Analysis

Supply bottlenecks are having wide-spread impacts on the economy

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AUTHORS



Annika Lindblad
Senior Economist



Taina Sinivuori
Economist

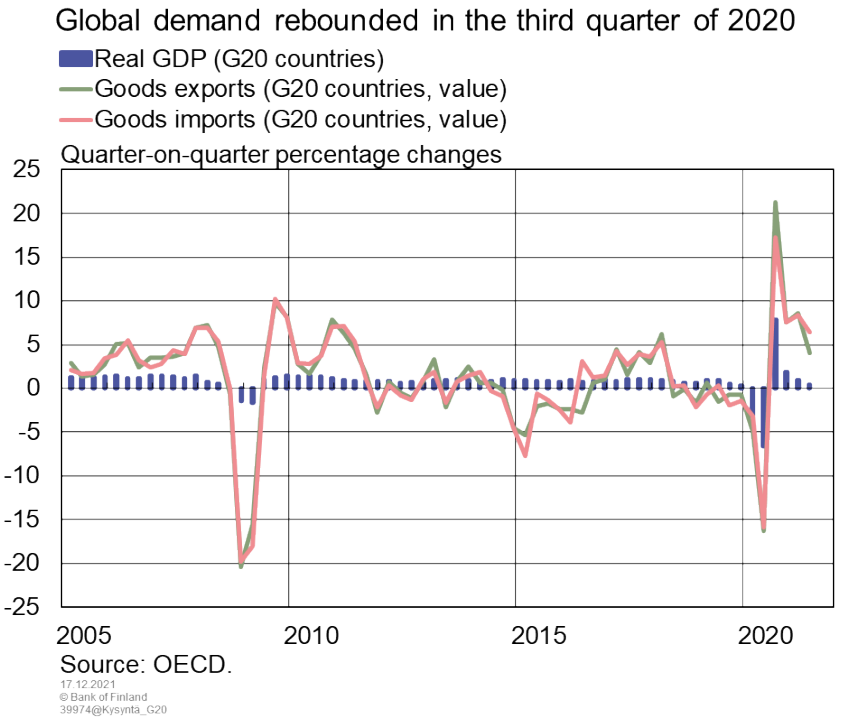
The supply-chain disruptions constraining world economic growth and the rise in raw material and shipping costs are inevitably affecting the Finnish economy. Finnish industrial output has recovered to pre-pandemic levels, even though manufacturers report supply bottlenecks, including materials shortages and logistics disruptions, widely limiting production in Finland. Supply bottlenecks are especially casting a shadow over Finnish industrial output and export growth.



In the spring of 2020 firms responded to the global collapse in demand caused by the COVID-19 pandemic by reducing production, which resulted in a lull in world trade (Chart 1). When

consumption picked up in autumn 2020, consumer spending shifted more towards goods on account of concerns surrounding the virus and restriction measures which were largely concentrated around the service industry. The surge in demand for consumer goods together with the slow ramping up of production has led to a global imbalance in supply and demand. Global supply bottlenecks in the production of semiconductors[1] and raw materials, shipping disruptions, and rising energy prices have closed factories, lengthened delivery times and pushed up freight and raw material costs since late 2020. Supply-chain disruptions have also slowed manufacturing output and export growth in the euro area.

Chart 1.



Finland's production structure has contributed to our industrial output withstanding the pandemic relatively well in 2020. However, business surveys suggest that Finnish manufacturers and exporters have been widely affected by tightening supply bottlenecks in 2021: about 36% of Finnish goods exports come from industries where at least half of manufacturers reported production running up against equipment and materials shortages in October 2021.

Supply bottlenecks are likely to have contributed to why manufacturing output, despite having recovered to pre-pandemic levels, has not kept up with growth in order books, which is being bolstered by strong global demand. While Finnish exports are recovering swiftly from their pandemic slump, supply-chain disruptions are creating headwinds to foreign trade growth. They are also raising consumer prices, which will moderate private consumption growth. The impact of

the supply bottlenecks on Finnish economic growth is also estimated in the forecast's alternative scenario, according to which growth would be some 0.5 percentage points higher in the absence of the bottlenecks in 2021.

Vulnerability of supply chains revealed by the pandemic

The container shipping industry had already fallen into disarray before global demand picked up in the third quarter of 2020. Disruptions began in the world's largest container ports in early 2020 and were caused both by a lack of handling capacity due to the pandemic and by the lull in manufacturing due to the Chinese New Year.[2] As a result of these disruptions, a significant number of the world's empty shipping containers were dispatched to the wrong ports, where they remained stranded.

Aggravating the situation were capacity reductions at large shipyards in 2020 and a smaller number of new shipping containers being manufactured in response to the contraction in world trade. In addition, the blockage of the Suez Canal in March–April 2021, port congestions, labour shortages and pandemic-related restrictions have all disrupted container shipping.

The semiconductor shortage, in turn, began with the car industry's global collapse in demand in the second quarter of 2020 while semiconductor demand surged in the electronics industry due to remote work and school and increased time spent at home. As the car industry's demand recovered faster than expected at the end of 2020, the demand for semiconductors was so great that it exceeded global supply.

Semiconductor manufacturers had also scaled back planned investments in 2019 due to oversupply issues and export controls imposed by the United States on China in 2018-2019 which restricted the sale of semiconductor software and manufacturing equipment.[3] Semiconductor delivery times have grown longer than ever in 2021. The longest delivery times at the end of October 2021 were for microcontrollers used in the car industry (38 weeks) and power management components[4] (25 weeks), while their normal delivery times range from 9 to 12 weeks.[5]

In addition to the rapidly increased demand for semiconductors themselves, there is also a shortage of magnesium and silicon discs, two semiconductor raw materials. As construction activity and consumption have recovered worldwide, the demand for commodities such as crude oil, metals and lumber has exceeded their supply. Supply-chain disruptions and factories being

closed or understaffed due to COVID-19 outbreaks have restricted growth in the supply of commodities. In addition, sharp rises in energy prices in 2021 have also affected the global supply and manufacture of commodities.

According to a report[6] by the Bank for International Settlements, Taiwan and South-Korea's semiconductor exports clearly exceed 2019 levels in spite of the supply bottlenecks. This is indicative of the grown demand for semiconductors. Although global chip manufacturers have announced plans to ramp up production and build new factories, capacity increases are not expected to raise output until 2023.[7]

ⓘ Asia plays a key role in global supply chains

Taiwan and South-Korea respectively control 63% and 18% of the global semiconductor manufacturing market.[8] Malaysia and Vietnam, in turn, are specialised in the packaging and testing of semiconductors. COVID-19 outbreaks are still closing factories and packaging facilities in Malaysia, even though the majority of its population is fully vaccinated. Inoculation rates are much lower in Taiwan and Vietnam. In addition, droughts, earthquakes and fires have also disrupted semiconductor manufacturing in Asia. One such event occurred in the spring of 2021, when Taiwan experienced its worst drought in 56 years. The manufacturing process for semiconductors requires vast amounts of water, but because of the drought, the use of water was heavily restricted in Taiwan. Bottlenecks in supply are thus being driven by a variety of factors.

Furthermore, China's strict COVID-19 policies in particular have caused delays in Chinese ports. Most container ships calling in China must quarantine for at least a week before they are allowed to berth and unload their freight.[9] In August 2021 a terminal at Ningbo-Zhoushan, one of China's busiest ports, was closed for two weeks after a single worker was diagnosed with COVID-19.

Shortages of raw materials are also being driven by a number of factors. For example,

China's Shaanxi province is one of the world's largest producers of magnesium. However, China has restricted its use of electricity due to a rise in world energy prices and coal shortages, among other reasons.[10] It follows that electricity restrictions in China are also reducing the production of magnesium.

Supply bottlenecks reinforce one another

Underlying the supply bottlenecks is a shift in demand towards manufactured goods. Increasing the supply of manufactured goods is difficult in the short term because of the capital intensity required in manufacturing. Manufactured goods are also dependent on inputs produced elsewhere in industry, as a result of which supply-chain disruptions in one industry are easily reflected in others. The semiconductor shortage in the car industry has an impact on the availability of commodities: mining companies in Indonesia need lorries to meet the higher demand for coal and minerals, but the delivery time on lorries is longer due to the semiconductor shortage. The semiconductor shortage in the car and electronics industries has slowly spread to other industries.

A second factor driving supply-chain disruptions are changes in the behaviour of the supply chain participants. Companies that use commodities and semiconductors in their production are preparing against materials shortages by increasing their stockpiles of commodities and semiconductors. This increases the incentive to build up buffers, which in turn aggravates the situation. The semiconductor shortage in particular is exacerbated by China's inventory policy, which involves stockpiling microchips and metals.[11] The complexity of supply chains has also made disruptions slow and difficult to fix.

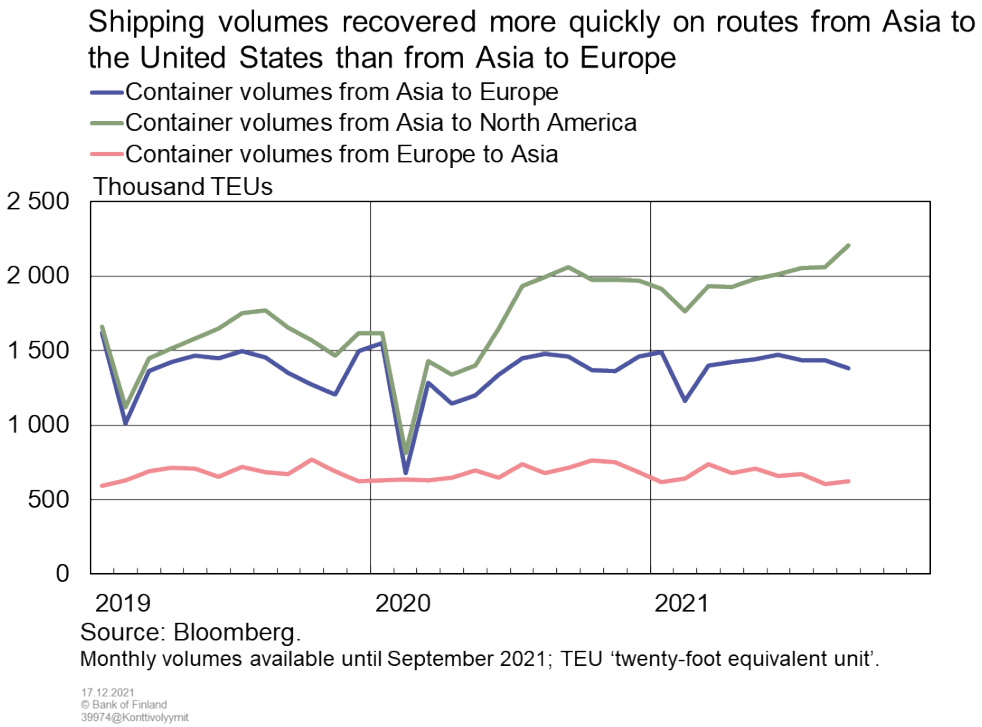
Shipping volumes are higher than before the pandemic

Soaring demand has also raised global container shipping volumes higher than before the pandemic. The rapid recovery of demand in the United States raised shipping rates on routes from Asia to the United States (Chart 3) and resulted in capacity being redirected here at the expense of other routes (Chart 2).[12] Container shipping volumes from Asia to the United States have consequently recovered faster than from Asia to Europe.

Container shipping volumes from Asia to Europe also returned to pre-pandemic levels but began to decline again in June 2021. Shipping volumes and container rates on routes from Europe to

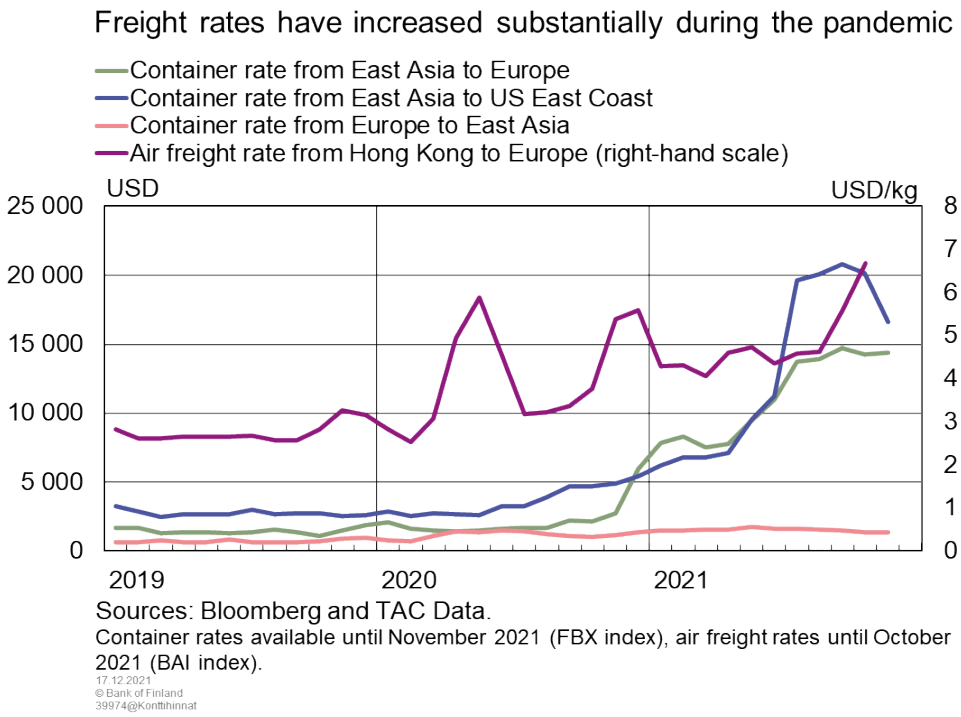
Asia, by contrast, have barely changed during the pandemic. The normal circulation of shipping containers is reflected in volumes between Asia and Europe, where more fully-loaded containers are shipped from Asia to Europe and more empty containers, in turn, from Europe to Asia.

Chart 2.



The shortage of the shipping containers available at the right place at the right time has raised shipping rates and made international shipping schedules exceptionally unreliable (Chart 3). As international travel has also come to a virtual halt, the cost of air freight has also increased, pushing up container-shipping rates even further.[13] Although the disruptions in shipping already began in early 2020, container-shipping rates only began to rise at the end of the same year, when previously negotiated fixed-price contracts expired. As of October 2021, container-shipping rates from Asia to Europe and the United States have started to fall.

Chart 3.



Due to the bottlenecks in shipping, 22% of port calls in northern Europe were missed during the second quarter of 2021. 47% of vessels en route from East Asia to northern Europe berthed within 24 hours of schedule. The imbalances in container shipping are projected to persist far into 2022, and even into 2023.[14]

ⓘ Container crunch also reflected in Finland

Finland is not exempt from the supply-chain disruptions caused by the pandemic. 92% of the volume of Finnish goods exports and 78% of goods imports were delivered by sea in 2019. Between 2019 and 2021 the share of Finnish exports delivered by land has increased by 1 percentage point. The share of Finnish imports delivered by sea has declined by about 3 percentage points during the pandemic, while the shares of imports delivered by rail and land have increased by about 2 percentage points and 1 percentage point, respectively.

The majority (62%) of Finnish goods exports are bound for Europe, where maritime shipping bottlenecks have remained mild. Similarly, Finland receives 62% of its goods imports from Europe. Asia accounts for 14% of Finland's goods exports and slightly below 14% of its goods imports.

Feeder shipping[15] and container handling in ports have functioned smoothly in Finland throughout the pandemic, and delays have been due to scheduling issues in ocean shipping. The number of port calls in Finland (excluding passenger ships) was 11% smaller in the first half of 2021 compared with the second half of 2019.[16]

The volume of inward freight (in tonnes) passing through Finnish ports in January–September 2021 was about 12% smaller compared with the same period in 2019. By contrast, outward freight has remained reasonably steady throughout the pandemic, albeit being about 6% smaller on average in January–September 2021 compared with two years earlier.

The effects of the global container shortage are also reflected in Finland. Finland's inward container traffic (TEUs, excluding transhipments) was about 18% smaller in September 2021 compared with September 2019, while outward traffic was about 15% smaller during the same period. Container freight accounts for about 15% of the total value of Finland's foreign trade. Containers are primarily moved in and out of Finland via sea transport.

Finland's forest and metal industries especially require the empty shipping containers that are brought into Finland for loading. In 2020, for example, 40% of all shipping containers brought into Finland were empty. However, Finland finds itself in an unfavourable position when it comes to the availability of empty shipping containers, as there is plenty of demand in other countries and Finland is situated at the far-end of the feeder network together with Estonia and Russia.

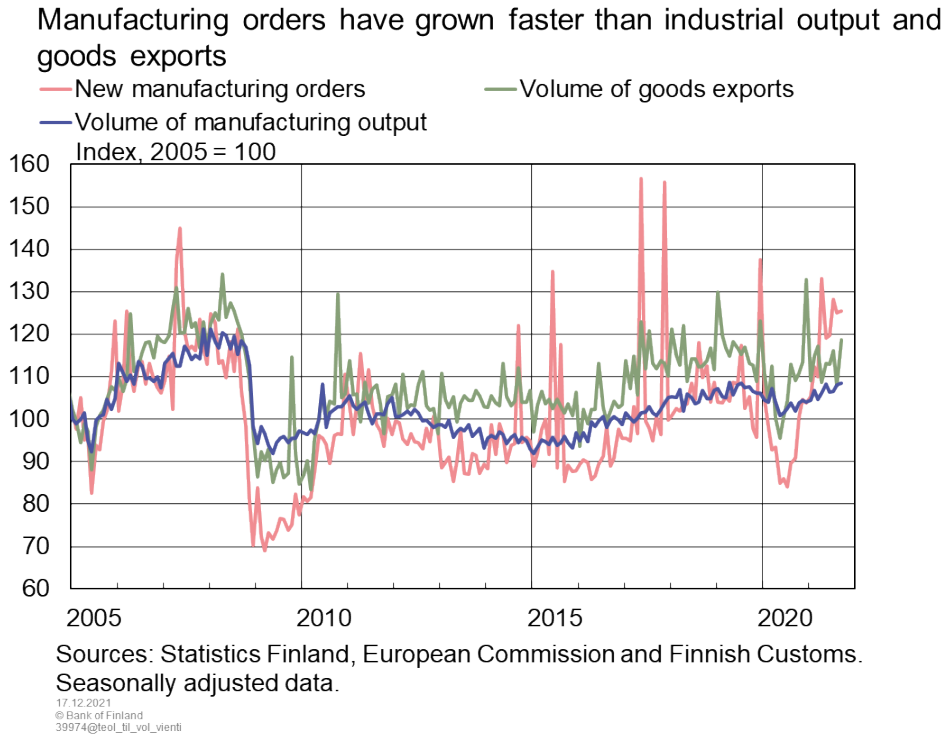
Feeder shipping means that vessels calling in Finland transport containers and freight from the Baltic Sea to Europe's major container ports. Vessels en route to Finland pick up empty containers along the way for use in Finland.

Finnish manufacturing output has not recovered at the same pace as new orders

Finnish manufacturing output had recovered to pre-pandemic levels in September 2021, but not substantially higher (Chart 4). Finnish goods exports recovered from the pandemic swiftly, but their growth has since slowed. New manufacturing orders, in turn, have risen sharply in 2021, reflecting the higher level of demand.

Manufacturing output growth has not kept pace with new orders. Finland's production capacity has not declined during the pandemic, so it has potentially been possible to ramp up production as demand has increased. The capacity utilisation rate in manufacturing was 86% in November 2021, clearly above its pre-pandemic levels. The utilisation rate bottomed out during the pandemic in August 2020, reaching only 54%.

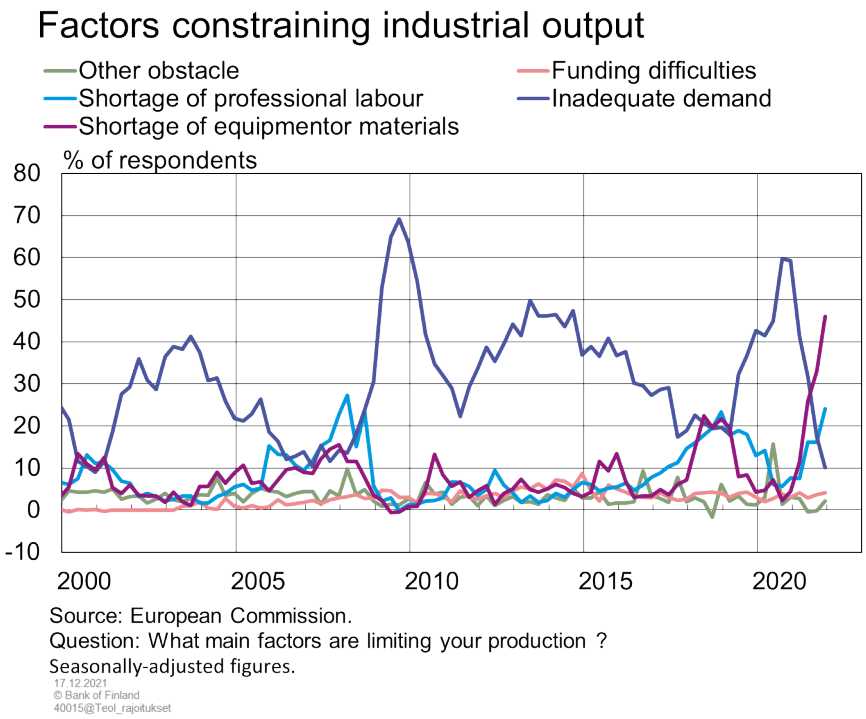
Chart 4.



According to the European Commission's Business survey, equipment and materials shortages are the largest limiting factor for manufacturing output in Finland. 46% of Finnish manufacturers that responded to the survey reported having experienced shortages in October 2021 (Chart 5). The corresponding figure for the euro area as a whole was 53%. The impact of the materials shortage has increased substantially in 2021. The Business survey would suggest that a materials shortage has never constrained manufacturing output so extensively in Finland before (recording started in

1995). In other industries, shortages of equipment or materials are less severe. In the construction industry 24% of respondents reported production being limited by shortages, and in services this figure was 1.3%.

Chart 5.



The second largest limiting factor for production in manufacturing is a lack of skilled labour, which likely reflects higher levels of demand. By contrast, insufficient demand, which has typically been the largest constraint on manufacturing output, is reported as having been a limiting factor by only 10% of survey respondents in October 2021. This is the smallest figure in over 20 years. Overall, the current challenges in the Finnish manufacturing industry are clearly concentrated around supply, not demand.

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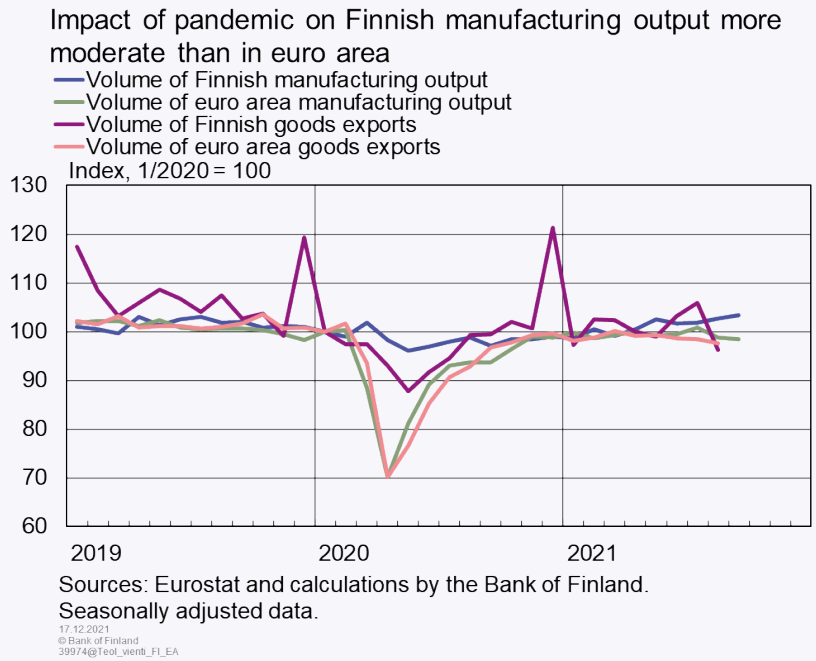
ⓘ Finland's production structure has cushioned the impact of the

pandemic

The pandemic has had diverse impacts on different industries and thus diverse impacts on different countries. The impact of the pandemic on Finland's manufacturing output and exports has so far been noticeably milder than for the euro area on average (Chart 6).[17] According to a report[18] by ETLA Economic Research, 16% of Finnish manufacturing output comes from industries that were worst hit by the pandemic on the level of the EU, such as the manufacture of motor vehicles and the textile industry; and 34% of Finnish manufacturing output comes from industries that were the least affected by the pandemic, including the pharmaceutical industry and the manufacture of computer, electronic and optical products. Finland's production structure has thus contributed to Finnish manufacturing output withstanding the pandemic relatively well so far.

What stands out looking at Finnish goods exports is that the pandemic only had a minor impact on exports of machinery and equipment. This may be due to the long order and delivery times on capital goods and the fact that Finnish order books were relatively full as the pandemic began. Machinery and equipment accounts for 13.4% of Finnish goods exports and is Finland's third-largest export industry.

Chart 6.



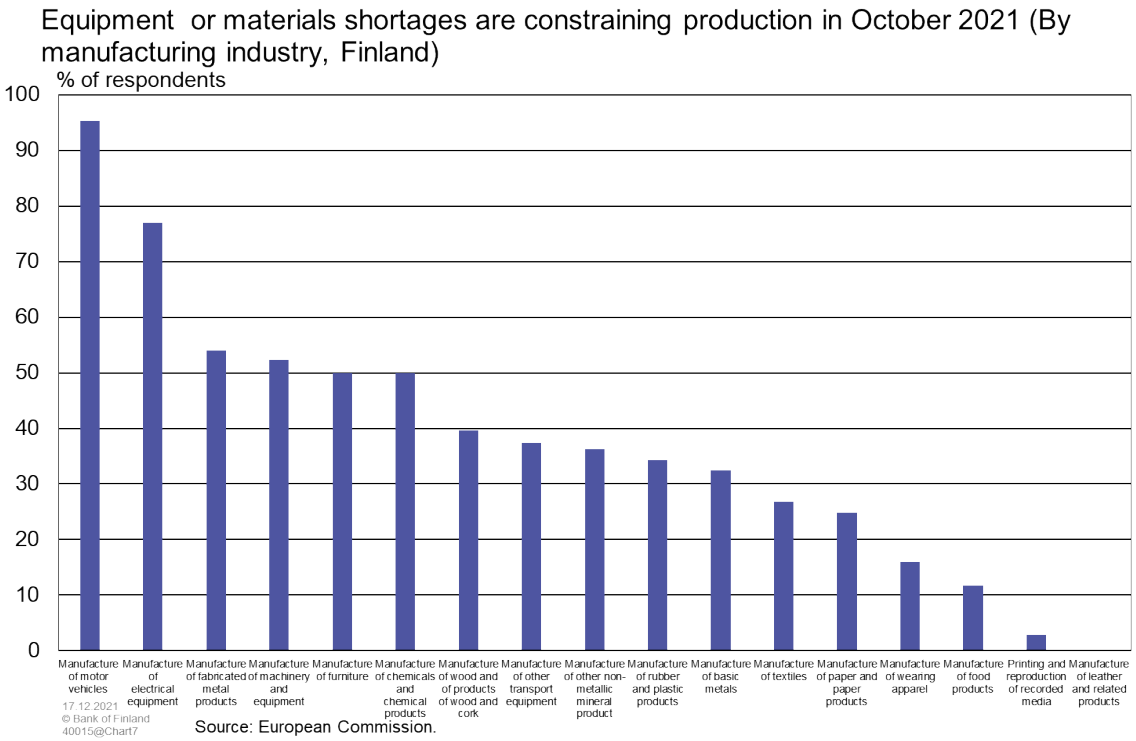
Materials shortages and logistics disruptions are affecting exports and export companies

In Finland, manufacturing accounted for 20.5% of gross domestic product in 2019 and 16.7% of gross value added [19]. The impact of the materials shortage has been unevenly distributed across industries (Chart 7 [20]). According to the European Commission's Business survey, materials shortages in 2021 have increasingly constrained production in the chemical industry, and in the manufacture of transport equipment, electrical equipment, machinery and equipment, and fabricated metal products.

The Finnish manufacturing industries most affected by equipment and materials shortages according to the Business survey are the manufacture of motor vehicles, trailers and semi-trailers, with 95.3% of firms reporting issues; and the manufacture of electrical equipment, with 77% of firms reporting issues. These industries account for only a very moderate share of Finnish gross value added, at 1.3%, and 12.4% of Finnish goods exports (Table 1).[21] The importance of the car industry to the Finnish economy is relatively minor compared with, say, Germany. In addition, a further 5.7% of Finnish gross value added and 23.4% of Finnish goods exports come from other manufacturing industries where at least half of firms reported suffering from equipment or

materials shortages in the October 2021 survey. These industries are the manufacture of fabricated metal products, machinery and equipment, chemicals and chemical products, and furniture manufacturers. Together these industries account for 7% of Finnish gross value added and 35.8% of Finnish goods exports.

Chart 7.



Industrial shares of Finnish gross value added and exports and imports (%) in 2019			
	Gross value added	**Goods exports**	**Goods imports**
Food industry[a]	*1.4*	*2.2*	*5.8*

Sources: Finnish Customs and Statistics Finland (basic prices in 2019, exports and imports by CPA).

[a] *Food industry incl. manufacture of food products, beverages and tobacco products.*

[b] *Textile industry incl. manufacture of textiles, wearing apparel and leather and leather products.*

[c] *Paper industry and printing incl. manufacture of paper, paper and cardboard products, printing and reproduction of recorded media.*

[d] *Chemical industry incl. manufacture of coke and refined petroleum products, chemicals and chemical products, pharmaceuticals and pharmaceutical products, and rubber and plastic products.*

Industrial shares of Finnish gross value added and exports and imports (%) in 2019			
Textile industry[b]	*0.2*	*1.1*	*3.8*
Manufacture of wood and of products of wood and cork	*0.6*	*4.1*	*1.0*
Paper industry and printing[c]	*1.8*	*14.9*	*1.2*
Chemical industry[d]	*3.1*	*19.2*	*17.4*
Manufacture of other non-metallic mineral products	*0.6*	*0.9*	*1.3*
Manufacture of basic metals	*0.7*	*13.1*	*5.6*
Manufacture of fabricated metal products	*1.4*	*2.1*	*3.2*
Manufacture of computer, electronic and optical products	*1.8*	*5.5*	*9.0*
Manufacture of electrical equipment	*0.9*	*5.9*	*5.2*
Manufacture of machinery and equipment	*2.7*	*13.4*	*9.0*
Manufacture of motor vehicles, trailers and semi-trailers	*0.4*	*6.5*	*10.1*
Manufacture of other transport equipment	*0.2*	*3.5*	*1.7*
Manufacture of furniture	*0.2*	*0.3*	*0.9*

Sources: Finnish Customs and Statistics Finland (basic prices in 2019, exports and imports by CPA).

[a] *Food industry incl. manufacture of food products, beverages and tobacco products.*

[b] *Textile industry incl. manufacture of textiles, wearing apparel and leather and leather products.*

[c] *Paper industry and printing incl. manufacture of paper, paper and cardboard products, printing and reproduction of recorded media.*

[d] *Chemical industry incl. manufacture of coke and refined petroleum products, chemicals and chemical products, pharmaceuticals and pharmaceutical products, and rubber and plastic products.*

As a share of output value, Finland's metal industry (incl. the manufacture of basic metals and fabricated metal products, machinery and equipment, transport equipment and the electronic and electrical industry) relies the most heavily on imported inputs, together with the chemical industry [22]. These industries are thus highly vulnerable to disruptions in the global supply chain. In addition to the industries suffering directly from materials shortages, it is important to consider the knock-on effects of these industries on other manufacturing industries.

Maritime shipping disruptions are also having effects on Finland. Shipping disruptions have affected all industries where raw materials, intermediate goods or final goods are transported across Finnish borders. According to the Finland Chamber of Commerce's export manager survey conducted in autumn 2021, a slightly higher proportion of Finnish exporters anticipate issues arising from logistics disruptions (84%) rather than semiconductor and materials shortages (82%). Logistics disruptions and materials shortages have clearly intensified over the course of 2021, as in the corresponding survey in the spring 69% of exporters reported suffering from logistics disruptions and 56% from materials shortages.

In 2019 the majority (63%) of Finland's goods exports comprised intermediate goods. Capital goods accounted for 22% of Finnish goods exports and consumer goods 14%. Finnish manufacturers of capital and intermediate goods especially reported suffering from materials shortages in the European Commission's October 2021 Business survey. 59% of Finnish capital goods manufacturers reported production bottlenecks due to equipment or materials shortages, while 47% of intermediate goods manufacturers reported the same.

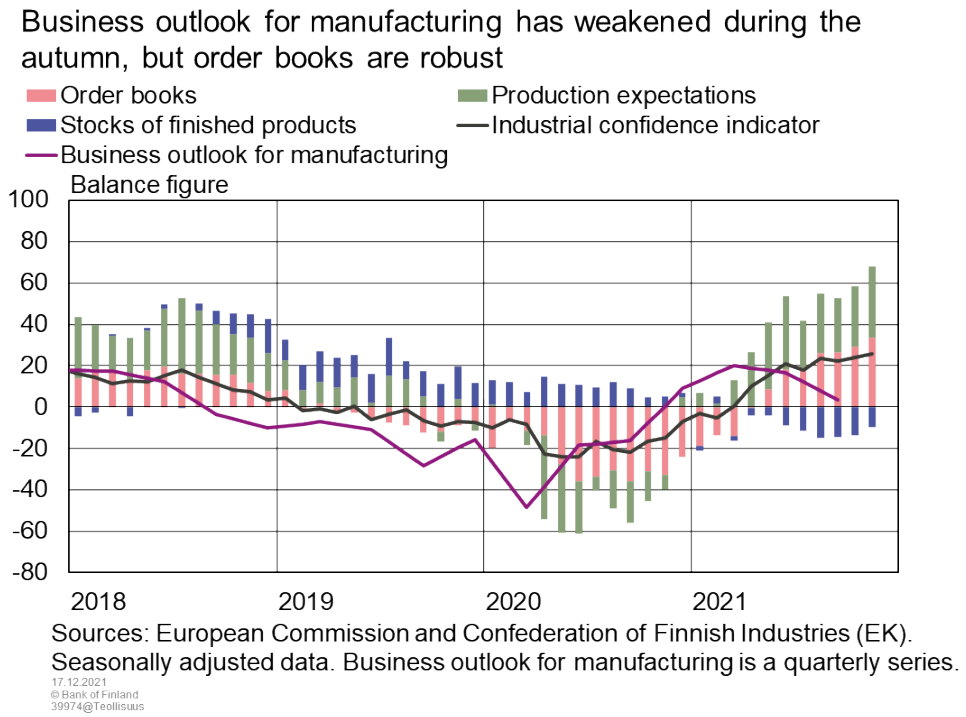
On the other hand, because Finnish exports are based around intermediate goods, issues relating to delivery times and price rises are not able to compound as they do further up the value chain. In the euro area, smaller countries have been impacted less by supply bottlenecks, as in these countries production is more concentrated around the beginning of the value chain and is less dependent on foreign inputs.

Industrial confidence is strong despite the supply-chain disruptions

Global supply bottlenecks, increased consumer spending on goods, and higher prices are all reflected in the manufacturing industry's confidence indicator in Finland. Manufacturers have seen their order books grow during the autumn; stocks of finished products are sold out; and selling-price expectations are higher than before (Chart 8). Production expectations levelled off

during the autumn but remained strong and reached their highest levels since 2006 in November. The industrial confidence indicator is markedly higher than in 2019. The industries with the highest confidence levels surveyed in November 2021 were the manufacture of textiles, electrical equipment, other transport equipment, and rubber and plastic products. The lowest confidence levels were surveyed in printing and reproduction of recorded media and in the manufacture of food products.

Chart 8.



Supply bottlenecks are likely to have contributed to production expectations moderating over the autumn and selling-price expectations rising. Manufacturers have reported that materials shortages and logistics disruptions have intensified over the course of 2021, and the business outlook for manufacturing has indeed weakened during the second half of the year. Although manufacturing output has not contracted this year, supply bottlenecks may limit the growth of manufacturing output. In spite of the semiconductor shortage, higher commodity prices and shipping bottlenecks, 63% of Finnish exporters expect exports to increase during the second half of 2021 compared with the first half of the year, according to the Finland Chamber of Commerce's export manager survey. Similarly, 73% of exporters expect exports to grow in 2022.

The imbalances in supply and demand are being sustained by supply bottlenecks as well as unprecedented consumer demand. How balance is restored will depend on a number of factors. These include how the pandemic will evolve and, in particular, how long it will take for the

composition of consumption to return to what it was before the pandemic, with more spending on services and less on goods. Other considerations include how quickly semiconductor and commodity investments will be carried out and production capacity expanded, or how the logistics bottlenecks at ports will be resolved. Similarly, it remains to be seen how much longer factories and ports around the world will be intermittently closed by COVID-19 outbreaks.

The supply bottlenecks are currently projected to ease starting in the latter half of 2022, which would strengthen global economic growth. On the other hand, a tightening of the bottlenecks could result in supressed growth and a longer period of high inflation than currently projected, which, in turn, might engender even stronger impacts on private consumption and wages.

Notes

1. Semiconductor materials include silicon, germanium, gallium arsenide, lead sulphide and indium phosphide. These materials are turned into semiconductor devices, such as integrated circuits (microchips), transistors, diodes, LEDs and solar cells. In this article 'semiconductor' refers to semiconductor devices. ↑
2. Ojala, L., Paimander, A. ja Kairinen I. (2021) Konttikuljetusten ajankohtaisselvitys, Logscale Oy. ↑
3. Asian Development Bank, 2021, Asian Development Outlook, Box 1.1.2: Developing Asia's electronics and automobile exporters at risk from the shortage of semiconductor chips. ↑
4. Power-management components let electronic devices, including photocopiers, computers, computer processors and computer graphics cards and peripherals, as such monitors and printers, to switch off or enter a low-power mode when idle. ↑
5. Wall Street Journal, 2021, Global Chip Shortage 'Is Far From Over' as Wait Times Get Longer. ↑
6. Bank for International Settlements, 2021, Bottlenecks: causes and macroeconomic implications (bis.org), BIS Bulletin No 48. ↑
7. European Commission, 2021, Supply side bottlenecks, Economic Forecast, Autumn 2021, Thematic Special Topics. ↑
8. Asian Development Bank, 2021, Asian Development Outlook, Box 1.1.2: Developing Asia's electronics and automobile exporters at risk from the shortage of semiconductor chips. ↑
9. Wall Street Journal, 2021, Global Supply-Chain Problems Escalate, Threatening Economic Recovery. ↑
10. China's electricity problems are assessed in more detail in BOFIT's weekly report: https://www.bofit.fi/en/monitoring/weekly/2021/vw202140_1/. ↑
11. Frohm, E., Gunnella, V., Mancini, M. and Schuler, T. (2021) The impact of supply bottlenecks on trade, ECB Economic Bulletin, Issue 6/2021. ↑

12. Frohm, E., Gunnella, V., Mancini, M. and Schuler, T. (2021) The impact of supply bottlenecks on trade, ECB Economic Bulletin, Issue 6/2021. ↑
13. Attinasi, M. G., Bobasu, A. and Gerinovics, R. (2021) What is driving the recent surge in shipping costs? ECB Economic Bulletin, Issue 3/2021. ↑
14. Ojala, L., Paimander, A. ja Kairinen I. (2021) Konttikuljetusten ajankohtaisselvitys, Logscale Oy. ↑
15. Feeder shipping means that vessels calling in Finland transport containers and freight from the Baltic Sea to Europe's major container ports. Vessels en route to Finland pick up empty containers along the way for use in Finland. ↑
16. UnctadSTAT, number of port calls, semi-annual. ↑
17. The spikes in Finnish exports in December 2019 and December 2020 are due to deliveries of vessels. ↑
18. In their publication Value Chains, International Trade and the Vulnerability of Economy (2021), particularly in section 2.4, authors Ali-Yrkkö, J., Kaitila, V., Kuusi, T., Lehmus, M., Pajarinen, M., and Seppälä, T. analyse the impacts of the COVID-19 pandemic on Finnish and EU manufacturing output and exports. ↑
19. Gross value added at basic prices is defined as output valued at basic prices less intermediate consumption valued at purchasers' prices. Gross domestic product at market prices, in turn, can be obtained by taking the sum of gross value added and product taxes (minus subsidies) for the economy as a whole. ↑
20. Survey responses are missing for Finnish manufacturers of beverages and tobacco products, coke and refined petroleum product manufacturers, pharmaceutical and pharmaceutical product manufacturers, and manufacturers of computer, electronic and optical products. ↑
21. The output of Finland's Uusikaupunki car plant, for example, is recorded as manufacturing services exports in the national accounts. Manufacturing services encompass processing and assembly done by an enterprise that does not own the goods in question. Ownership of the vehicles manufactured at the Uusikaupunki car plant remains with Germany throughout the production process, even though the cars are manufactured in Finland. Manufacturing services account for about 6% of all Finnish services exports. ↑
22. Pekkarinen, T. (2017) Tavaroista palveluihin – Suomen teollisuus rakennemuutoksen pyörteissä, Euro & talous. ↑

Keywords

COVID-19 pandemic, exports, Finnish economy, industry, supply disruption