

International trade, global supply chains and monetary policy

Silvana Tenreyro says global supply chains can improve a country's productivity and income. But the benefits they bring are not evenly spread across sectors

will talk about international trade, global supply chains and their implications for monetary policy in the UK. I will first discuss some of the reasons for international trade, and how the development of global supply chains has increased the scope for trade.

In the context of recent disruptions to global supply chains, I will then examine some past crises affecting trade volumes and compare these to the trade disruptions during the pandemic. I will finish by explaining what I think this means for monetary policy and setting out how I see the current economic outlook. I will make three key points:

- International trade brings benefits in the form of higher productivity and increased average incomes. The development of global supply chains has allowed further gains to be realised. While in the past there have been questions over whether trade and global supply chains also have costs by increasing income volatility, recent evidence suggests that trade can also reduce income volatility by allowing countries to diversify their risks. Trade and supply chains have also proved resilient in the face of crises.
- Recent disruption to global supply chains has arisen because of an unprecedented combination of a strong rotation in global demand towards some sectors – mostly goods, and away from others, mostly services – and a variety of reductions in supply, particularly affecting a few critical inputs. The rotation in demand reflects changes in consumption patterns brought on by the pandemic, which made some types of consumption less desirable, given the associated health risks.

It has also been influenced by the large fiscal programs in place in a number of economies. Many of the reductions in supply have also been COVID-related, with lockdowns taking place across the world, while several other disruptions have been idiosyncratic.

- In the UK, the economy has not yet recovered to the employment and output trends we would have seen without the pandemic. At the same time, a range of temporary factors have been pushing CPI inflation above target, and will continue to do so over the coming months.

Some of these, such as base effects and the direct impact of energy price rises, are short-lived, and monetary policy can do little to offset them: much of the effect of policy would not come until after their impact had faded; more important will be any indirect effects of energy prices on real incomes or production costs. The effects of supply chain disruption should also be temporary, and unwind as supply of some goods increases, and as demand rotates back towards pre-COVID consumption patterns.

The current supply chain disruption will also ultimately be temporary. For some products, disruption and its effect on inflation are likely to dissipate quickly as firms find new suppliers or current ones are able to expand

The speed of this rotation is a key uncertainty, and will be related to the evolution of the pandemic around the world. In the UK, domestic cost pressures will depend on the evolution of the labour market now that the furlough scheme has ended. My policy votes will aim to strike a balance between these different effects and risks while bringing inflation back to target sustainably.

Trade and global supply chains

Global supply chains have been dominating the news agenda. Just as the global financial crisis brought the financial system to the attention of the general public (as well as many economists), so too has the pandemic moved the workings of modern supply chains from the background to the front page. But while the focus on these complex production networks is new, many of the debates hark back to some of the oldest questions in economics: the benefits and potential costs of international trade.

International trade affects the daily lives of almost everyone in the world. In the UK, with around one-third of the consumer price index basket consisting of imported goods and services, our typical supermarket basket would look very different without it. Trade brings many benefits.

By allowing different countries to specialise in products they can produce more efficiently, it increases average productivity and incomes. We can also purchase more varieties of the same products: French and Italian cheeses to supplement British ones, for example.

And international trade integration can boost the productivity of UK firms – irrespective of whether they trade directly¹ – in several different ways: firms learn from best practices abroad and adopt new technologies developed elsewhere², and greater international competition favours more productive firms.

The development of global supply chains – production processes that use intermediate goods and services sourced from other countries – are a natural extension of this logic. A large share of trade has always consisted of inputs used in production, as opposed to imported final goods and services.

But in recent decades, global supply chains have continued to grow in importance. This reflected large reductions over time in the cost of transporting goods, initially through industrialisation.

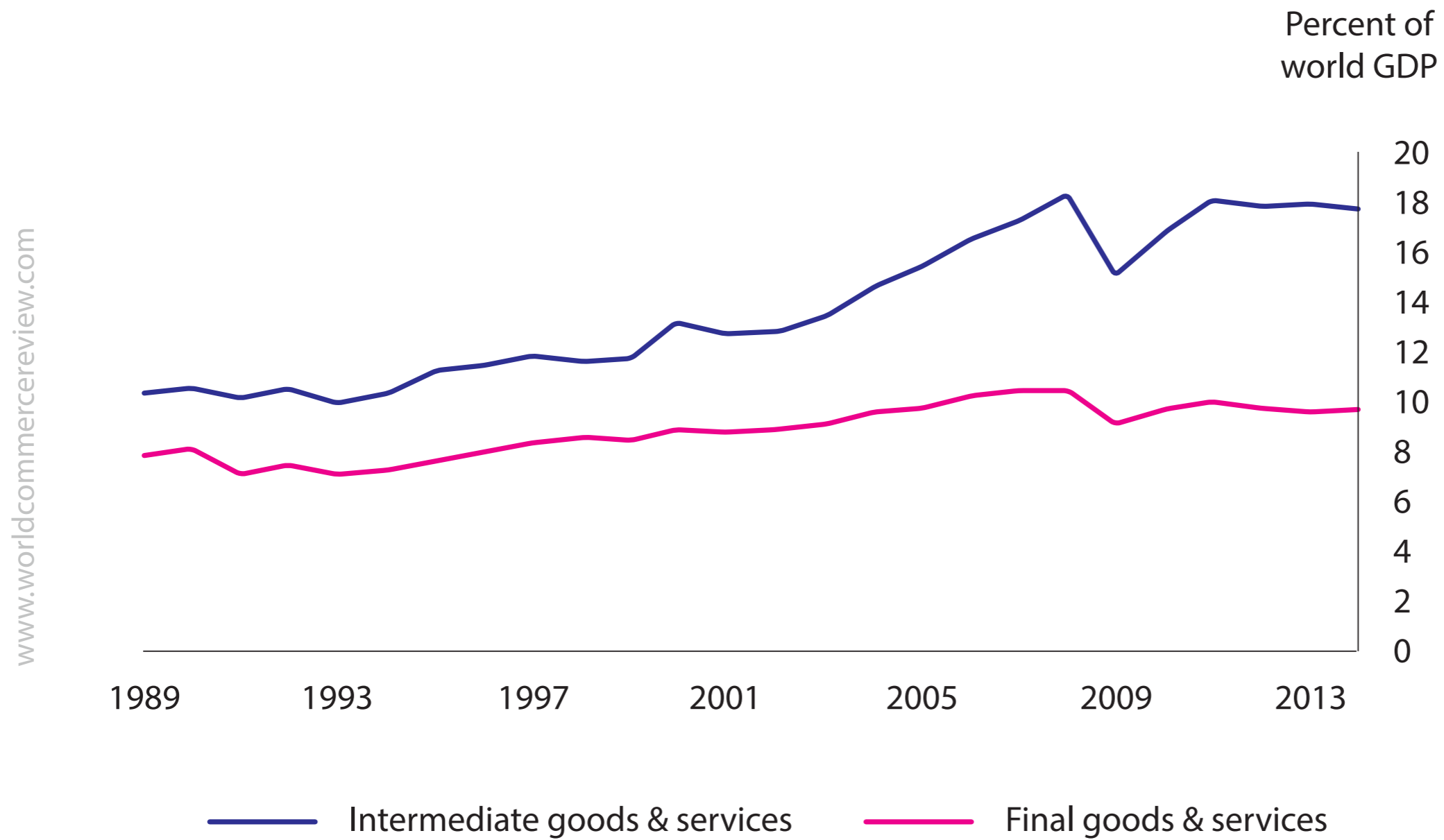
More recently, progress in information and communications technology has made it easier to transport ideas, thus enabling the coordination of work at a distance³. As a result, supply chains have also become longer and more complex, with stages of production offshored or unbundled across various firms located in different countries.

As a concrete example, all you have to do is look down at your smartphone; from design to delivery, our mobiles have been designed and constructed using the flow and exchange of know-how and parts and components produced and assembled across multiple borders.

To measure the increased importance of supply chains in international trade, there is a range of different metrics we might consider. Chart 1 shows that as a share of world GDP, intermediate input trade had increased far faster over the 20 years to 1990 than trade in final goods and services.

We might also want to know about how exposed different countries are to each other, either to measure risks and vulnerabilities, or to trace out how shocks in one region may transmit to others. These bilateral exposures are more complex to quantify.

Chart 1. Trade in intermediate and final goods and services



Source: Carney (2017), using data from Johnson and Noguera (2017), Powell (2016), World Input-Output Database (2016 release) and BIS.

For example, we might think of a British car, say a Mini, as being produced in Plant Oxford in the UK, because that is where final assembly happens. But by 2016, over half of the parts used in cars assembled in the UK are produced abroad⁴.

Even taking these inputs into account would miss links in the network, however, since each input may be produced using sequences of inputs from elsewhere: the engine could contain cylinders from Germany, containing pistons from China, and so on.

To try to capture the indirect links in the network, in Caselli *et al* (2020), we build a quantitative model of trade with global supply chain networks for all countries using data from the 1970s to the 2000s. The model allows researchers to trace how economic shocks in one or more countries (or sectors) transmit across other countries and sectors in the network, and to study quantitatively how that transmission has evolved over time, as countries and supply chains became more integrated⁵.

A more recent paper by Baldwin and Freeman (2021) proposes a measure of foreign input reliance based on gross, or cumulative trade⁶. This index gauges the total potential exposure to shocks emanating from abroad. Disruption to production or shipping from one country, due to a COVID lockdown, for example, is likely to affect the total value of goods produced or shipped, irrespective of the source of the inputs⁷.

Both papers stress that the substitutability between different intermediate inputs as well as the possibility to diversify suppliers will influence how a shock in one country affects its trading partners, a point I will come to discuss below.

As global supply chains have expanded the scope for international trade, many of their benefits correspond closely to those from trade in general. Supply chains allow even more specialisation, again increasing productivity and average incomes. Lower cost or higher quality inputs, and a greater variety of inputs can do the same.

Supply chains also offer more possibilities for productivity gains from learning and technology spillovers: between importers or exporters and their suppliers or buyers, including via activities like the sharing of blueprints or managerial practices⁸.

So trade and integrated global supply chains bring benefits in the form of higher national income. An important caveat is that these benefits may not be evenly distributed across societies, unless governments use the gains from trade to compensate any workers or consumers who lose out.

That said, if giving up globally integrated trade makes the overall level of aggregate income smaller, these losses often tend to fall on the lower part of the income distribution. From an aggregate perspective, given the disruption we have seen to supply chains in recent months, it is also important to assess whether there are other potential costs or risks.

One possibility is that while trade and supply chains raise the level of income in an economy, they could also make it more volatile. This was once a widely held view by economists, based on the idea that increased specialisation in one sector, which goes hand in hand with international trade, increases the exposure to shocks to that sector⁹.

For example, the UK has long specialised in the export of financial services, which means that trade is likely to be disproportionately affected by shocks to the financial sector, as occurred during the 2007-08 global financial crisis.

My own research has highlighted that there is an offsetting effect, however, which means that trade can actually reduce income volatility, and typically has done so in the past. In Caselli *et al* (2020) we explain how higher trade integration allows countries to rely on a more diverse set of suppliers and buyers. This reduces the domestic economy's exposure to shocks to any single producer or country that they trade with.

If the supply of labour falls in the UK, for example, this has a smaller effect on our UK car manufacturer than it would for a firm with a less diverse supply chain, since the shock has no direct effect on the cost of its imported inputs. Other recent studies echo these conclusions.

For example, recent work by Bank of England economists¹⁰ concludes that a blanket reduction in supply chain integration can be economically costly while not significantly reducing economic volatility; and that reshoring production would increase aggregate volatility by reducing source diversification¹¹.

This diversification channel also allows countries to pool technologies, as we saw in the recent example of vaccine development. Only a small number of countries witnessed the successful development of COVID vaccines, but a much larger number have been able to benefit from their discovery.

How do the recent supply chain disruptions, which have dominated news cycles, fit into this framework? We have seen widespread supply shortages, bottlenecks and transport disruptions over the past year.

Some of the causes have been idiosyncratic – such as the grounding of the Ever Given ship in the Suez Canal in March. Have these highlighted additional risks or fragilities in global supply chains that negate some of their benefits?¹²

While this is possible, as I will come on to discuss, many of the disruptions have been directly or indirectly related to COVID. As a shock that has been global in nature, it seems likely that there are limits to how easily its effects can be diversified away. To get some indication of how, and how quickly, such global shocks to supply chains might unwind, we may be able to learn from similar examples in the past.

Past supply chain crises

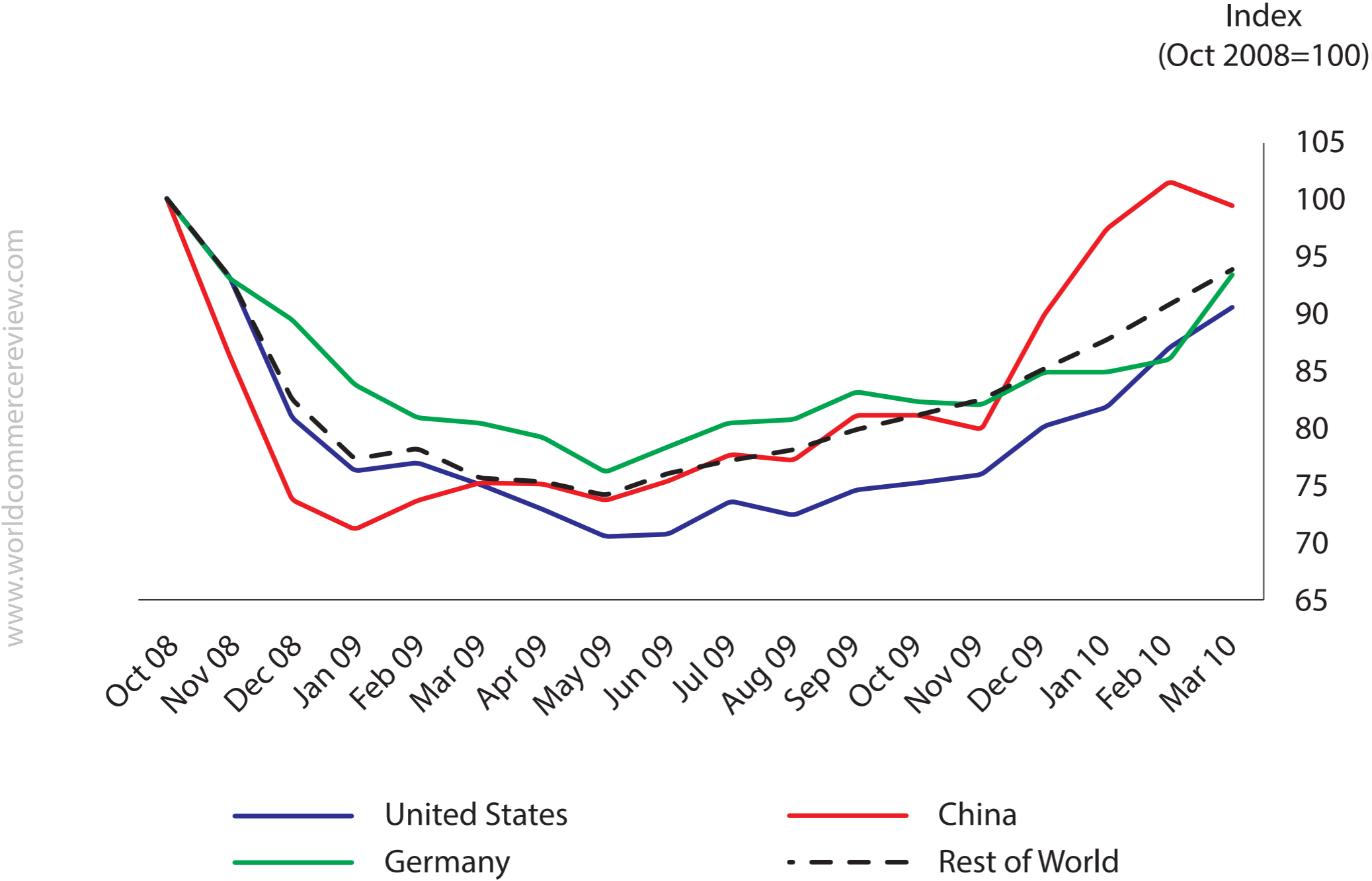
I will now turn to how supply chains have behaved during previous crises. Doing so suggests that supply chain trade can be resilient in the face of large, synchronised shocks. It can also help mitigate crises emanating from large supply disruptions in one region. However, there are no perfect parallels to the effects of COVID on the global economy, so there are limits to how far we can read across from previous examples.

The world experienced a similar global trade disruption following the 2007-08 global financial crisis. This has been termed the Great Trade Collapse, and as with the financial crisis itself, it simultaneously affected countries worldwide.

Chart 2 shows that the size of the collapse was on a massive scale – comparable to that seen over the past 18 months – and that it affected large GSC hubs (US, China, and Germany) similarly to the rest of the world. It was driven in large part by the fall in global demand following the financial crisis, which impaired demand for tradeable goods. In turn, this led to a reduction in supply chain volumes as intermediates demand also collapsed¹³.

Perhaps encouragingly for the current situation, trade rebounded to its pre-crisis level quickly after the financial crisis (Chart 2). To the extent that there are similarities, this swift recovery might give us comfort that even when there is a global shock affecting supply chains, it can reverse relatively quickly.

Chart 2. World goods trade, sum of exports and imports



Source: CBP World Trade Monitor.

At a macroeconomic level, large-scale policy stimulus after the financial crisis helped reverse the fall in demand for tradeable goods, with a consequent increase in supply chain trade.

Many studies even suggest that supply chains helped mitigate the scale and persistence of the overall trade collapse, as supply chain relationships tend to be highly resilient due to the fact that buyer-seller networks are hard to break. During the financial crisis, firms tended to maintain trading relationships (albeit at a much lower scale), allowing them to quickly rebuild volumes as demand recovered^{14, 15}.

Looking to other, more geographically-concentrated disruptions, such as the 2011 Tōhoku earthquake, reveals similar responses. Recent work by Freund *et al* (2021) zooms in on automotive and electronics sector trade after the earthquake, and provides evidence that intermediate imports were significantly less affected compared to final goods imports. As such, their analysis provides further evidence that global supply chain links are more difficult to untangle after a crisis than the import of final goods.

These past examples suggest there are some grounds for optimism about the resilience of supply chain relationships in the wake of the COVID pandemic, and about how quickly large global shocks can be reversed¹⁶. But although also global, the COVID shock has differed from the global financial crisis a decade ago.

The main difference is that although it had some supply elements, the financial crisis was primarily a large fall in demand below supply, including a reduction in the demand for tradeable goods.

In contrast, a connecting theme of recent supply disruption has been demand running ahead of supply for some products or sectors. This has had some demand-side causes: COVID has caused a material rotation of demand

towards goods, and away from services where health risks are higher, which has increased demand for tradeable goods above their pre-COVID levels, as illustrated by trends in global shipping volumes (Chart 3).

Goods demand has been further boosted by large fiscal policy stimuli in advanced economies, particularly in the US. It has also had some supply-side causes: lockdowns and other health restrictions have impeded production or transportation in some regions, while the spread of COVID has led to isolation or health-related reductions in labour supply in others.

And adding to these factors, a number of idiosyncratic and unrelated shocks to goods supply (eg. multiple extreme weather events occurring during the pandemic, or the grounding of the Ever Given) have contributed further to global imbalances in the goods sector.

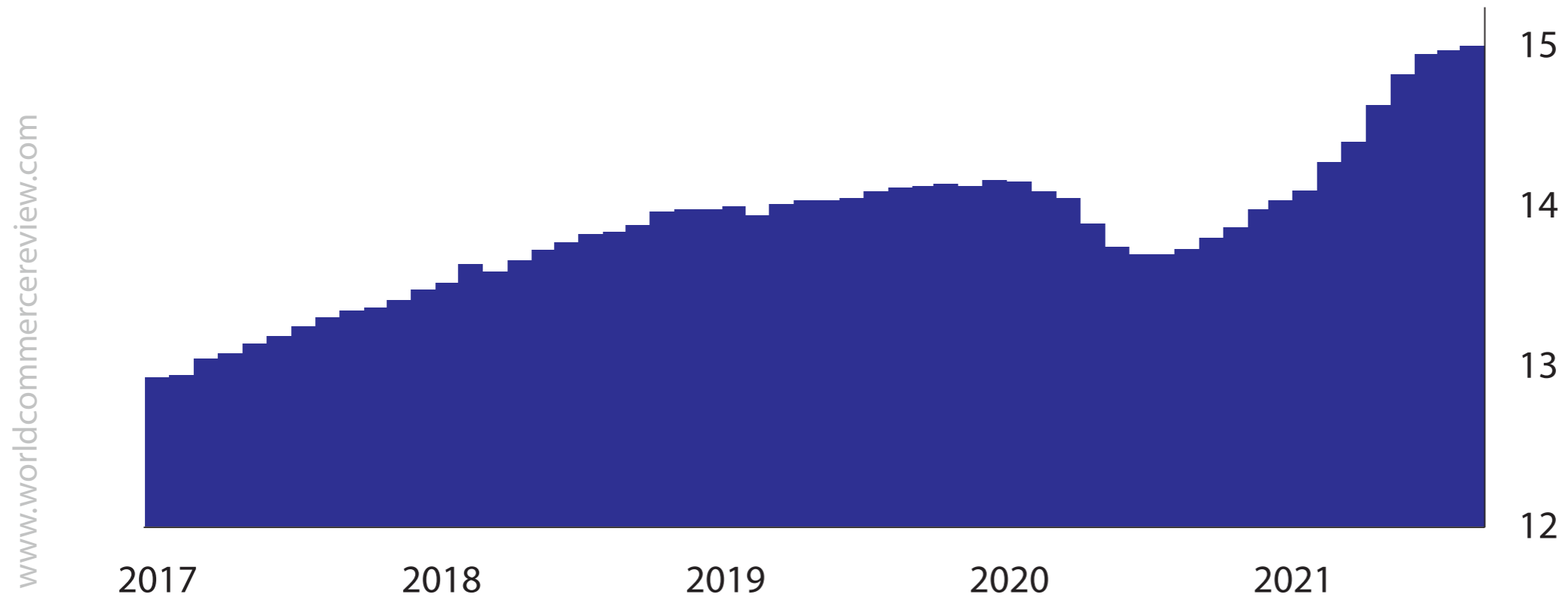
A second difference is that the effects of the financial crisis were felt simultaneously around the world, while the COVID shock has been less synchronous. The spread of the virus has waxed and waned at different rates in different regions (Chart 4).

Partly as a result, lockdowns and other public health interventions have also differed across locations across time. The relatively lower synchronicity during the pandemic has in all likelihood helped cushioning the impact of the COVID shock, as some countries were able to resort to imports from less affected regions abroad, and thus mitigate the impact of some products' shortages in their domestic economies.

However, the nature of the shock and the disparities in timing may have posed challenges to some supply chains. It is typically easier to recover demand than it is to increase capacity, as has been required for some goods and

Chart 3. Global shipping container volumes

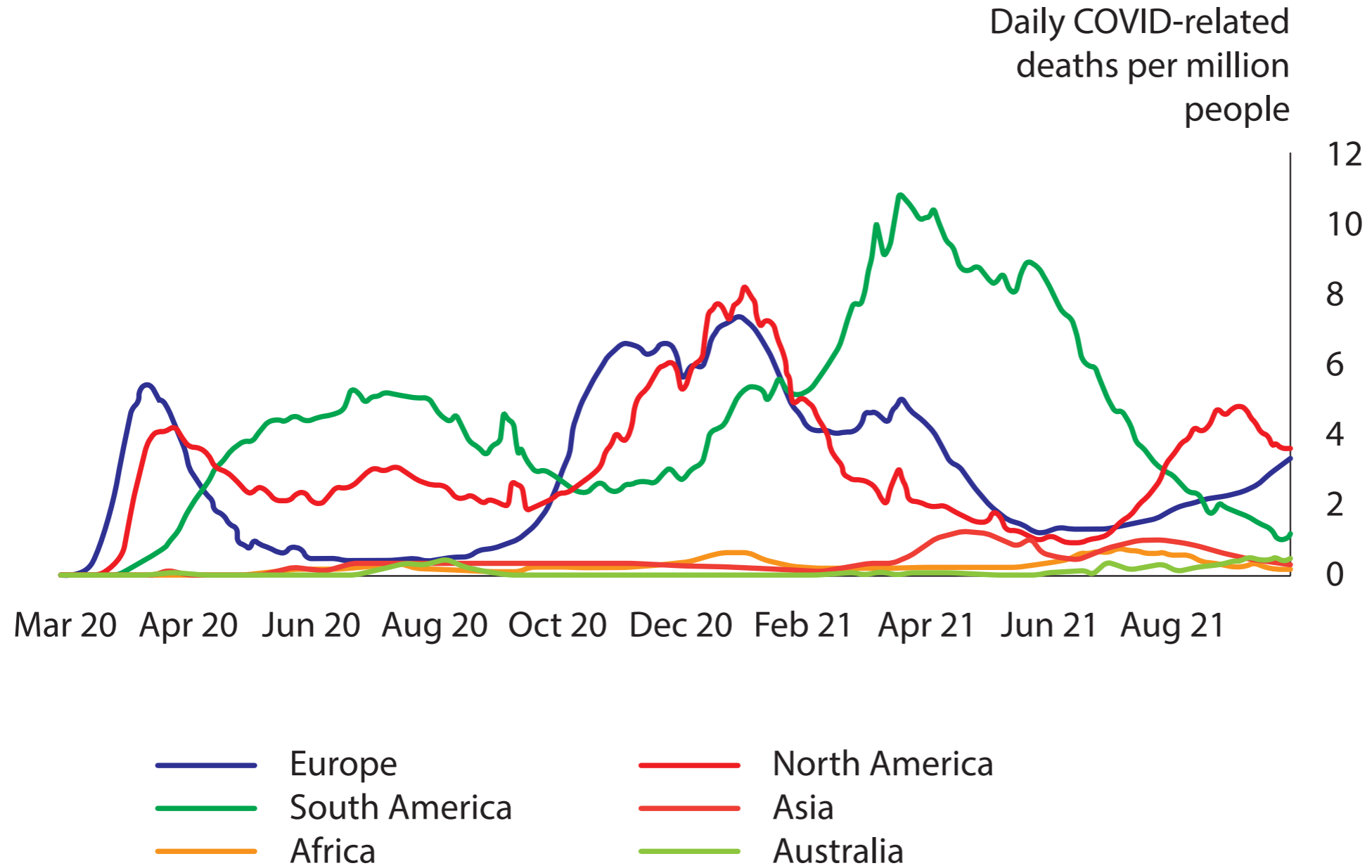
Million TEUs shipped per month
(12-month rolling average)



Source: Container Trades Statistics.

Chart 4. COVID deaths per million people

www.worldcommercereview.com



Source: Our World in Data.

inputs; furthermore, in long multinational supply chains, the way COVID has led to a series of regional supply and transportation disruptions may have had a somewhat more persistent impact than a single, large shock.

Supply chains during the pandemic

In light of the unique nature of the challenges during COVID and the recovery, with a battery of different shocks affecting supply chains at different times, it is tempting to ask whether it has been an exception to the usual benefits of trade.

The disruption has intensified calls for 'reshoring' production networks – aiming to reverse some of the supply chain integration we have seen in recent decades by increasing firms' reliance on domestic suppliers. The question these calls raise is whether countries would have been able to tackle the COVID shock better without trade and global supply chains.

If we were to imagine such a scenario, it seems unlikely that the absence of global supply chains would have been beneficial. Given the link between trade and the level of income, a more closed economy would have initially faced a far more difficult task, with fewer resources available to help maintain incomes of workers and businesses most affected.

Lockdowns abroad would not have affected production or supply chains domestically, but domestic lockdowns would have had a far larger effect¹⁷. So although the timing would have been different, it is not obvious that the overall shock would have been smaller. In fact, the volatility induced would likely have been larger, since the smaller scale of domestic production in a closed economy would have made it impossible to shift to substitute suppliers. Losing just a few workers due to an event like an outbreak in a given plant could mean losing the entire production line of certain inputs or foods.

Indeed, a number of the specific shocks and bottlenecks that are currently impacting output in the UK are at least partly domestic in nature, albeit we are seeing similar effects in many other economies. Shortages of truck drivers, for example, have been impacting logistics in the UK, most notably the supply of petrol. While this shortage has several discrete causes, it is difficult to see how any of them would be addressed with less international trade¹⁸.

If anything, it seems plausible that by enabling more diversification, supply chain trade could have mitigated the overall impact of the shock. Where producers had substitute suppliers in different regions, the asynchronous nature of lockdowns and other impacts of the pandemic may have enabled them to continue production when a supplier in one region was unable to satisfy demand.

Clearly there are areas where diversification has been more difficult: we have seen a range of transport bottlenecks, reflected, for example, in increases in shipping costs. And, echoing the financial crisis, the opacity of many production networks means that beyond their direct suppliers, it is not always clear to firms how diversified supply chains for different products are.

Fundamentally, many of the current disruptions seem to simply reflect unusually large imbalances between supply and demand for some products and from some locations. COVID and its spread are the proximate cause of most of these imbalances.

While there may be limits to the benefits of supply chain-driven trade in the face of such shocks, reshoring production in response would be a risky strategy, which would almost certainly lower incomes on average, without necessarily providing any benefits in terms of lower volatility, or more resilience in response to supply shocks.

The debate is an important one to continue, however, and is linked to that on how policy can enhance the resilience of supply chains, for example by better understanding their associated risks¹⁹. With a higher risk of climate-related extreme weather events in future, it may be that shocks to supply chains become more frequent in the coming years²⁰.

Supply chains and monetary policy

So far I have described what global supply chains are and why they have come to be so important to international trade, as well as some of their benefits and potential costs. But in the capacity in which I am speaking today as an MPC member, the most pressing concern is the implications of global supply chains for monetary policy.

There are two different categories of effects. The first consists of the various long-run impacts supply chain integration may have had on the structure of the UK economy and the consequences for monetary policy.

These impacts, including on the slope of the Phillips curve, and the degree of output volatility, have been covered extensively by former Bank of England colleagues, so I will not focus on them today²¹. Instead, I would like to discuss the implications of global supply chain impacts on the near-term UK and global inflation outlooks.

In the near term, the persistence of current supply-chain disruptions is a key source of uncertainty for the inflation outlook. If the effects of supply-chain disruption on CPI inflation are short-lived, then attempting to use monetary policy to offset them would only serve to add additional volatility, since the effects would be fading by the time policy was having a major impact on inflation²².

Where the temporary effect is on the level of prices, rather than its rate of change, inflation, then the disruption we are currently seeing would have a disinflationary impact as we progress later into our three-year forecast.

If, in contrast, supply-chain disruption were to have a more persistent impact, it would play a larger role in my assessment of appropriate monetary policy. By simultaneously pushing down on output while persistently increasing inflation, it would create a trade-off between the MPC's objectives, which policy would have to manage.

The MPC will be giving its collective assessment of the effects of supply chain disruption, alongside the other factors influencing its inflation forecast, in the November Monetary Policy Report. But for my own part, I would like to explore some of the factors that may determine how quickly disruptions will unwind for specific products.

I will do so by using, as case studies, two of the most prominent examples of goods subject to disruption over the past 18 months: semiconductors and personal protective equipment (PPE)²³.

Case-study A: semiconductors

Semiconductors are a crucial input to a large number of industries, including cars and consumer electronics²⁴. Although the semiconductor industry accounts for a small share of GDP, many upstream buyers rely on semiconductors with no substitutable alternatives. As a result, a global shortage of semiconductors during the pandemic has had disproportionately large economy-wide effects²⁵.

The shortage has been due to both demand and supply factors. On the demand side, a range of goods have benefitted from a rotation away from some services, owing to higher COVID risks in the latter. But within that, demand for electronic devices has been particularly strong among individuals working or learning remotely.

When lockdowns ended, there was also a sharp recovery in the demand for motor vehicles, given both pent-up demand and a COVID-induced preference shift from public towards private transport, as well as a secular shift

towards electric vehicles, which use more chips. Both factors have boosted demand for semiconductor inputs, leading to sharp rises in sales (Chart 5).

On the supply side, global semiconductor production was hit by a number of idiosyncratic shocks. These included winter storms and power outages in manufacturing plants in Texas, a fire at one of the largest semiconductor factories in Japan and a drought in Taiwan²⁶. Although semiconductors production increased over 2020, delivery times are higher than pre-COVID, while import prices have picked up (Chart 6).

The supply of semiconductors is typically slow to adjust to large shifts in demand. The manufacturing process is complex²⁷, and lead times – the wait between order and delivery – are long²⁸. The industry operates at large scale, is capital intensive, and requires significant R&D expenditure.

As a result, significant investment is required to increase capacity. Given the increase in demand, new manufacturing facilities are under construction, but will take some time to come online and to be scalable. Moreover, even with increased production capacity, it will likely take time to fulfil current backlogs which have accumulated during the shortages.

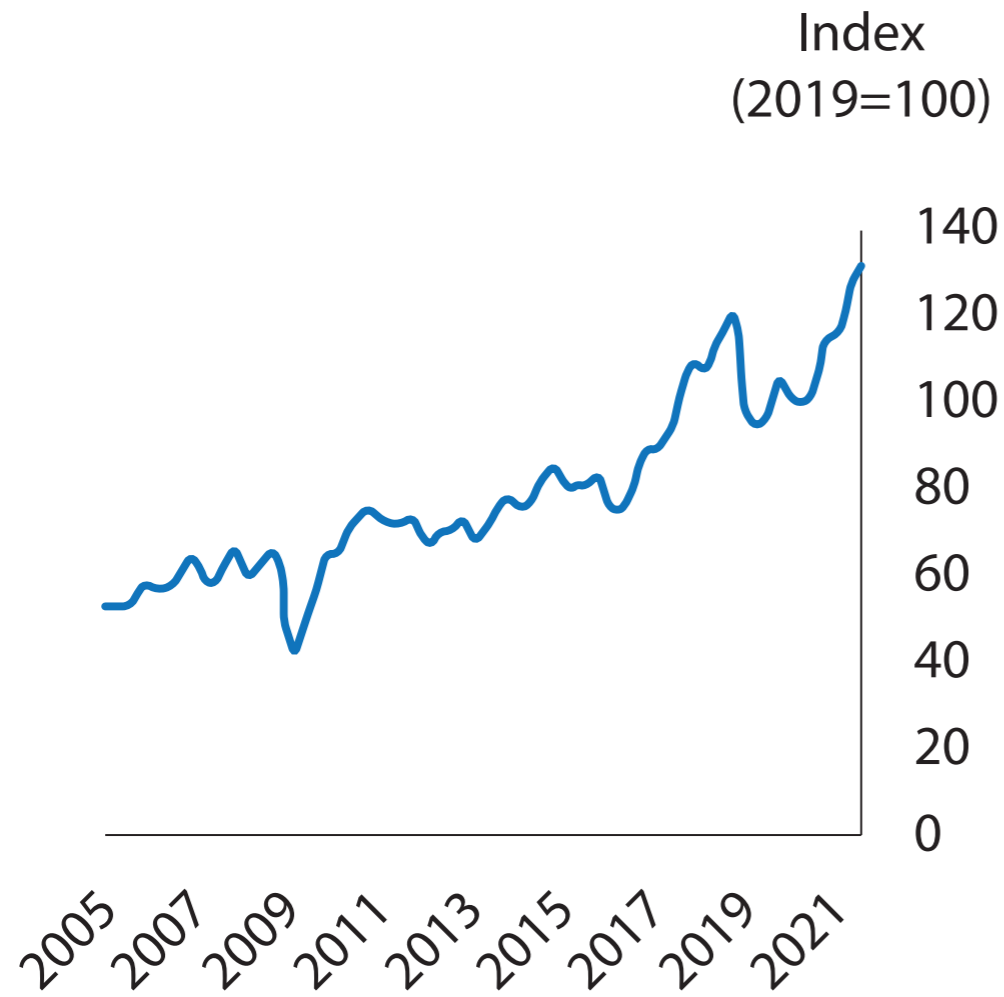
Case-study B: personal protective equipment (PPE)

PPE is a collective term used for wearable equipment and gear that protects users from hazards. As a key form of protection from COVID, the pandemic has led to an extraordinary increase in global demand for PPE, of which face masks have of course been the most visible type²⁹.

This steep increase is clear in Charts 7 and 8, which show the example of US imports of masks, respirators and medical gowns. This spike in demand was also present in the key supplier of PPE – China, reducing net exports to

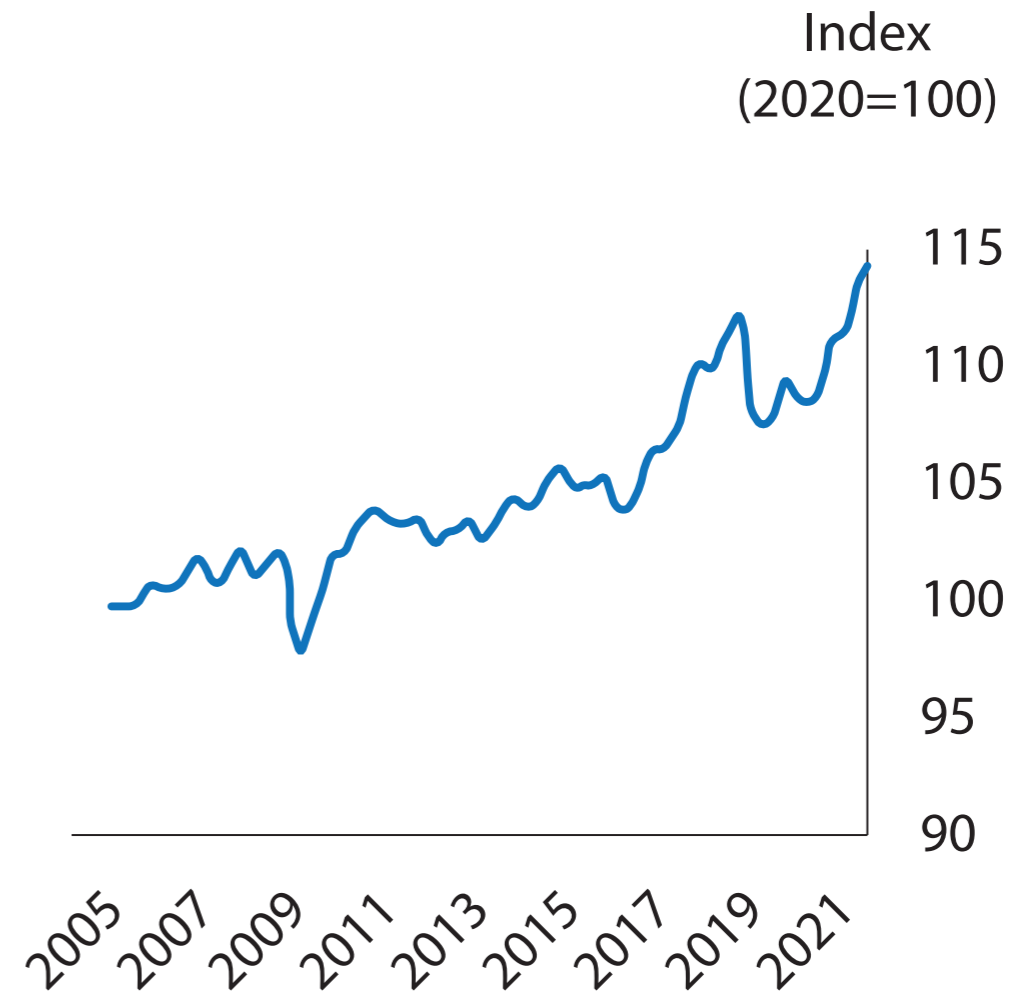
Chart 5. World semiconductor manufacturers' sales, 3 month rolling average

www.worldcommercereview.com



Source: Semiconductor Industry Association via Refinitiv Eikon.

Chart 6. US semiconductor import prices



Source: Refinitiv Eikon.

Chart 7. US imports of medical gowns

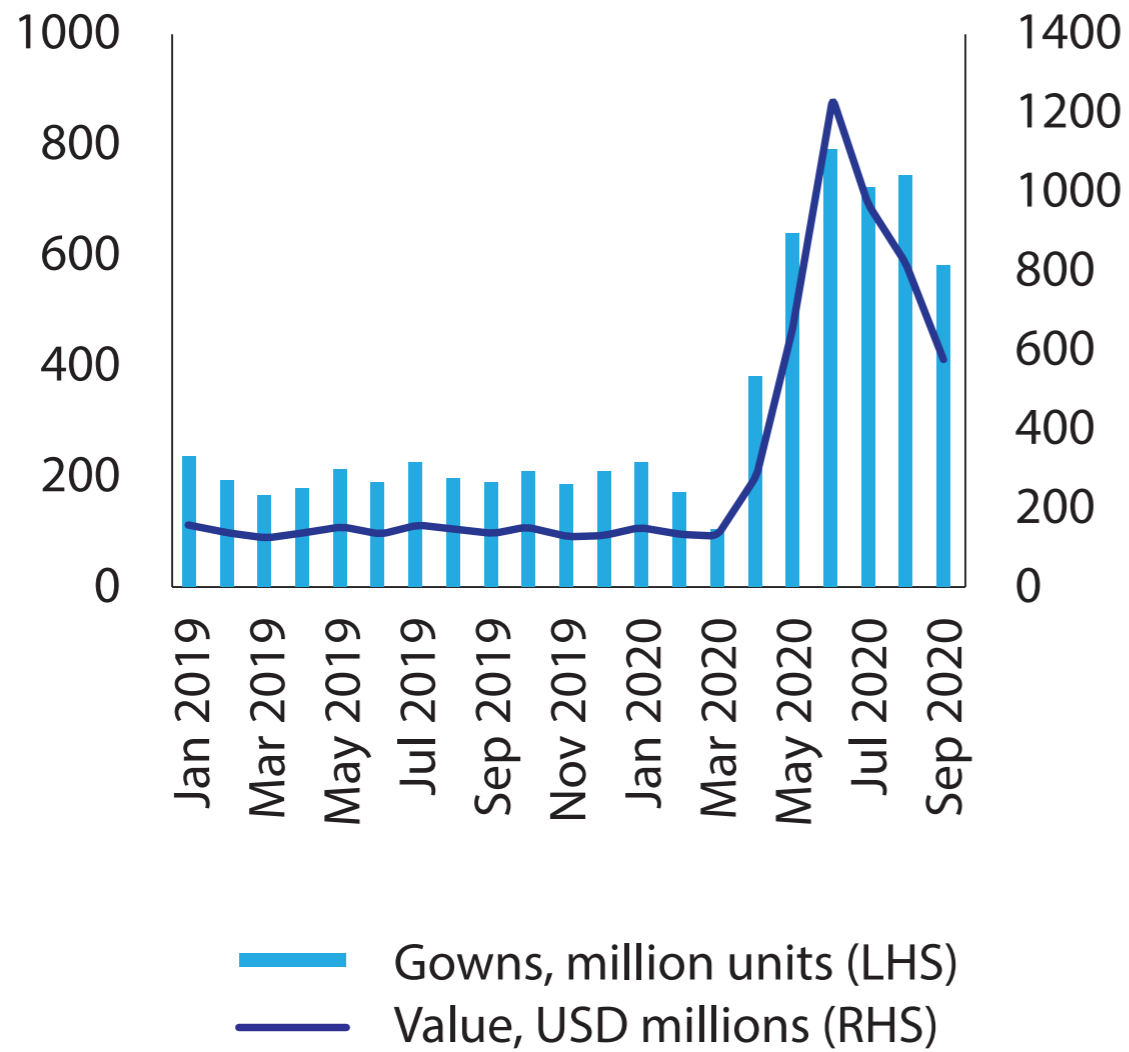
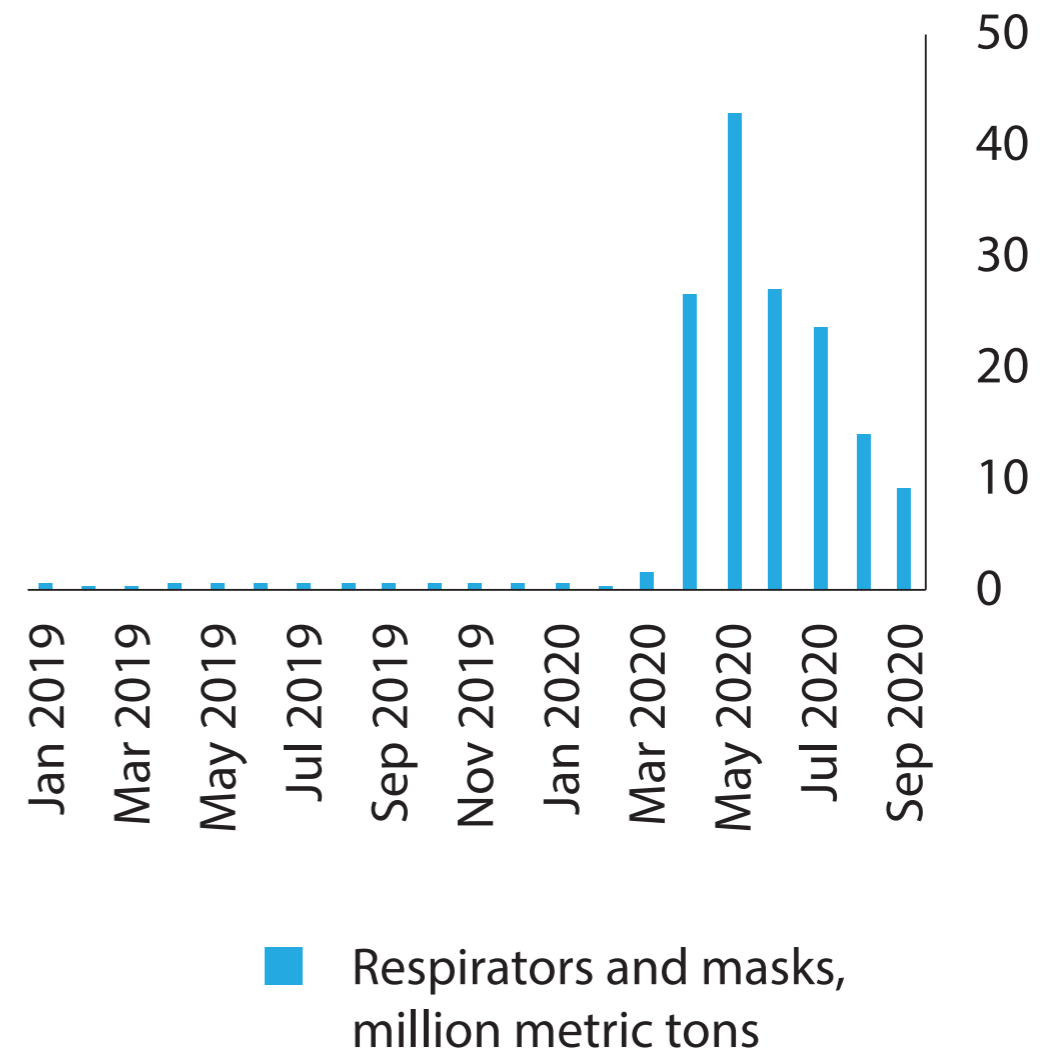


Chart 8. US imports of respirators and masks



Source: US International Trade Commission.

Source: US International Trade Commission.

the rest of the world, while some countries also applied restrictions on PPE exports. At the same time, supply was disrupted by lockdowns and factory closures worldwide.

The combined effects of a rapid increase in demand alongside supply restrictions were amplified by the fact that the industry holds low inventories. So available stocks were drawn down quickly when demand outstripped supply.

Production of PPE is typically high volume, low value and low profit margin, in part because the main buyers are cost-sensitive healthcare facilities. To keep costs low, PPE suppliers tend to use 'just-in-time' inventory management, leaving supply vulnerable to shocks.

Although the acute phase of the pandemic saw shortages for many types of PPE, some of these supply-chain issues were solved fairly quickly as firms were able to increase production. As products with a relatively simple production process, it was also easier for firms to convert production or switch to substitute suppliers of some types of PPE than would be the case for semiconductors.

Nonetheless, issues with some types of PPE persisted longer due to difficulties in sourcing inputs and the time and cost of bringing new capacity to market³⁰. An important consideration was that with much of the increase in PPE demand expected to be temporary, the return on any investment in capacity is uncertain.

Lessons

Extrapolating from the case studies back to the macroeconomy, one can infer that as supply disruptions feed through into price increases, supply can and will adjust in response. But the speed of that adjustment, and so the persistence of the price increases, is likely to vary across products.

For simpler, more homogenous goods such as PPE, where there are many suppliers and limited market power, supply may be able to adjust relatively quickly. For more complex goods such as semiconductors, some disruption may persist into 2022.

In determining the macroeconomic effect, the adjustment of relative demand for different products seems likely to be more crucial still. Even for goods such as PPE where supply can adjust more quickly, firms will be less inclined to do so if the increase in demand is expected to be temporary.

For items such as semiconductors, a fast rotation in demand back towards pre-COVID patterns has the potential to ease disruption more quickly than an expansion in supply. If so, there may even be the possibility of the price of semiconductors falling back, if a reduction in demand meets greater supply.

One source of the rotation will be as a response to price changes – as the global prices of goods subject to disruption rise relative to other goods and services, relative demand is likely to respond.

These demand patterns have also been closely tied to the evolution of COVID, both in the UK and around the world. When virus spread has increased, mandated or voluntary social distancing has led consumers to substitute away from riskier, high-contact services towards goods.

As a result, the prospects for a rapid rotation back towards services, and so the persistence of supply chain disruption, will also greatly depend on how the pandemic evolves over winter and beyond.

Current outlook

COVID initially had a disinflationary impact on the UK and the global economy, as weaker domestic and global

demand led to declines in wage and price pressures³¹. In contrast to the initial year of the pandemic, the uneven recovery is likely to create a temporary trade-off, which monetary policy will need to navigate.

Disinflationary pressures have given way to inflationary ones, while output remains a normal-sized recession below its pre-COVID level, and further still below its medium-run trend. As I have discussed, this tension stems partly from the various disruptions and bottlenecks currently affecting global supply chains, which are leading to temporary negative supply shocks in the UK.

These disruptions have been driven in large part by the effects of COVID and the subsequent recovery on both supply, and on the balance of demand between goods and services.

In the near-term, the inflation side of the trade-off will also be exaggerated by a number of temporary factors, which may not be informative about how prices are likely to change in future. In particular, base effects from weak prices a year ago have been pushing up on recent inflation outturns³².

And while inflation is likely to increase further over the next few months, a large part of this increase will come from the direct impact of higher energy prices. Increases in the level of energy prices are not typically a sign of future energy price inflation, so these tend to only have one-off impacts on the level of CPI.

Monetary policy cannot offset these effects on inflation, which are driven mostly by global factors, because the level effects tend to drop out of the inflation calculation before policy can have much impact.

It will of course be important to remain vigilant in case of any second-round impacts of higher energy prices: these include the reduction in households' real income, which could weigh on demand and future inflation; and any

impact of higher energy prices on firms' production costs, which they may ultimately pass through to consumer prices.

The current supply chain disruption will also ultimately be temporary. For some products, disruption and its effect on inflation are likely to dissipate quickly as firms find new suppliers or current ones are able to expand.

For others, where supply is slower to adjust, the rotation of demand from goods back towards services should help ease pressure on supply chains. In either case, responding to short-lived effects on inflation would only be likely to impart additional volatility.

While my expectation is that the effects of supply chain disruption will be short-lived, a non-negligible risk is that the switch from goods back towards services is more protracted, leading to a longer period of supply disruption and inflationary pressure.

Given the close relationship between the composition of output and COVID risks and restrictions, it is likely that the epidemiology of the pandemic across the globe will be crucial in determining whether this risk crystallises.

The other major uncertainty for the UK inflation outlook at present is the evolution of the labour market, where there are two-sided risks. Given the near-term outlook for headline inflation, there is a possibility that higher inflation or higher inflation expectations begin to feed through into higher wage demands.

The effects of inflation expectations on wage bargaining can be difficult to gauge, so I will be paying particular attention to direct indicators of wage pressures, including our best assessment of underlying wage growth, settlements data, and information from the Bank's Agency network.

The opposing risk is that the end of the furlough scheme in September leads to a loosening in the labour market and a moderation in wage pressures. A large number of workers need to be reabsorbed into the labour market over the coming months, some of whom will flow into unemployment.

The literature on unemployment benefits, which are comparable in effect to the furlough scheme, would suggest that furlough has been boosting underlying wage growth. Its withdrawal could put this process into reverse.

Along with my colleagues on the MPC, I will be weighing up these different risks ahead of our November *Monetary Policy Report*. At the time of our August forecast, I expected that if the economy were to evolve as in our forecast, some modest tightening, broadly in line with our conditioning path, would be required to achieve the inflation target sustainably.

Since then, we have had large upside news for near-term inflation from energy prices, an effect which should fade quickly. We have also seen a moderation in recent GDP growth, which looks set to continue as we enter the winter months, affecting supply as well as demand.

Higher energy prices may reduce households' real incomes and depress spending, with additional risks stemming from the prevalence of COVID in the UK, and falls in income for any furloughed workers who move out of employment.

Overall, I judge that the balance of this set of news is unlikely to have a large effect on the amount of tightening required over the next few years. The August forecast was conditioned on market expectations of a gently rising path for Bank Rate, gradually unwinding the relatively small amount of monetary policy stimulus added since the onset of COVID³³.

They were also consistent with evidence that the medium-run equilibrium interest rate remains low, and is likely to be so for some time. The precise path policy takes towards that equilibrium rate will partly depend on how the risks I have highlighted evolve.

As always, my votes on any future policy changes will depend on incoming data and my assessment of the economy at the relevant MPC meetings. Uncertainty over the effects of the furlough scheme should be resolved over the coming months, which should help paint a clearer picture of the position of the labour market.

We will also continue to learn more about the persistence of disruptions to global and domestic supply chains and their impact on the UK inflation outlook. ■

Silvana Tenreyro is an external member of the Monetary Policy Committee of the Bank of England

Endnotes

- 1. Specifically, firms which source from upstream industries that export, as well as supply to downstream industries that import, boosts the productivity of purely domestic firms through learning channels (Merlevede and Theodorakopoulos, 2021; Blalok and Veloso, 2007).*
- 2. Caselli and Wilson (2004) show that imports of high-tech capital are a main source of TFP growth and technological development across countries.*
- 3. Baldwin (2016).*
- 4. SMMT (2016), quoted in Bailey, D and De Propris, L (2017).*

5. *The quantitative model can be used to carry out different scenario analyses, shocking different parts of the system; it is available on request from the authors.*
6. *This measure differs from more standard GVC measures, which focus on value added trade, and hence where work is carried out.*
7. *One finding from this metric is that all major manufacturing producers are highly dependent on China, with between 6% and 23% of their manufacturing output relying on Chinese inputs. See also Caselli et al (2020), which explores how much of the rise of China in the international trade scene has affected patterns of transmission and volatility across countries. While the Baldwin and Freeman (2021) metric is particularly relevant when thinking about shocks from the COVID pandemic, the authors also stress that the specific metric used to assess vulnerabilities should depend on the risk being evaluated.*
8. *See Halpern et al (2015), Topalova and Khandelwal (2011) and Taglioni and Winkler (2016) for more discussion of these channels.*
9. *See Newberry and Stiglitz (1989).*
10. *D'Aguanno et al (2021).*
11. *Similarly, academic work, which gained traction at the onset of the pandemic, examines the international transmission of supply chain shocks due to COVID-19. Using a large-scale general equilibrium model with many countries and sectors, the paper's authors ultimately conclude that reshoring production will not make countries more resilient to shocks – it would simply concentrate risk to the domestic economy. In addition, similar points are made by Koren and Tenreyro (2013) who examine diverse sources of energy as a volatility dampener, as well as Javorcik (2021) who underscores that the recent pandemic has highlighted firms' need to diversify their supplier base to protect against disruptions which may be concentrated to one supplier/geographic location.*
12. *For governments, there are a separate set of considerations about reshoring production on national security or critical infrastructure grounds, which I do not discuss here*
13. *See Baldwin (2009) or Domit and Shakir (2010) for detailed analyses.*

14. See Antras (2020).

15. This is true in aggregate, but also at the firm level. For example, various academic studies that use detailed firm-level data on European customs transactions show that GSCs and production network structures indeed played a minor role in the collapse; rather it was trade volumes – rather than trade relationships surrounding individual product lines – which mostly adjusted (Bricogne et al 2012; Behrens et al 2013).

16. Indeed, while it is still too early to see these effects in disaggregated data, world goods trade mostly rebounded to pre-crisis levels in the 11 months following the lowest troughs in April 2020. This suggests that, by and large, global supply chains were agile and adaptable. However, there remain some specific bottlenecks in the more recent part of the pandemic.

17. This sentiment has been echoed in various academic studies, for example Bondio et al (2020) and Eppinger et al (2021).

18. See Bailey (2021) for a summary of these causes.

19. For further discussion, see D'Aguanno et al 2021.

20. A point made recently by Javorcik (2021).

21. See Carney (2017). Aquilante et al (forthcoming) looks at the impact of global supply chain integration on the UK Phillips Curve and finds that a higher imported-intermediate goods share from emerging market economies results in a flatter Phillips Curve for the period of 2000 to 2014.

22. Given empirical evidence that policy lags to inflation are faster than they were in the past, discussed in Tenreyro (2019), this may not be the case for slightly more persistent shocks.

23. See Bown (2021) for a discussion of the PPE supply chain during the pandemic.

24. Semiconductor-based components are used intensively in communications, computing, healthcare, military systems, transportation, clean energy, and countless other applications.

25. Semiconductors are materials that find widespread use in the electronics industry thanks to their useful electrical properties – such as showing variable resistance, passing current more easily in one direction than the other, and

reacting to light and heat. They could be described as critical inputs, as in the O-ring theory of Kremer (1993): they are key components in memory chips, microprocessors and integrated circuits.

26. Semiconductor producers use large volumes of ultra-pure water to remove impurities.

27. Manufacturing takes place in highly specialised fabrication plants called foundries. The process is highly automated, very energy-intensive and involves many steps.

28. Fabrication takes on average 11-13 weeks to complete.

29. Outside of the pandemic context, PPE includes a broad set of garments intended for industrial as well as healthcare applications. These range from head, eye and face protection to protective clothing and footwear, hand and arm protection, respiratory protection, hearing protection, fall protection, and others. PPE finds extensive application in industries where injuries can result from contact with physical, chemical, biological, mechanical and radioactive substances, such as the chemical industry, oil and gas, construction, pharmaceutical, healthcare and manufacturing.

30. Based on data from the Get US PPE initiative, N95 respirators, disinfecting wipes, surgical masks and face shields were the most requested types of PPE in the US between March 2020 and June 2021.

31. This was also in line with historical experience from past pandemics, as discussed in Tenreyro (2020).

32. Although the 12-month CPI inflation rate was 3.1% in September, part of this increase has reflected a recovery from low levels of prices a year ago. As a rough metric of the size of these effects, over a longer period, the 24-month CPI inflation rate is only 1.8% at an annualised rate, although this figure is likely to increase further over the next few months.

33. Fiscal policy played the major role in offsetting the economic effects of the pandemic, while monetary policy played a relatively smaller part. Bank Rate was cut by 65 basis points, which was smaller than the typical cut in past (smaller) recessions. The MPC also increased the stock of QE, but in my view, its primary effect was to prevent yields from rising in the face of market DYSFUNCTION, rather than providing additional net stimulus relative to pre-COVID. (The additional net stimulus vis-a-vis January 2020 imparted by QE, measured as the change in long yields relative to January 2020, was more limited and hence so was the net boost to activity or inflation relative to January 2020.) Despite the much larger size

of the fall in activity, the overall monetary stimulus was therefore relatively small when compared to shallower recessions in the past.

References

Altomonte, C, di Mauro, F, Ottaviano, G, Rungi, A and Vicard, V (2012), "Global value chains during the great trade collapse", ECB Working Paper No. 1412.

Antras, P (2020), "De-Globalisation? Global Value Chains in the Post-COVID-19 Age", NBER Working Paper 28115.

Aquilante, T, Dogan, A, Firat, M and Soenarjo, A (forthcoming) "Global Value Chains and the dynamics of UK inflation", mimeo.

Bailey, A (2021), Treasury Committee oral evidence on Bank of England July Financial Stability Report and August Monetary Policy Report, HC 672.

Bailey, D and De Propris, L (2017), "Brexit and the UK automotive industry", National Institute Economic Review, 242(1).

Baldwin, R (2016), The great convergence, Harvard University Press.

Baldwin, R and Freeman, R (2022), "Risks and Global Supply Chains: What We Know and

What We Need to Know". Annu. Rev. Econ. 14: Submitted. DOI: [10.1146/annurev-economics-051420-113737](https://doi.org/10.1146/annurev-economics-051420-113737)

Behrens, K, Corcos, G and Mion, G (2013), "Trade crisis? What trade crisis?", Review of Economics and Statistics 95(2), 702–709.

Blalock, G and Veloso, FM (2007), "Imports, productivity growth, and supply chain learning", World Development 35(7), 1134–1151.

Bonadio, B, Huo, Z, Levchenko, A and Pandalai-Nayar, N (2020), "Global supply chains in the Pandemic", NBER Working Paper No 27224.

Bown, C (2021), "How COVID-19 medical supply shortages led to extraordinary trade and industrial policy", CEPR Discussion Paper No 16359.

- Bricongne, J-C, Fontagne, L, Gaulier, G, Taglioni, D and Vicard, V (2012), "Firms and the global crisis: French exports in the turmoil", *Journal of international Economics* 87(1), 134–146.
- Caselli, F, Koren, M, Lisicky, M and Tenreyro, S (2020), "Diversification through trade", *The Quarterly Journal of Economics* 135(1), 449–502.
- Caselli, F and Wilson, D (2004), "Importing technology", *Journal of Monetary Economics*, 51(1), pp 1-32.
- Carney, M (2017), "[De]Globalisation and inflation", speech given at 2017 IMF Michel Camdessus Central Banking Lecture.
- D'Aguzzo, L, Davies, O, Dogan, A, Freeman, R, Lloyd, S, Reinhardt, D, Sajedi, R and Zymek, R (2021), "Global value chains, volatility and safe openness: Is trade a double-edged sword?", Bank of England Financial Stability Paper No. 46.
- Domit, S and Shakir, T (2010), "Interpreting the world trade collapse", *Bank of England Quarterly Bulletin*, 2010 Q3.
- Eppinger, P, Felbermayr, GJ, Krebs, O and Kukharsky, B (2021), "Decoupling global value Chains", CESifo Working Paper No 9079.
- Koren, M and Tenreyro, S (2013), "Technological Diversification." *American Economic Review*, 103 (1): 378-414.
- Kremer, M (1993), "The O-Ring Theory of Economic Development", *Quarterly Journal of Economics*, 108(3), pp. 551-575.
- Halpern, L, Koren, M and Szeidl, A (2015), "Imported inputs and productivity", *American Economic Review* 105(12), 3660–3703.
- Javorcik, B, (2020), "Global Supply Chains Will Not Be the Same in the Post-COVID-19 World", In *COVID-19 and Trade Policy: Why Turning Inward Won't Work*, 111–16. VoxEU eBook, CEPR Press.
- Johnson, R and Noguera, G (2017), "A Portrait of Trade in Value-Added over Four Decades," *The Review of Economics and Statistics*, 99(5), pp 896-911.
- Merlevede, B and Theodorakopoulos, A (2021), "Productivity effects of internationalisation through the domestic supply chain", *Journal of Applied Econometrics* pp. 1–25.
- Powell, J (2016), "The Global Trade Slowdown and Its Implications for Emerging Asia", speech given at "CPBS 2016 Pacific Basin Research Conference", sponsored by the Center for Pacific Basin Studies at the Federal Reserve Bank of San Francisco.

SMMT (Society of Motor Traders and Manufacturers) (2016), 2016 Sustainability Report, London: SMMT.
Taglioni, D and Winkler, D (2016), Making global value chains work for development, World Bank Publications.
Timmer, M, Dietzenbacher, E, Los, B, Stehrer, R and de Vries, G (2015), "An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production", Review of International Economics., 23: 575–605
Tenreyro, S (2019), "The elusive supply potential: monetary policy in times of uncertainty", speech given in Glasgow.
Tenreyro, S (2020), "COVID-19 and the economy: what are the lessons so far?", speech given at London School of Economics webinar.
Topalova, P and Khandelwal, A (2011), "Trade liberalization and firm productivity: The case of India", Review of Economics and Statistics 93(3), 995–1009.

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