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How shocks to Chinese supply chains affect US and euro area manufacturing*


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In this policy brief, we discuss results from a novel approach that identifies shocks to Chinese supply chains and tracks their impact on industrial regions. We document large but short-lived negative spill-overs from the early Covid-19 shutdowns in China to United States and euro area manufacturing. The results also indicate that in the course of the pandemic shocks shifting demand towards sectors with high Chinese value added (such as electronics) and therefore a stronger dependence on Chinese supply chains supported the recovery of US and euro area manufacturing. Our findings are informative for assessing risks and benefits related to cross-border supply chain integration and current debates on reshoring production from China.

*The views expressed in this policy brief are those of the authors and do not necessarily reflect those of the Deutsche Bundesbank or the Eurosystem.

In the last few years Chinese supply chains to major industrial economies faced several challenges. In 2018 and 2019, trade tensions between China and the US intensified and led to the imposition of additional tariffs. In early 2020, the lockdowns in China disrupted established trade routes. China reopened its production faster than other economies, but during the pandemic transport disruptions such as bottlenecks in major ports in addition to China's zero-Covid strategy continued to mess up China's supply chain trade. In late 2022, China finally lifted its zero-Covid policy. At the same time, the rise in geopolitical tensions put the high reliance on Chinese supplies of many advanced economies at the forefront of policy debates. This all raises the question about the consequences of shocks to Chinese supply chain trade for domestic production.

New approach to identify shocks to Chinese supply chains to US and euro area manufacturing

In Khalil and Weber (2022), we propose a novel approach to identify shocks to Chinese supply chain trade within structural vector autoregressive (SVAR) models of United States and euro area manufacturing. It is based on the idea that, in the event of unexpected disruptions in the imports from China, producers in the US or the euro area reliant on Chinese supplies try to source some of their inputs from other trading partners. Thus, Chinese supply chain shocks that lead to lower Chinese imports raise imports from elsewhere. The short-run possibilities for substitution are, however, too small to prevent bottlenecks for downstream production.

By using information on volumes and prices of Chinese imports, our approach differentiates supply-type supply-chain shocks, which are associated with delivery bottlenecks in the Chinese supply chain – for instance, due to containment measures in important industry hubs or ports – from demand-type shocks. The latter represent shifts of downstream demand away or towards goods with a high input content sourced from China. This includes policy-induced demand shifts, for instance the imposition of bilateral import bans or tariffs.

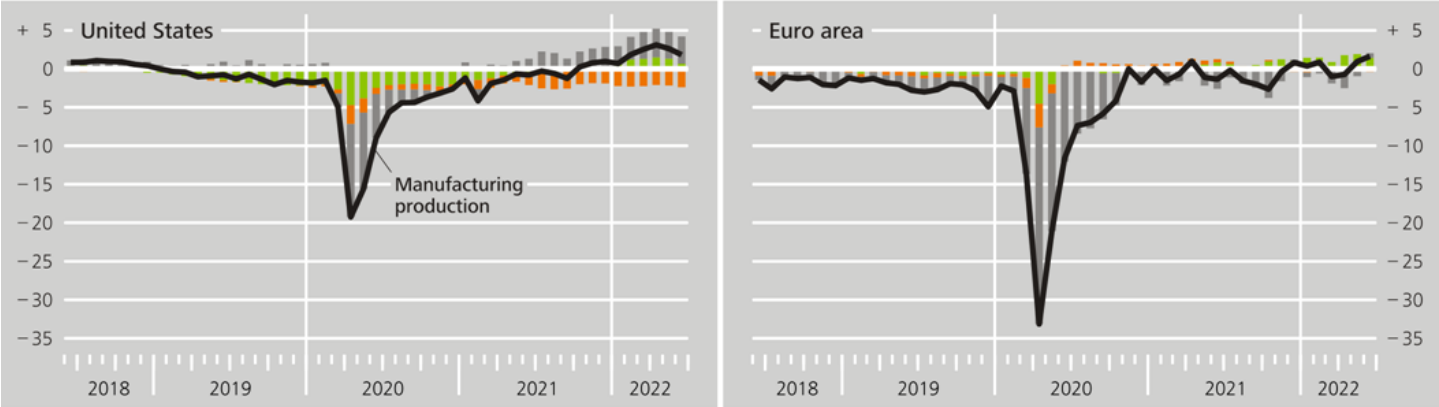
Chinese lockdowns in early 2020 lead to large but short-lived drop in downstream manufacturing

According to our results from a historical shock decomposition, in the US already prior to the Covid-19 pandemic adverse demand-type Chinese supply chain shocks – related to the Sino-American trade tensions that led to the imposition of additional tariffs – reduced manufacturing production markedly. This explains most of the slowdown of US manufacturing in 2019 (see Figure 1).

With regards to the pandemic recession in spring 2020, Chinese supply chain shocks explain around one-seventh of the decline in US manufacturing production at the trough in April 2020 (relative to February 2020); for the euro area, the fraction is even a bit larger. Although the effects are substantial, the main contributions to the slump in output came from domestic sources. Moreover, whereas the impact of interrupted trade with China was sizable, it was not persistent.

The role of Chinese supply chain shocks for US and euro area manufacturing* Figure 1

Percentage points relative to December 2017. CHN supply chain (demand-type) CHN supply chain (supply-type) Other



* Results from a SVAR model with sign restrictions including four variables: manufacturing production, real imports from China, real imports from other countries, and prices for imports from China. Historical shock decomposition for three groups of identified shocks: "CHN supply chain"are Chinese supply chain shocks. Demand-type (supply-type) indicates that quantities and prices of Chinese imports move in the same (in different) direction(s), "Other"include US demand and US supply shocks and the deterministic component. Cf. Khalil and Weber (2022).

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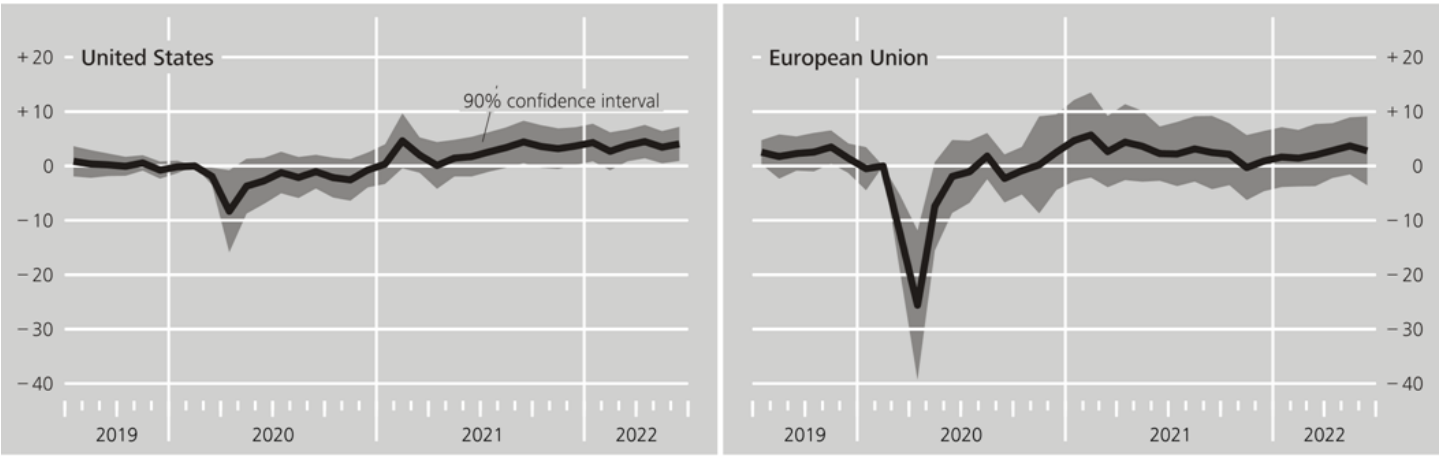
Effects of large dependence on Chinese inputs during the pandemic* Figure 2

Percentage points



* Results from a panel of manufacturing sectors. Differences in output between sectors that are very dependent on Chinese supplies and less-dependent sectors relative to February 2020. Sample size: 55 (United States), 70 (European Union). Sample period: January 2019 to June 2022. Cf. Khalil and Weber (2022).

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The early 2020 Chinese lockdowns hit US and European industries with a high dependency on Chinese imports particularly hard. This can be illustrated by a difference-in-difference approach à la Flaaen and Pierce (2019) in which we distinguish sectors with relatively high and low exposure to Chinese supply chains as measured by the cost share of Chinese inputs in production for manufacturing industries.[1] As Figure 2 (left panel) shows, in April 2020 production in US manufacturing industries with above-median import exposure to China declined by almost 10% more than in industries with below-median exposure. The corresponding estimate for the European Union (Figure 2, right panel) is larger at more than 20%. In line with the results from the SVAR model, the effect was short-lived due to a fast reopening of the Chinese economy and the subsequent recovery of Chinese exports.

[1] Meier and Pinto (2020) and Lafrogne-Joussier, Martin and Mejean (2022) also employ different-in-different approaches to study the effects of the early lockdowns in China for the US and France respectively.

Demand shifts towards sectors with high Chinese input content supported US and euro area recovery

Our results from the SVAR model suggest that in 2021 and 2022 a number of adverse supply-type Chinese supply chain shocks hit downstream manufacturing production. Nevertheless – perhaps surprisingly – *favourable* demand-type Chinese supply chain shocks played an important role in lifting manufacturing production in the US and in the euro area markedly above the pre-pandemic level (see Figure 1).

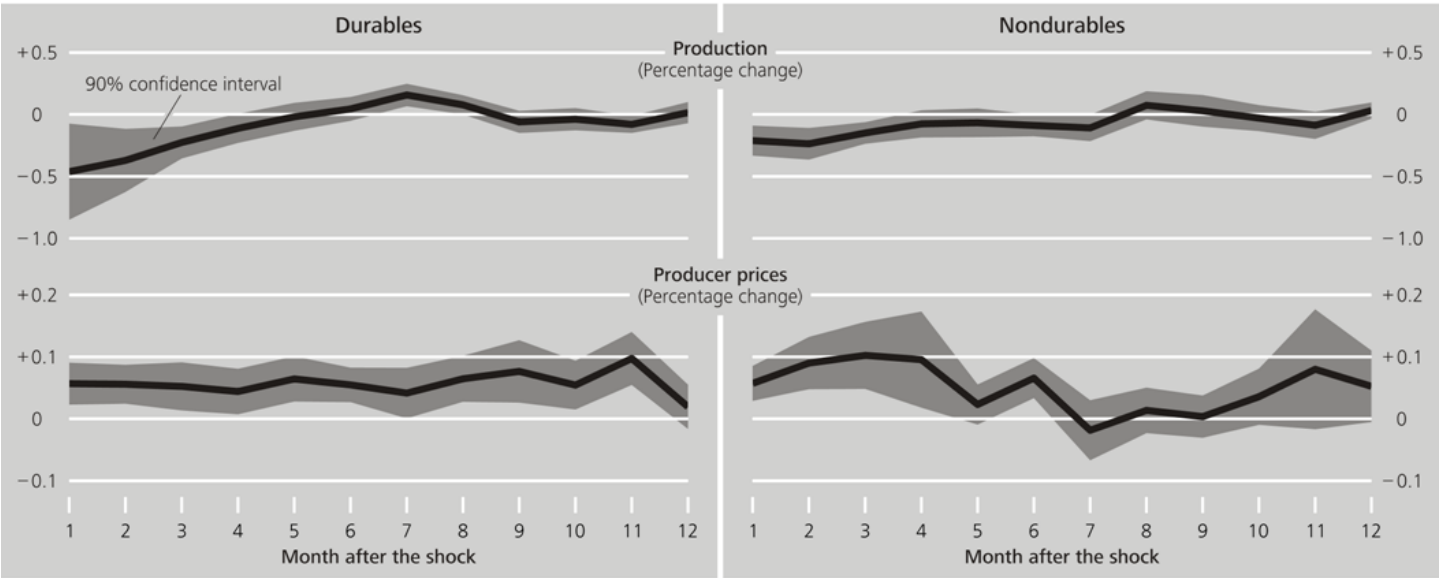
These demand-type shocks raised imports from China on the account of imports from other countries while leading to higher prices for Chinese imports. At the same time, manufacturing production in the US and in the euro area benefited. The exceptional pandemic-induced demand shift towards sectors that rely heavily on Chinese inputs (for instance electronics) fuelled supply-chain trade with China and supported the recovery of US and euro area manufacturing production.

Chinese supply chain shocks affect downstream producer prices across the whole manufacturing industry

Our study also suggests that Chinese supply chain shocks are a relevant source of domestic producer price dynamics. This is documented in Figure 3 that shows the estimated responses of output and producer prices of different US manufacturing branches to adverse supply-type supply chain shocks (i.e. shocks that lower aggregate US imports from China and US manufacturing production while raising US imports from the rest of the world and US prices for Chinese imports).

Effects of an adverse Chinese supply chain shock across durable and nondurable goods production in the US*

Figure 3



* Response to a one-standard-deviation adverse Chinese – supply-type – supply chain shock (from the four-variable SVAR model underlying the left panel in Figure 1) in a panel of manufacturing sectors in the US. Separate regressions for sectors producing durable and nondurable goods. Based on Khalil and Weber (2022).

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Especially manufacturing branches that produce durable goods suffer in terms of output losses. These branches are particularly reliant on Chinese supplies. Interestingly, although nondurable production uses relatively little Chinese value added, firms in both the durable and the nondurable sector increase prices to a similar extent. This suggests that storage – in particular the limited possibilities to store final goods in the nondurable sector – in addition to sectoral linkages plays an important role in the transmission of Chinese supply chain shocks to downstream producer prices.

Conclusion

Participation in Chinese supply chains may result in large spill-overs in case of unexpected disruptions in Chinese trade, as it was the case during the early Chinese lockdowns in 2020. Nevertheless, it also allows cushioning domestic shocks, as witnessed in the further course of the pandemic when China's relatively fast reopening production supported the US and euro area economies in tackling exceptional demand shifts.

As of recent, the pressure on Chinese supply chains has probably eased as China lifted its zero-Covid policy and the effects from the pandemic-induced demand changes have faded. Nevertheless, a careful assessment of risks and benefits from supply chain integration with China by firms and policy makers is still warranted.

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