NSW Treasury

# Economic data briefing:

Tuesday, 29 March 2022

# Global supply chains

## The impact of COVID-19 on global supply chains

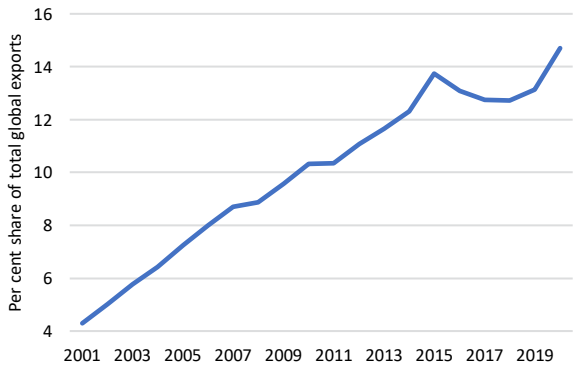
- Over the last few decades, increased globalisation has combined with the move towards 'just-in-time' inventory management. This has resulted in **undiversified global supply chains that operate on lean margins with limited capacity to respond to adverse shocks**. Dependence on regular, predictable shipments further limit the flexibility of supply chains to respond to sudden shifts in demand.
- **COVID-19 presented both a demand and supply side shock to global supply chains.** Restrictions and stimulus measures concurrently shifted spending away from services while driving unprecedented demand for goods. Conversely, restrictions adversely impacted the production and distribution of goods, especially in China - a major global supplier.
- The impact has been uneven across sectors. Crucially, **critical industries**, such as fertiliser and semiconductor chips, have struggled to meet demand. Because of limited ability to substitute these goods, supply chain issues in these sectors **impact downstream industries and lead to higher inflation**.
- Looking ahead the outlook is for **some supply chain pressures to ease over the course of 2022** as goods demand subsides from record levels, allowing for backlogs to clear. **However, some pressures appear set to persist into 2023 as supply side constraints continue to weigh heavily.** Investment is underway to increase capacity in certain critical sectors, but the benefits will only be seen in the medium to longer term. As always, future COVID-19 outbreaks present a downside risk.

### *Less diversified and lean supply chains*

As businesses have globalised, they have sought more cost effective and competitive markets for inputs. This has seen more manufacturing shift from western countries to Asia. As a result, global supply chains[1] have become increasingly geographically concentrated. China, in particular, has emerged as a popular manufacturing location over recent decades, making it a central player in supply chains. Since 2001, China's share of global goods exports has steadily climbed to around 15 per cent (*Chart 1)*.

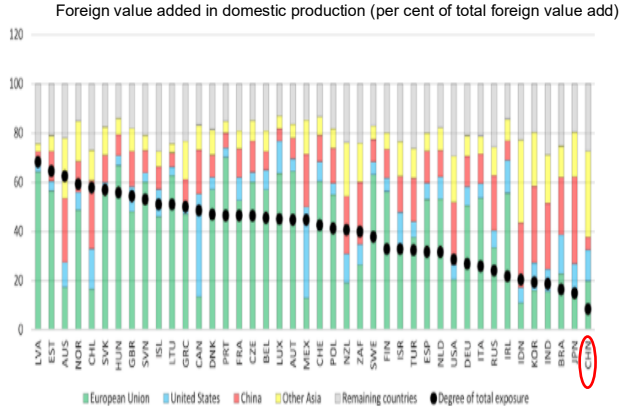
China's response to COVID-19 includes pursuing an elimination strategy that involves strict lockdowns and mobility restrictions. This policy mix has implications for China's manufacturing output and global trade. For example, in February 2020, when China imposed harsh restrictions on mobility, the value of total merchandise exports fell 62 per cent [2] compared to the previous month.

**Chart 1: Since 2001 China's share of total global exports has almost quadrupled**




Source: United Nations Conference on Trade and Development (UNCTAD) and NSW Treasury

**Chart 2: China's domestic production is least exposed to global supply chain issues**




Source: Organisation for Economic Co-operation and Development (OECD)

Disruptions are less likely to flow the other way because China has a smaller proportion of foreign value add in domestic production than other countries (*Chart 2)*. This indicates that China is significantly less susceptible to global supply chain disruptions. Much of the global risk around supply chains will continue to fall on China's domestic policy and particularly its approach to pandemic management. Continued adherence to an elimination strategy could see strains on production networks emanating from China that persist for the foreseeable future.

[1] A supply chain is a system of sourcing, producing, and delivering a good or service.
[2] World Trade Organisation, 2021.

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The concentrated nature of supply chains is especially evident in industries that manufacture critical inputs used in the production of a broad range of goods (for example, semiconductor chips). Due to high entry costs and requirements for a highly trained workforce or specialised equipment, it is not possible to quickly increase supply of these critical inputs. Moreover, these goods have limited substitution capacity, which leaves downstream businesses vulnerable to sudden changes in supply and cost.

At the same time, businesses have generally moved towards a 'just-in-time' logistics model, which operates on lean inventory holdings. This involves smaller, more frequent shipments that help businesses adapt to changing consumer preferences, while reducing warehousing costs and high inventory levels that tie up vital working capital. Given its lean operating margins, this model leaves little buffer to respond to sudden increases in demand.

***How has COVID-19 impacted global supply chains?***

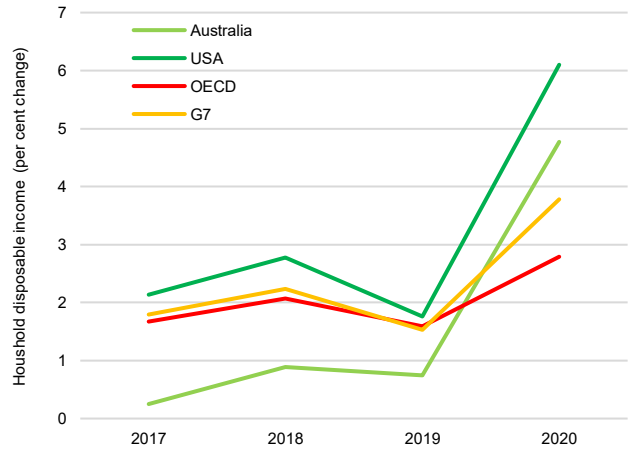
COVID-19 has had a material impact on global supply chains through both demand and supply effects. Shifts in consumer spending led to an unexpected increase in demand for goods. This burdened global supply chains that were also facing disruptions to labour supply, worker mobility, and other pandemic related barriers to production. The disruptions caused by COVID-19 have highlighted the vulnerability of undiversified and lean supply chains in many countries. According to the International Monetary Fund (IMF), supply chain disruptions lowered 2021 global gross domestic product growth by 0.5 – 1.0 percentage points, while adding 1 percentage point to core inflation.

*Shifts in demand patterns put pressure on supply chains*

In the early stages of the pandemic, many governments imposed restrictions to reduce mobility, especially in high-risk social settings, to help contain the spread of COVID-19. These measures were especially significant for many service sectors, such as hospitality and tourism. In many cases, working from home mandates or guidelines also were implemented, effectively forcing large amounts of the population to spend increased amounts of time in their homes, for both work and recreation. This consequently saw an increase in demand for household goods.

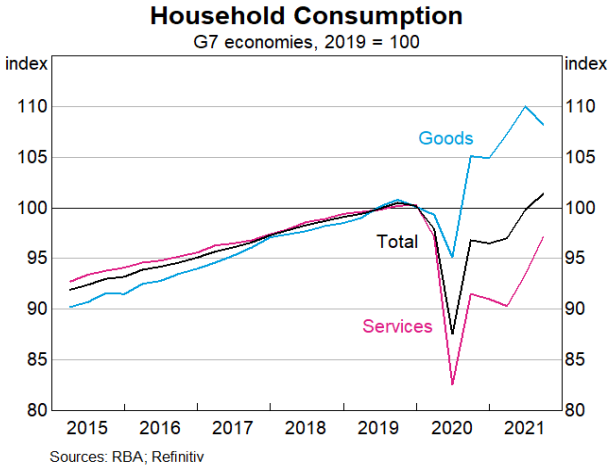
In addition, in response to restrictions, some countries (mostly in high- and middle-income countries) provided financial stimulus to help mitigate the negative shock to demand. During most economic downturns, income and saving levels normally drop as unemployment rises. However, COVID-19 related economic stimulus actually raised disposable incomes in 2020 (*Chart 3*). Additionally, most economies rebounded faster than expected from COVID-19 related downturns, leading to higher than anticipated economic activity. This fuelled consumption and led to an unprecedented demand for goods (*Chart 4*), which increased pressure on lean supply chains.

**Chart 3: Household disposable income rose in 2020, partly due to government support**




Source: OECD and NSW Treasury

**Chart 4: Demand for goods skyrocketed in 2020, while services demand fell sharply**




Source: Reserve Bank of Australia

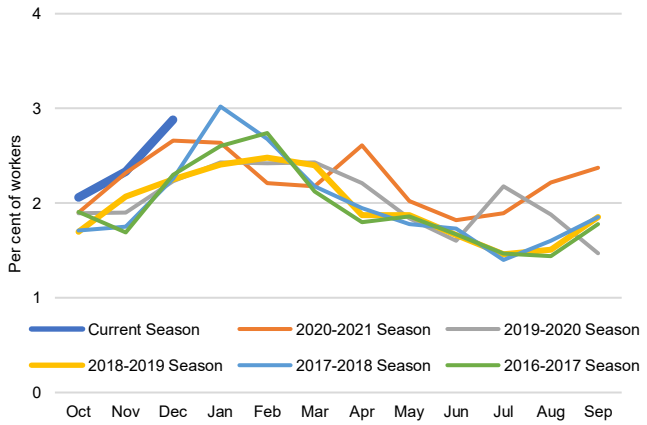
*Disruptions to production and distribution of goods*

COVID-19 and the associated containment measures restricted the supply and movement of labour. Initially, this was because of strict lockdowns and isolation requirements. However, the virus affected labour supply as it spread. People either become too ill to work, are required to isolate, need to care for someone who is sick, or voluntarily self-isolate to minimise exposure. The uncertainty generated around the day-to-day supply of labour makes it difficult for factories to maintain normal operations or scale up production to meet higher demand.

It is difficult to disentangle the various supply/demand impacts COVID-19 has had on labour utilisation. Nonetheless, in the OECD, the average number of hours worked by an employee fell 3.2 per cent in 2020 compared to the previous year[3]. In the United States, increases in health-related absenteeism during the pandemic has been material at times. Relative to pre-COVID-19 levels absenteeism has increased by more than ½ a percentage point, reaching 2.9 per cent in December 2021 (*Chart 5*).

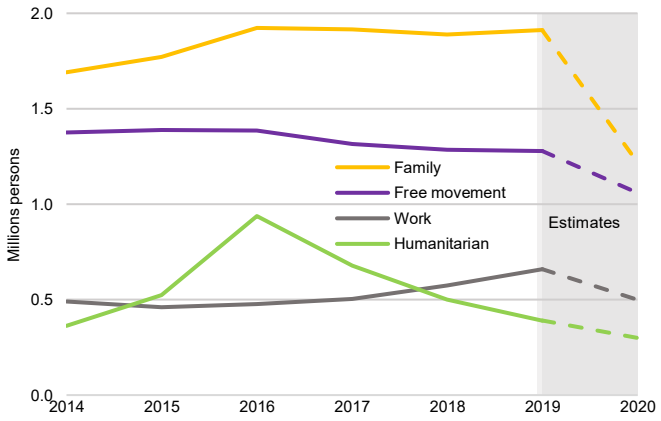
The global slowdown in migration has compounded labour supply disruptions. Due to COVID-19, in 2020, only 3.7 million permanent migrants arrived in OECD countries, a fall of more than 30 per cent from 2019 and the lowest level of migration since 2003 (*Chart 6*).

**Chart 5: Health-related absenteeism has increased in the US during the pandemic**




Source: United States Centers for Disease Control and NSW Treasury

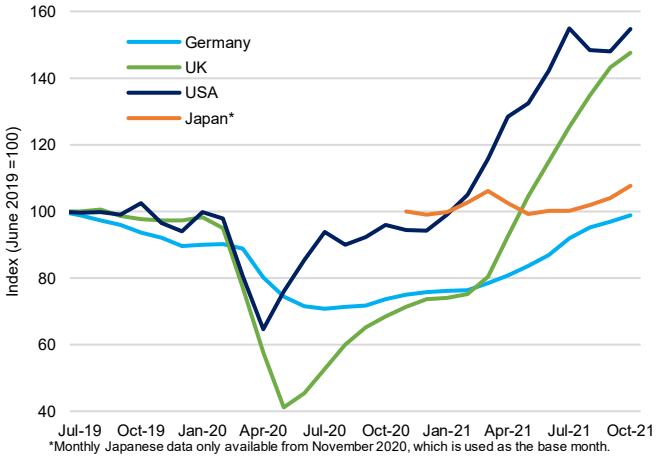
**Chart 6: In 2020 permanent migration to OECD countries dropped to its lowest level since 2003**




Source: OECD

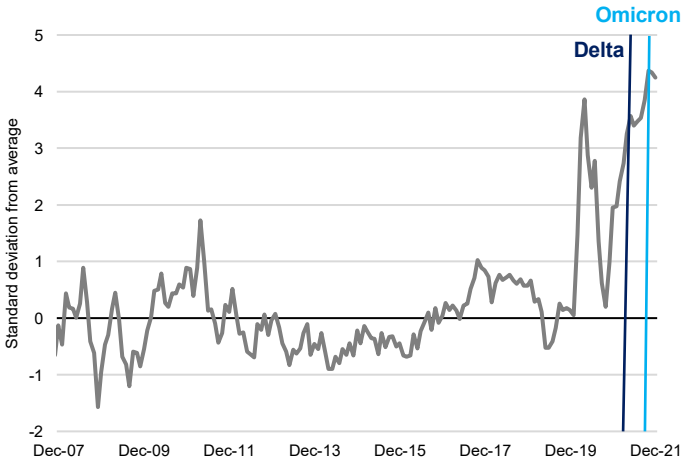
High job vacancy rates (*Chart 7)* indicate that businesses are still struggling to fill positions, a malaise that further exacerbates disruptions to both production and distribution. The Global Supply Chain Pressure Index (GSCPI), a composite index covering global transport costs and country-level manufacturing data that corrects for demand effects, shows that global supply chains have faced intense pressure since the onset of COVID-19 (*Chart 8*). During the pandemic, supply chains have struggled to operate 'business as usual', let alone a scale up of production to meet extra demand. This has contributed to the backlog and delays in supply.

**Chart 7: Job vacancies have increased during COVID-19 due to labour shortages**




Source: OECD, The Japan Institute for Labour Policy and Training and NSW Treasury

**Chart 8: Global Supply Chain Pressure Index - COVID-19 put severe pressure on global supply chains**



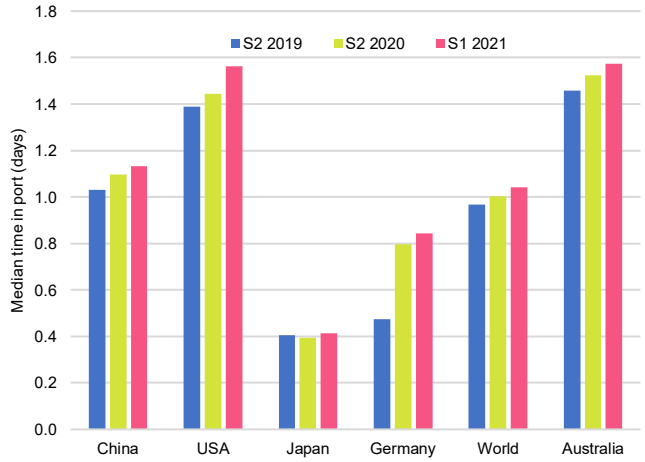

Source: New York Federal Reserve and NSW Treasury

The impact of restrictions has been acutely felt along distribution channels, including ports. *Chart 9* shows that compared to pre-pandemic, the median time spent at port for all ships has increased during COVID-19, albeit this is more evident in certain countries. Compounding the interruption to labour supply, health requirements imposed extra, time-intensive, processes that further delayed shipping. Additionally, having slumped at the beginning of COVID-19, crude oil prices have rebounded, hitting a seven year high in January 2022[4]. These disruptions and high fuel prices have contributed to a dramatic

[3] OECD, 2021.
[4] Bloomberg, 2022.

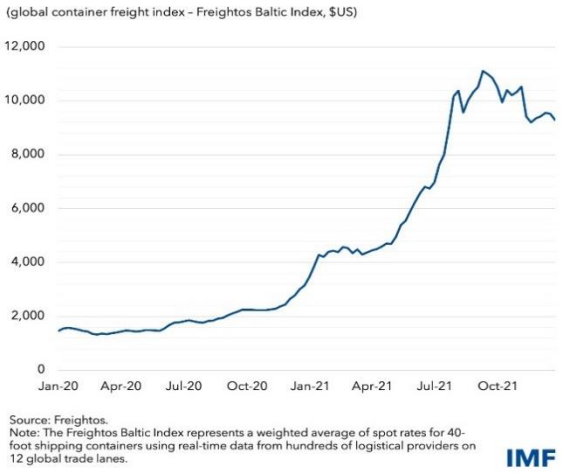
increase in shipping costs over 2021 (*Chart 10*). While freight costs have eased a little since September 2021, they remain elevated. This has major repercussions, as nearly 90 per cent of global goods are distributed through maritime transport[5]. According to the Supply Chain Stress Tracker (for the United States) produced by Oxford Economics, issues in transportation are making the largest contribution to supply chain stress, followed by higher upstream prices and strong demand. Higher transportation costs eat into margins and make it less economical to supply some goods. If there is strong demand for these goods, the higher costs get passed on to the consumer leading to the higher global inflation currently being experienced.

**Chart 9: Median time in port for all ships has increased due to COVID-19**




Source: UNCTAD and NSW Treasury

**Chart 10: Global shipping rates have eased, but remain elevated**




Source: International Monetary Fund

***Which sectors are most affected?***

Supply pressures are being felt in key upstream and distribution industries such as transport and manufacturing which, in turn, are contributing to broader impacts across the global economy. The housing and food sectors have also been stand-outs in terms of affected sectors.

*Industries that use semiconductors as direct inputs*

Semiconductors play a vital role in electronics, vehicles, and communications equipment. It takes almost 26 weeks to manufacture a semiconductor using a highly skilled workforce and specialist equipment. Thus, it is not possible to quickly scale up production to meet higher demand. More than 70 per cent of the semiconductor manufacturing market is controlled by two Asia based companies - Taiwan Semiconductor Manufacturing Co and Samsung Electronics. In 2021, the price of semiconductor chips rose by 10-20 per cent[6] reflecting strong consumer demand for goods that use semiconductors (for example, gaming equipment), while the effective production duopoly of the leading firms made it very difficult to source chips from other suppliers. Higher prices of semiconductors subsequently flow into higher prices of a broad range of goods. Prices have increased by more in manufacturing industries that used semiconductors as a direct input versus those that did not[7].

As at January 2022, demand for semiconductors was already 17 per cent higher than in 2019, while stocks were extremely low – median inventory for key chips has fallen from 40 days in 2019 to less than 5 days now[8]. This impacts supply and prices for upstream goods. Because of semiconductor shortages, global light vehicle production is expected to have fallen by around 6 per cent in 2021 and is forecast to drop by a further 9.3 per cent in 2022[9]. This is partly due to car manufacturers cancelling or slashing orders at the beginning of the pandemic on the assumption that car sales would drop. With demand not falling to the extent expected, car makers have found themselves at the back of the queue as semiconductor manufacturers prioritised other sectors like electronic goods. This is seen in Apple and Samsung's December 2021 quarter results, which indicate that despite semiconductor chip shortages, major smartphone players saw their profits rise.

[5] World Economic Forum, 2021.
[6] Bloomberg, 2021.
[7] Federal Reserve Bank of St Louis, 2021.
[8] United States Department of Commerce, 2022.
[9] IHS Markit, 2021.

*Electric vehicles*

In addition to semiconductor chip shortages, car manufacturers are struggling to source lithium, a key component in electric vehicle (EVs) batteries. EVs are generally more expensive than fuel consuming cars but demand has surged in the last two years due to higher household disposable income (due in part to stimulus support provided by governments during the pandemic) and government initiatives to incentivise EV purchases. Global sales of EVs doubled in 2021 from the year earlier and, since 2019, EVs have more than tripled their market share of global vehicles sales[10]. However, lithium production has been unable to meet higher demand. Supply is limited as scaling up production or operationalising new mines is expensive and time consuming. In 2021, this combination of limited supply and high demand drove a 431 per cent jump in lithium carbonate prices[11].

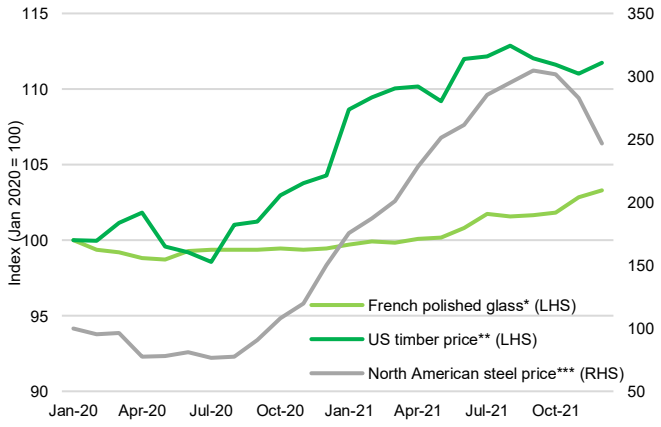
These higher costs are passed on to consumers. The cost of batteries is expected to rise by 2 per cent this year[12]. While this increase appears marginal, the underlying trend has been for battery prices to decline. This rise is significant because it pushes back the timeframe at which prices fall below USD $100/kWh – generally seen as the point at which EVs reach price parity with fuel consuming vehicles and become more affordable – by two years[13].

*Housing*

In a normal economic downturn, falling disposable income weighs on demand for housing while increasing supply as some borrowers, facing mortgage stress, are forced to sell. This would see house prices decline in the early part of the downturn. However, by contrast, house prices have risen steadily during the pandemic. The IMF's Global House Price Index, a composite of real house prices in nearly 60 countries, shows that house prices rose during 2020. In nearly 23 countries, the annual increase was greater than five per cent[14].

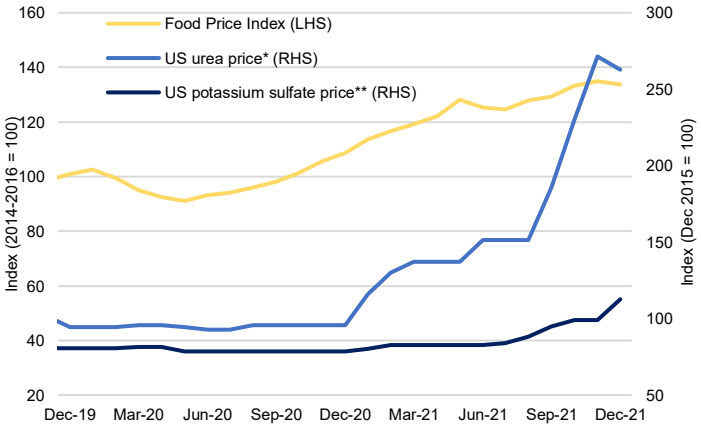
An extremely expansionary monetary and fiscal environment helped fuel demand for new houses and renovations. This has increased pressure on supply chains and costs for critical inputs such as timber, steel, and glass (*Chart 11*). The International Construction Market Survey 2021 points to higher construction costs. Over a third of respondents reported that the pandemic had a high or significant impact on their supply chains. The Survey indicates that the price of structural steel beams, reinforcement bars, softwood timber and copper pipe all have risen sharply, with an increase of up to 40 percent (year-on-year) being observed in some markets. Labour constraints and logistical issues are blamed for the increases and have led to construction delays and a rise in construction prices. Survey respondents expect these higher construction costs to continue.

**Chart 11: The cost of basic household materials has increased during the pandemic**




Source: Bloomberg and NSW Treasury
* France PPI Polished Sheet Glass
** US PPI Logs Bolts Timber Pulpwood & Wood Chips
*** North America Steel Hot Rolled Coil Spot Ex-Works

**Chart 12: The cost of food has risen sharply during COVID-19, driven recently by a spike in fertiliser prices**




Source: The Food and Agriculture Organisation of the United Nations (FAO), Bloomberg and NSW Treasury
* US Pacific Northwest Urea Granular Spot Price
** Potassium Sulfate Pacific Northwest Ask Price

[10] International Energy Agency, 2022.
[11] Australian Financial Review, 2022.
[12] Nikkei Asia, 2022.
[13] Bloomberg NEF, 2021.
[14] IMF, 2021.

*Food*

Global supply chain issues, combined with hoarding, speculative behaviour and rising fuel prices have contributed to food shortages and higher prices. Like other sectors, food distribution has been affected by container shortages, limited port capacity and COVID-19 restrictions that affect food production, like worker isolation requirements. Additionally, high energy prices and food demand have increased fertiliser prices.

Again, the undiversified nature of these supply chains is at work. China is a major exporter of common fertilisers, such as urea and phosphate. Rising domestic fertiliser prices have led to informal bans on fertiliser exports, with Chinese fertiliser companies given government guidance to prioritise local markets. In October 2021, directives apparently were issued restricting the export of phosphate until at least mid-2022.

Reflecting this, the price of fertilisers commonly used in Australia rose by nearly 230 per cent in 2021[15], contributing to a rise in food prices (*Chart 12*). The FAO Food Price Index, which measures the monthly change in international prices of a basket of food commodities, reached a ten year high in December 2021, reflecting the increased pressure that COVID-19 has placed on global food supply chains.

**The outlook for global supply chains**

Supply chain disruptions will likely continue in 2022 before easing somewhat at the end-2022/early-2023. In its January 2022 World Economic Outlook, the IMF expects global demand-supply imbalances and supply chain issues to slowly decrease in 2022. As restrictions on borders and mobility are eased, demand should shift away from goods as service sector demand rebounds. As governments transition away from restrictions and pandemic stimulus to 'living with COVID-19', there will be less support for disposable income and saving rates should fall sharply. These factors should relieve some demand-side pressure on global supply chains.

Existing supply-side constraints and high fuel prices will be key going forward. Although shipping costs are easing, the IMF argues they could remain somewhat elevated given ongoing issues: backlogs and port delays, labour shortages in related occupations and disruptions to inland distribution networks, such as road transportation. Maritime transport also needs to address longer-term challenges such as slow capacity growth and consolidation of market power with a few carriers. Additionally, the outlook for oil prices is always uncertain, but even more so at present given tensions between Russia and the Ukraine.

Meanwhile, COVID-19 will continue to create a highly uncertain environment. Any new variant and corresponding government restrictions or stimulus will adversely impact global supply chains. The GSCPI highlights how quickly new variants lead to steep rises in supply chain pressures (*Chart 8 – Delta versus Omicron*). China's 'zero tolerance' COVID-19 policy means restrictions can be reimposed any time cases rise. Any restrictions will have repercussions for global supply chains, given China's central role in global trade.

In the medium to longer term, there are positive signs that COVID-19 has prompted governments and businesses to invest in diversifying supply chains and increasing distribution capacity. Globally, USD $1.7 trillion is forecast to be spent on port infrastructure investment pipeline until 2040, equivalent to 0.07 per cent of global GDP. But this is less than the projected 0.09 per cent of GDP required to meet funding needs[16]. However, it will take some time for these investments to bear fruit.

Meanwhile, investments by Intel, Samsung and TMSC in new American semiconductor chip factories are not expected to be completed until the end of 2024/mid-2025. Notwithstanding this, semiconductor manufacturers believe they can address existing backlogs by the end of2022.

Moreover, diversifying supply chains is an expensive and lengthy investment and is highly vulnerable to geopolitical risk. Last month, Serbia revoked Rio Tinto's permits for a lithium mine. The mine was expected to produce 58,000 tonnes of battery grade lithium carbonate per year and would have significantly eased lithium shortages[17].

Governments also are supporting businesses to build resilience given the high risk associated with undiversified supply chains. The United States government has announced USD $50 billion to fund semiconductor manufacturing and research, while the Australian government has allocated nearly $107 million for Australian manufacturers to use towards building supply chain resilience. The longer term economic, political and health repercussions of COVID-19 also will be important in how successfully supply chains adapt and build capacity to respond to future shocks.

[15] Australian Broadcasting Corporation, 2022.
[16] Global Infrastructure Hub, 2021.
[17] Rio Tinto, 2021.