L. Calmfors et al. (2008), *The effect of globalisation on Western European jobs: curse or blessing?*, CESifo.

⁹ See Goodhart, D. (2017). *The road to somewhere: The populist revolt and the future of politics*. Oxford University Press.

BOX 1: THE PARTICIPATION IN GVCs

Countries are involved to different degrees in GVCs. To measure their participation in GVCs, one can look at the vertical specialisation, calculated as the import content of exports: the backward participation index. This indicator focuses on the upstream foreign suppliers in the value chain. One could also look at the share of exported goods and services that are used by other countries as imports in the production of exports. This is called forward participation.

The participation indices are shown in chart 7. A few observations can be made: First, smaller countries have traditionally a higher backward participation rate (Belgium, Singapore, and Taiwan) as they source a higher proportion of inputs from abroad than larger countries, which rely more on their domestic markets. Second, countries that export a large proportion of energy (Russia, Saudi Arabia, Norway) have a high forward participation, because energy is a critical raw material for most sectors of production. Therefore, these two groups of countries have an economy that is structurally more dependent on external demand and thus relatively more vulnerable to trade frictions than average countries.

Between 2008 and 2018, the participation rates for most countries included in Chart 7 have fallen, in line with the view that the process of globalisation has stalled.

PARTICIPATION TO GVCs FOR SELECTED COUNTRIES (%)

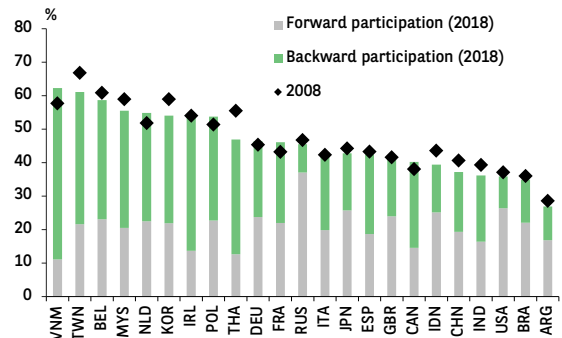


CHART 7

SOURCE: OECD, BNP PARIBAS

Another negative effect of globalisation is the increase in greenhouse gas emissions. The decline in transportation costs has been a driving force behind the expansion in world trade. However, fossil fuel-based energy and transport systems do not take into account the social cost of carbon (i.e. the economic harm, expressed as the dollar value of the total damages from emitting one ton of carbon dioxide into the atmosphere). Moreover, companies have sometimes moved their production to emerging economies in order to benefit from less stringent environmental regulations (carbon leakage).



Slowing globalisation and regional concentration

Since the global financial crisis in 2008, the pace of economic integration has slowed. World trade as a percentage of GDP has declined (see Chart 1). The Dutch trend watcher Adjiedj Bakas has coined it “slowbalisation¹⁰”. What explains this slowdown? In principle, the slowbalisation after a period of extraordinary growth in international exchanges is not extraordinary and a manifestation of the “Stein principle”, that says that if something cannot go on forever, it will stop¹¹.

In this case, the stagnation in international trade can be traced to various factors:

- A decline of manufacturing activity relatively to services. As an economy develops, and income rises, the demand for good tends to decline relatively to the demand for services. The latter are usually less easily outsourced than goods, which progressively leads to a less dynamic trend in merchandise trade.
- Transport costs have levelled off, after a significant decline due partly to the greater use of containers.
- Labour costs are becoming less important as manufacturing processes become increasingly automated, and companies are relying more on skilled workforce, and less on low-wage workers.
- Shorter supply lines may allow firms to adapt quickly to consumer preferences, which could give them a competitive advantage.
- Rising trade frictions and customs duties, as well as inward-looking trade policies.
- Past disasters and ensuing supply-chains disruptions have often led to a reassessment of supply chains. In particular since the Tohoku earthquake in 2011, firms are giving more attention to improving the resilience of GVCs (see section *Building more resilient supply chains*).

Kilic and Marin (2020)¹² argue that the era of hyper-globalisation ended after the 2008/09 Global Financial Crisis. They show that imported inputs from the developing countries as a percentage of total inputs in the developed countries have stabilised since 2011.

However, the process of globalisation is complex and needs to be appraised from a broad perspective. Despite the apparent slowdown in global trade, Baldwin and Freeman (2020b) show that countries’ total exposure (i.e. direct and indirect exposure), to each other is still increasing in many cases. The OECD-WTO TiVA databank shows that for the EU15 the share of foreign value added in total final demand continued to rise from 15% in 1995 to close to 30% in 2018. In particular, the contribution of East and Southeast Asia reached 11.3% in 2018, almost 4 points higher than a decade earlier. Moreover, imports from the European transition economies (EU13) have rapidly increased. Since joining the EU, their value added contribution increased from around 2% in 2004 to 4.6% in 2018.

There is also a greater regional concentration of trade. Table 1 maps the interconnection of manufacturing sectors between the major countries and geographical areas based on value-added contributions in 1998, 2008 and 2018¹³. The numbers are the shares of the column nations in the

10 See for example *Globalisation has faltered*, The Economist, 24 January 2019.

11 This principle was enunciated by Herbert Stein, chair of the Council of Economic Advisers (from January 1972 to August 1974) during the administrations of Richard Nixon and Gerald Ford.

12 Kemal Kilic and Dalia Marin, *How COVID-19 is transforming the world economy*, CEPR, May 2020.

13 The table is inspired by Richard Baldwin and Rebecca Freeman, 2020, *Supply chain contagion waves: Thinking ahead on manufacturing ‘contagion and reinfection’ from the COVID concussion*, VoxEU

		TOTAL EXPOSURE OF ROW NATIONS TO COLUMN NATION'S MANUFACTURING SECTORS											
Year	Country	CAN	MEX	USA	FRA	DEU	ITA	ESP	GBR	JPN	KOR	CHN	
1998	CAN	38.6	1.2	37.8	1.4	1.9	1.1		1.8	4.2	1.3	1.6	
	MEX	0.9	65.6	22.9	0.6	1.6	0.5		0.5	2.1	0.7	0.5	
	USA	3.4	1.6	75.5	0.9	1.9	0.9		1.2	4.5	0.9	1.6	
	FRA			5.1	56.4	8.1	4.7	3.0	3.8	2.4	0.5	1.0	
	DEU			3.8	3.6	66.3	2.9	1.3	2.4	2.6	0.5	0.9	
	ITA			2.4	4.4	6.8	67.0	1.5	2.4	1.4		0.7	
	ESP			3.4	7.2	7.4	4.6	57.1	3.4	2.2	0.6	0.9	
	GBR	0.5		6.9	4.2	6.2	2.7	1.5	57.3	3.2	0.8	1.1	
	JPN			3.1			0.7				89.0	0.6	1.4
	KOR	0.6		8.7	0.8	2.7	0.8		1.1	10.0	63.3	2.1	
	CHN			2.7	0.5	1.1				4.0	1.5	83.4	
	2008	CAN	39.5	1.9	27.6	1.1	2.9	1.2		1.2	4.0	1.6	7.5
MEX		1.3	57.7	18.5	0.6	2.5	0.9	0.7		3.1	1.7	4.5	
USA		2.8	1.9	67.8	0.9	2.3	0.9		1.0	3.6	1.4	6.2	
FRA				4.0	47.5	9.5	4.9	3.6	2.3	1.9	0.9	4.0	
DEU				3.3	3.0	60.5	2.5	1.2	1.6	1.9	1.1	3.6	
ITA				2.2	3.5	7.7	59.3	1.8	1.3	1.4	0.9	3.3	
ESP				3.0	5.1	8.0	4.2	51.9	2.0	1.8	0.9	4.3	
GBR		0.7		5.8	3.8	7.6	2.8	2.1	47.9	2.3	1.0	4.6	
JPN				2.8			1.2	0.5			80.9	1.2	5.1
KOR				5.6	0.8	2.5	0.8		0.6	9.0	58.2	9.1	
CHN				2.3	0.6	2.0				4.6	2.2	80.0	
2018		CAN	35.4	2.9	25.8	1.0	3.1	1.2		1.0	3.2	2.2	11.3
	MEX	1.3	46.0	21.3	0.7	3.0	1.1	0.8		2.9	2.7	10.0	
	USA	2.3	2.8	66.0	0.7	2.4	0.8		0.7	2.9	1.7	8.4	
	FRA			4.6	38.9	10.7	4.6	3.5	2.1	2.0	1.1	7.2	
	DEU			3.6	2.7	54.3	2.7	1.4	1.4	1.8	1.2	6.1	
	ITA			2.4	3.6	9.2	53.9	2.1	1.3	1.0	0.8	5.1	
	ESP			3.6	5.3	9.4	4.0	43.7	2.0	1.5	1.0	6.8	
	GBR	0.5		4.7	3.0	8.9	2.5	1.9	46.0	1.8	1.0	6.6	
	JPN			3.8	0.5	1.5	0.5				74.2	1.7	8.0
	KOR			5.0	0.6	2.6	0.7		0.5	5.7	61.7	10.6	
	CHN			1.8		1.5				2.3	2.3	84.2	

The figures are the value-added share of direct and indirect inputs from the column nation in the row nation's total manufacturing output. Share below 0.5% are zeroed for clarity

TABLE 1

SOURCES : OECD-WTO TiVA, BNP PARIBAS

value added of the row nation's final demand. For example, in 2018, the manufacturing sector in Germany uses 54.3% of domestically-produced inputs, whereas it relies on China for 6.1% of its direct and indirect inputs.

The table clearly shows Asia's dominance in manufacturing. China, Japan and South Korea all contribute significantly to the manufacturing production in the rest of the world. In particular, the inputs from China increased substantially between 2008 and 2018. In 2018, China contributes for more than 5% of every major country's manufacturing output. China has also reduced its dependence on other countries for its inputs. For this reason, the share of imported input in the non-OECD countries has diminished (see Box 2).

Nevertheless, GVCs remain more concentrated at the regional level than at the global level. Three regional blocks – Asia, North America and Europe – can be discerned. The inputs for countries within each of these blocks come predominantly from those in the same block.

Furthermore, the nature of trade is shifting progressively from “physical” goods to services. Before the Covid-19 pandemic, services exports accounted for a quarter of world exports, compared to a ratio of around 20% before the 2008 financial crisis (WTO data).



BOX 2: TRADE BETWEEN OECD AND NON-OECD AREAS BY INDUSTRIES

Table 2 shows the integration of the various manufacturing branches in GVCs within the OECD and outside the OECD, excluding interregional trade. The least integrated branch is "Food products, beverages and tobacco". Due to relatively high transportation costs and the short preservability of the inputs, manufacturers in this branch mainly source from local providers. By contrast, in the textile, computer and electrical equipment industries, the OECD countries imported around 15% of value added from outside the zone in 2018.

The most rapidly evolving branches are in advanced technologies such as "Computer, electronic and optical products" and "Electrical equipment". The share of imported value added in OECD countries nearly doubled in these branches in the span of ten years. The increased dependence of the industrialised countries on foreign suppliers, mainly China, has led to a deteriorating trade balance of the OECD economies for these goods. By contrast, the share of imported value added for non-OECD countries declined over the same period, as these countries moved to higher value-added products. Many of the products that were formerly imported from OECD countries are now produced domestically.

IMPORTED VALUE ADDED AS A % OF TOTAL DEMAND OF OECD AND NON-OECD AREAS

	1998		2008		2018	
	OECD	Non-OECD	OECD	Non-OECD	OECD	Non-OECD
Manufacturing	2.1	7.9	4.7	7.7	5.8	5.4
Food products, beverages and tobacco	0.9	1.5	1.5	1.5	1.8	1.4
Textiles, wearing apparel, leather and related prod.	3.5	3.9	9.0	2.2	13.9	1.4
Chemicals and pharmaceutical products	2.5	7.4	5.5	8.1	6.2	6.1
Computer, electronic and optical products	3.8	15.6	9.0	12.5	15.5	8.7
Electrical equipment	2.7	8.9	6.9	8.6	14.0	5.9
Machinery and equipment, nec	0.9	17.4	2.8	12.3	4.0	7.6
Transport equipment	0.5	9.8	1.3	9.3	1.7	6.0

TABLE 2

SOURCES : OECD-WTO TIVA, BNP PARIBAS

International trade in services is currently recovering more slowly than trade in goods, due to Covid-related border restrictions that are seriously affecting tourism and business travel as well as construction services¹⁴. However, "high-tech" services have been much less impacted by the pandemic. This is the case of telecommunication and ICT, financial services or intellectual property revenues. In particular, ICT services have more than doubled over the past decade and accounted for over 10% of total services exports in 2019. All this partly reflects the acceleration of some structural trends such as digitalisation, automation or servicification of the production process (i.e. greater use of services alongside traditional products).

The disruption of supply chains during the Covid-19 crisis

End December 2019, the Wuhan Municipal Health Commission reported a cluster of cases of pneumonia in Wuhan, Hubei Province. It turned out to be a novel coronavirus that transmits the disease, later baptised as Covid-19. A month later, on 23 January 2020, the Chinese authorities ordered a lockdown in Wuhan and other cities in Hubei, which was

subsequently tightened and widened¹⁵. China's seemingly extreme lockdown worked as the contaminations almost completely stopped, according to the official figures. Nevertheless, these measures came too late, as the virus had already spread to large parts of the globe. Many European countries ordered a lockdown in March 2020 in an attempt to bring down the infection rate, soon followed by several US states. Despite all the efforts to limit contaminations and an extensive vaccination campaign, the pandemic is still not brought under control. At the time of writing (end December 2021), Europe is confronted with a new wave of infections and hospitalisations. According to official estimates, the pandemic has caused more than five million victims worldwide.

The Covid-19 pandemic was a typically low probability event, which had an enormous impact. Nassim Taleb called such an event a "black swan"¹⁶. It is true that a global pandemic is not a new or even an improbable event in itself. In 2011, a movie called *Contagion* was made about the outbreak of a pandemic.

¹⁵ Huang, Y., Lin, C., Wang, P., & Xu, Z. (2020), *Saving China From the Coronavirus and Economic Meltdown: Experiences and Lessons*. In Baldwin, R., & di Mauro, B. W. (2020). *Mitigating the COVID Crises: Act Fast and Do Whatever It Takes*, VoxEU.org, 18 March.
¹⁶ Taleb, N. N. (2007). *The black swan: The impact of the highly improbable*. Random House.

¹⁴ Because of difficulties getting local or foreign workers back on site



However, these stories were seen as thrillers and horror stories. In general, market participants expect that authorities are taking sufficient precautions to prevent these low-probability events from happening, as in the case of the outbreak of SARS (2002-2004). Moreover, many companies participating in GVCs may ignore or underestimate the impact of these events through their network of suppliers.

The impact of the pandemic is very important because of its global effect, its long duration and the disruption it caused for almost all industrial sectors. Prior to the pandemic, the IMF estimated that world GDP, in purchasing power parity terms, would grow by 2.3% in 2020 (October 2019 forecasts). According to its latest projections (October 2021), GDP finally contracted by 2.2% in 2020, implying that the pandemic had wiped off around USD 6 tn worldwide in 2020. In 2021, the strong rebound allowed to claw back some of these losses.

The Covid-19 pandemic has affected the economy through various channels. First through containment measures: travel restrictions and administrative closures of businesses have reduced activity, particularly in the services sector (non-food stores, theatres, cafés and restaurants, etc). The manufacturing industry was less affected, although in some areas, the authorities ordered the temporary closure of plants as part of a general lockdown¹⁷. The second channel is a demand shock. Due to restrictions on mobility, consumers have been unable or less willing to purchase goods. For example, car sales plummeted as a result of the implementation of travel restrictions.

The third channel is through the effect of supply disruptions on GVCs. As the pandemic first hit China, its manufacturing sector was the first to experience plant closures and supply restrictions. Given the country's central role in world manufacturing, this shock was quickly transmitted to manufacturing plants elsewhere, even based in countries less affected by the pandemic, as they had difficulties in acquiring the necessary imported industrial inputs. Moreover, international trade was held back by travel restrictions. In this way, the initial supply shock was amplified to the rest of the world. Just-in-time management of inventories aggravated the problems in many sectors.

The disruptions were not quickly resolved once the pandemic decreased in intensity and lockdown restrictions were gradually lifted. Chinese exports were hampered, as the unprecedented reduction in world trade had severely disrupted the normal flow of containers. Shipping companies were not able to find sufficient containers for transporting goods overseas, which drove up maritime transport costs. Moreover, many ports were unable to quickly handle the sudden surge of incoming container ships. Some were also disrupted by Covid-related closures. The problems were compounded by the stranding of the *Ever Given*, a large container ships, in the Suez Channel, which had paralysed one of the world's busiest shipping routes for almost a week in March 2021. These transportation problems are expected to last well into 2022¹⁸.

The industrial sector has not been able to keep up with the quick and strong rebound in activity. Expecting a prolonged depression of car sales, the automobile industry had cancelled orders for semiconductors. In reaction, the semiconductor industry redirected more production toward the consumer goods sector, as the lockdown boosted demand for game consoles, laptops and televisions. Once activity in the car industry normalised, the semiconductor industry lacked the capacity to ramp up production quickly enough to satisfy the demand in this sector.

17 In areas where plants were kept open, activity have also suffered due to the implementation of safety measures to reduce the risk of infections, travel restrictions, or the lack of staff because of sickness leave and/or the necessity to look after the children.

18 See *Governments need to fix supply chain crisis, top shipping boss warns*, Financial Times, 25 October 2021.

Analysts expect that the problems in the automobile sector could last to late-2022 or even through 2023 for the most pessimistic.

Building more resilient supply chains

The disruption of the global supply chains during the Covid-19 crisis has intensified the debate on the structural weaknesses of these production chains. It has been centred on the question as to whether the efficiency gains from GVCs outweigh the associated risks of transmission of shocks.

McKinsey Global Institute (MGI) has written an in-depth study on the exposure of the manufacturing sector to supply chain disruptions caused by natural disasters, financial crises, geopolitical uncertainties, and cyberattacks¹⁹. It concludes that companies can expect to lose more than 40% of a year's profits every decade on average. In some industries, a single severe event that disrupts production for 100 days could erase almost a year's earnings.

Already before the Covid-19 outbreak, companies have been paying increasingly attention to the risk of supply chain disruptions and have been investing substantial amounts in the prevention of these events or the mitigation of their impact. A major trigger was the Tohoku earthquake in Japan followed by the severe flooding in Thailand in 2011. Just-in-time management of inventories had enabled companies to improve cost efficiency by reducing their stocks of raw materials and semi-manufactured products. However, it also increased the vulnerability of their supply chains. After the Tohoku earthquake in March 2011, many Japanese plants located outside the affected area had to close because of a lack of inputs²⁰. In reaction, companies have reviewed their production recovery plans. As a first step, they have created a comprehensive database of their entire supply chains. It took Toyota a week to list 500 parts sourced from 200 locations, which would be difficult to secure and recover to the normal production level²¹. The automotive industry was hit particularly hard by the wiping out of a production line of Renesas, a semiconductor manufacturer²².

Learning from the Covid-19 crisis

The Covid-19 crisis was very different from previous crises because of its global scale and from the fact that it was not purely a supply problem. In fact, most of the supply chain disruptions have been caused by a surge in demand, rather than by the breakdown of production lines. For example, the shortage of personal protective equipment and respiratory devices in the early stages of the crisis was due to a surge in demand. In this case, GVC played an important role in alleviating the shortages of facemasks, as China was able to ramp up its production. Similarly, the shortage of semi-conductors is a demand problem, related to the rapid recovery of the economy. Bottlenecks that have appeared in port infrastructure are mostly in the domestic part of the value chain and are likely to be transitory.

19 McKinsey Global Institute, *Risk, resilience, and rebalancing in global value chains*, August 2020.

20 For a study of the economic impact of the Tohoku earthquake, see Carvalho et al. (2016), *Supply Chain Disruptions: Evidence from the Great East Japan Earthquake*, Cambridge Working paper.

21 Matsuo, H. (2015), *Implications of the Tohoku earthquake for Toyota's coordination mechanism: Supply chain disruption of automotive semiconductors*, International Journal of Production Economics, 161, 217-227.

22 Following the events, the company has revised its recovery plans. It now aims at reducing production disruptions from three months to one month, in case of an earthquake of similar magnitude. First, it will increase the earthquake resistance of its buildings and production sites. Second, it will make efforts to establish an alternative production source (second-sourcing), either internally or externally. Third, to facilitate second sourcing, it will reduce the number of product references (SKU) which is now 100 000. This is relatively high. Non-Japanese integrated manufacturers typically have around 40 000 SKUs. These actions would allow its customers to reduce their inventory of semi-conductors.



The Covid-19 pandemic has once more highlighted the central role of China and East and Southeast Asia in GVCs. This concentration is not only because companies have been searching for low wages. A major factor in reducing production costs is to profit from economies of scale. However, the concentration of suppliers or buyers can increase the probability of disruption and can magnify the propagation of shocks. In case of disruption, the firms depending on them have not much leeway to switch to other providers in the short run. On the demand side, reliance on too few customers is also a source of fragility.

The MKGI study examines in detail the possibility of the rebalancing of value chains for several industries. Importantly, the interconnected nature of value chains limits the economic case for making large-scale changes in physical locations. Capital- or knowledge-intensive value chains are difficult to relocate given the huge sums that have been invested in them and/or the ecosystems that have been developed around them. By contrast, labour-intensive value chains are comparatively “easier” to move. These diverging developments between capital and labour-intensive value chains were already observed before the outbreak of the pandemic. Between 2015 and 2018, production in capital-intensive sectors such as semiconductors and mobile communications became more concentrated in a few Asian countries. By contrast, the trade share of the three leading export countries in apparel have dropped.

According to the MKGI study, 93% of global supply chain leaders are planning to improve resilience of their network. Similar strategies as those of the Japanese companies after the Tohoku earthquake are used. First, companies are improving the transparency of the value chains. Second, firms need to have more redundancy into supplier networks. If one supplier falls out, they can turn to another one. Even though relying on multiple suppliers may be more costly, it can also save the company money in case of severe disruptions or disaster. Companies can also build more redundancy in transportation and logistics. Third, supply chain resilience can also be improved by reducing the products offering and designing products with common components. Fourth, companies need to step up investment in cybersecurity.

Some macro implications

What action can be taken at a macro level to improve the resilience of global supply chains? In particular politicians have at occasions argued that reshoring and localising value chains would be a solution to improve supply chain security. The reasoning goes that supply is better guaranteed if the product is made at home. In case of a global demand surge, one could impose export restrictions to secure the products for the domestic market.

Arriola et al. (2020)²³ assessed the costs and benefits of the re-localisation of value chains, using a set of economic model simulations and two economic regimes regarding value chains: “interconnected” and “localised”. They conclude that GVCs enhance economic welfare and macroeconomic stability, although the study the costs of GVS on the environment. A country with a “localised” regime (i.e. less interconnected via GVCs) has significantly lower levels of economic activity and lower incomes. This suggest that, in the actual situation, a greater “localisation” of value chains would have added further losses to GDP²⁴. Costs of localisation would be particularly high for those countries that are currently located more downstream in GVCs. The more a country relies on foreign inputs for production the larger the drop in GDP. The report also warns that the countries most exposed

to supply shocks are those that have a relative high share of foreign value added in their exports (backward GVC participation), which is more the case for smaller countries. These economies also tend to be more exposed to demand shocks as they rely heavily on exports (forward GVC linkages). For example, manufacturers in Central and Eastern Europe that provides inputs into the European car industry export between 60% and 80% of the total amount of value added produced domestically.

Moreover, the OECD researchers find that localised supply chains are more – not less – vulnerable to shocks for most countries. That is because domestic markets need to shoulder most of the adjustment pressures. In fact, trade helps to smooth shocks to supply of globally consumed products. Some downstream GVC participating countries could gain marginally in terms of stability in a “localised” regime, but at a high efficiency cost. Even though the economic case of localised supply chains is limited, non-economic factors, such as considerations of security, self-sufficiency, and environmental considerations, can also be a reason for shortening value chains.

The developed economies are increasingly dependent on technical knowledge in East and Southeast Asia. This could be problematic, the more so if the technical expertise is developed in countries that are competitor nations. The shortage of semi-conductors, a sector dominated by Taiwan and South Korea, has clearly demonstrated the vulnerability of the Western countries in this area. In reaction, the US and the European Union have announced plans to construct their own production facilities. Recently the US senate approved the US Innovation and Competition Act, which will provide USD 52 bn for the domestic manufacturing of semiconductors. In Europe, Thierry Breton, the Commissioner for the Internal Market, has announced a fund of EUR 42 bn for stimulating the development of semiconductors. However, these initiatives will not solve the shortages in the short term.

In the pharmaceutical sector, production has become less concentrated in the past 20 years. However, the production of some specific products is highly concentrated in particular in Asia. The European Fine Chemical Group (EFCG), an organisation representing producers of active pharmaceutical ingredients (API), reported to the European Commission that more than 80% of the ingredients necessary to manufacture drugs in Europe come from China and India. This move towards these two countries has reduced costs in the medical system for developed economies, but at the same time, it has increased its vulnerability regarding the provisioning of essential medicines. Last year, the European Commission launched a five-year plan aiming at guarantying supplies of medicines and reducing Europe’s dependence on imports of API from third parties to produce antibiotics, cancer and generic drugs. The Biden administration has also announced initiatives to reduce the dependence of the US healthcare system on China.

Overall GVCs have brought substantial gains for the world economy. Drawbacks have been growing income inequality within countries and environmental damages. Moreover, on some occasions – and today is the clearest example – GVCs have broken down, causing damages to the global economy.

Indeed, the Covid-19 pandemic has been the most serious supply chain disruptions in recent history because of its duration and its global scale. It has increased calls for making GVCs more robust and resilient. These efforts will undoubtedly have profound changes on the international trading system, although the scale of these transformations remains highly uncertain.

23 C. Arriola et al. (2020), *Efficiency and risks in global value chains in the context of Covid-19*, OECD Working Paper.

24 Specifically, the authors find that a shift to a localised regime of GVCs leads to a drop in global real GDP of “more than 5%” compared to the interconnected regime.



First, companies will step up initiatives to make their supply chains more secure by improving the information, not only on first-tier suppliers but on suppliers at all levels, in order to identify bottlenecks at all stages of production. Moreover, recovery plans will be reviewed, and some redundancy will be created in supply chains to have backup capacity. These changes come at a cost, which can be viewed as insurance costs against supply disruptions.

Second, the Covid-19 pandemic has once more underlined that, in some crucial sectors such as IT equipment, semiconductors and pharmaceuticals, the world economy has become very dependent on East and Southeast Asia. Industrial clusters in these regions have come into existence to exploit economies of scale. However, in this search for suitable industrial locations, insufficient attention has been given to supply-chain security and other concerns such as environmental and geostrategic considerations. As a result, supply chains have become more fragile because of a lack of alternative suppliers outside these clusters. Moreover, these clusters have often been located in countries with lower environmental standards.

Both in Europe and North America, governments have announced initiatives to repatriate strategic industries. This will be a slow and very costly process, with uncertain benefits; some supply chains, in particular capital-intensive ones, will be difficult to move, because of their interwovenness and the enormous investment required. Nevertheless, these policies are needed in order to reduce dependency of Western economies in some key industries.

In the coming years GVCs might also evolve to respond to the tightening of environmental standards required to limit CO2 emissions. This will encourage the development of shorter supply chains. The introduction of a Carbon Border Adjustment Mechanism as considered by the EU will also discourage industries from moving to regions with looser environmental standards.

Nevertheless, we should not forget that GVC in itself is not the problem. On the contrary, during the Covid-19 crisis, GVCs have also proved to be a solution. In fact, trade helps to smooth shocks to supply of globally consumed products. GVCs have also proved to be, overall, welfare enhancing for both the developed and the developing countries provided that they are accompanied by the right incentives and legislation.

Guillaume.a.derrien@bnpparibas.com

Raymond.vanderputten@bnpparibas.com



GROUP ECONOMIC RESEARCH

William De Vijlder
Chief Economist

+33 1 55 77 47 31

william.devijlder@bnpparibas.com

OECD ECONOMIES AND STATISTICS

Hélène Baudchon
Head - France, Eurozone

+33 1 58 16 03 63

helene.baudchon@bnpparibas.com

Guillaume Derrien
Southern Europe - International trade

+33 1 55 77 71 89

guillaume.a.derrien@bnpparibas.com

Stéphane Colliac
France

+33 1 42 98 43 86

stephane.colliac@bnpparibas.com

Raymond Van Der Putten
Germany, Netherlands, Austria, Switzerland, Japan – Climate, pensions,
long-term growth

+33 1 42 98 53 99

raymond.vanderputten@bnpparibas.com

Veary Bou, Patrick Capeillère, Tarik Rharrab
Statistics

ECONOMIC PROJECTIONS, RELATIONSHIP WITH THE FRENCH NETWORK

Jean-Luc Proutat
Head - United States, United Kingdom

+33 1 58 16 73 32

jean-luc.proutat@bnpparibas.com

BANKING ECONOMICS

Laurent Quignon
Head

+33 1 42 98 56 54

laurent.quignon@bnpparibas.com

Laure Baquero

+33 1 43 16 95 50

laure.baquero@bnpparibas.com

Céline Choulet

+33 1 43 16 95 54

celine.choulet@bnpparibas.com

Thomas Humblot

+33 1 40 14 30 77

thomas.humblot@bnpparibas.com

EMERGING ECONOMIES AND COUNTRY RISK

François Faure
Head – Argentina

+33 1 42 98 79 82

francois.faure@bnpparibas.com

Christine Peltier
Deputy Head – Greater China, Vietnam, South Africa

+33 1 42 98 56 27

christine.peltier@bnpparibas.com

Stéphane Alby
Africa (French-speaking countries)

+33 1 42 98 02 04

stephane.alby@bnpparibas.com

Stéphane Colliac
Turkey, Ukraine, Central European countries

+33 1 42 98 43 86

stephane.colliac@bnpparibas.com

Pascal Devaux
Middle East, Balkan countries

+33 1 43 16 95 51

pascal.devaux@bnpparibas.com

Hélène Drouot
Korea, Thailand, Philippines, Mexico, Andean countries

+33 1 42 98 33 00

helene.drouot@bnpparibas.com

Salim Hammad
Latin America

+33 1 42 98 74 26

salim.hammad@bnpparibas.com

Johanna Melka
India, South Asia, Russia, CIS

+33 1 58 16 05 84

johanna.melka@bnpparibas.com

CONTACT MEDIA

Mickaëlle Fils Marie-Luce

+33 1 42 98 48 59

mickaëlle.filsmarie-luce@bnpparibas.com



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WORLD EXPORTS, AS A SHARE OF WORLD GDP

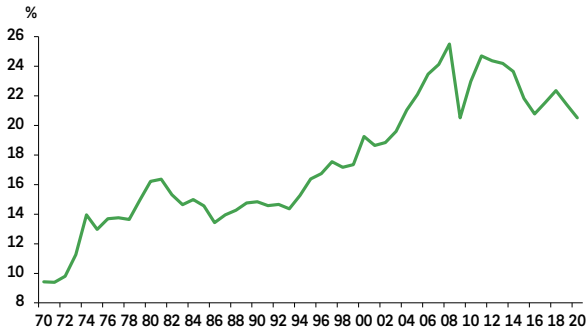


CHART 1

SOURCE: IMF, WORLD BANK, BNP PARIBAS

TARIFFS APPLIED TO THE VALUE OF IMPORTS, WORLD AVERAGES

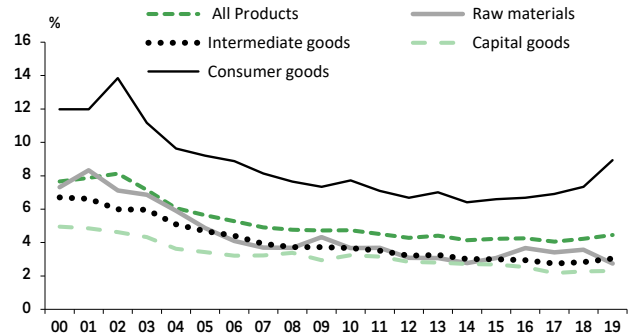


CHART 4

SOURCE: WORLD BANK, WITS

INTERMEDIATE GOODS EXPORTS & WORLD GDP

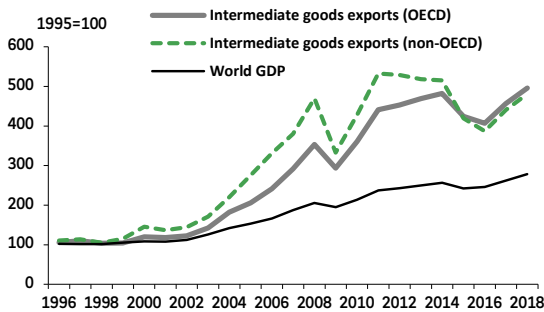


CHART 2

SOURCE: OECD, WORLD BANK, BNP PARIBAS

IMPORTS OF OECD COUNTRIES

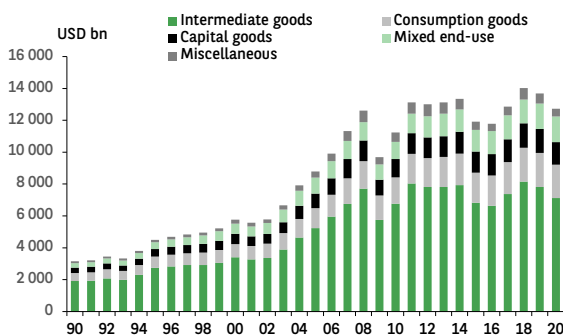


CHART 3

SOURCE: OECD, BNP PARIBAS

The second development is the growing integration of world markets. In many regions, customs barriers have come down (see Chart 4). In the European Union, the single market was created in 1993. In North America, the US, Canada, and Mexico signed the North American Free Trade Agreement that came into force on 1 January 1994. In 2011, a group of countries in East and Southeast Asia and the Pacific signed the Regional Comprehensive Economic Partnership. Another major step was the integration of China and the former communist countries in Central and Eastern Europe in the world trade system. Thirdly, transportation costs have fallen over time, partly thanks to the widespread use of container transport.

From the 1990s to the financial crisis of 2008, GVCs – both backward and forward participations – expanded significantly, which coincided with a period of rapid trade liberalisation (see Box 1). New export powerhouses emerged, first China, but also countries in Southeast Asia (Vietnam, Thailand, Malaysia), central and eastern Europe (Bulgaria, Czech Republic, Hungary, Poland and Slovakia), while manufacturing hubs such as South Korea and Taiwan strengthened their position.

However, this process has stalled since the global financial crisis of 2008. World exports, as a share of world GDP peaked in summer 2008 and has been on a downward trajectory since then (see Chart 1). Other indicators such as intermediate goods exports, FDI flows, and GVC participation have been trending down since that time⁶.

The rapid expansion of internal trade has drastically changed the world economy. Since David Ricardo developed the theory of the comparative advantage in the early part of the 19th century, economists agree that international trade can be advantageous for all countries. Countries will thus benefit from lower prices for imported goods, technological spill-overs, economies of scale (on goods where they have a comparative advantage) and productivity gains. Moreover, thanks to the splitting up of production processes, the developing countries could more easily participate in the global production process, particularly by using their comparative advantages on costs in labour-intensive activities. This process has had a positive impact on the productivity and income per capita in developing countries⁷. The global income distribution has become unipolar again, as was the case until the 1950s (see Chart 5).

⁶ See for example, *Globalisation has faltered*, The Economist, 24 January 2019. See also *Sustaining Global Value Chains*, Asian Infrastructure Investment Bank, 2021

⁷ See Ignatenko, Raeli and Mircheva (2019), *Global Value Chains: What are the Benefits and Why Do Countries Participate*, IMF Working paper.

