

Supply Chain Disruptions and Inflation During COVID-19

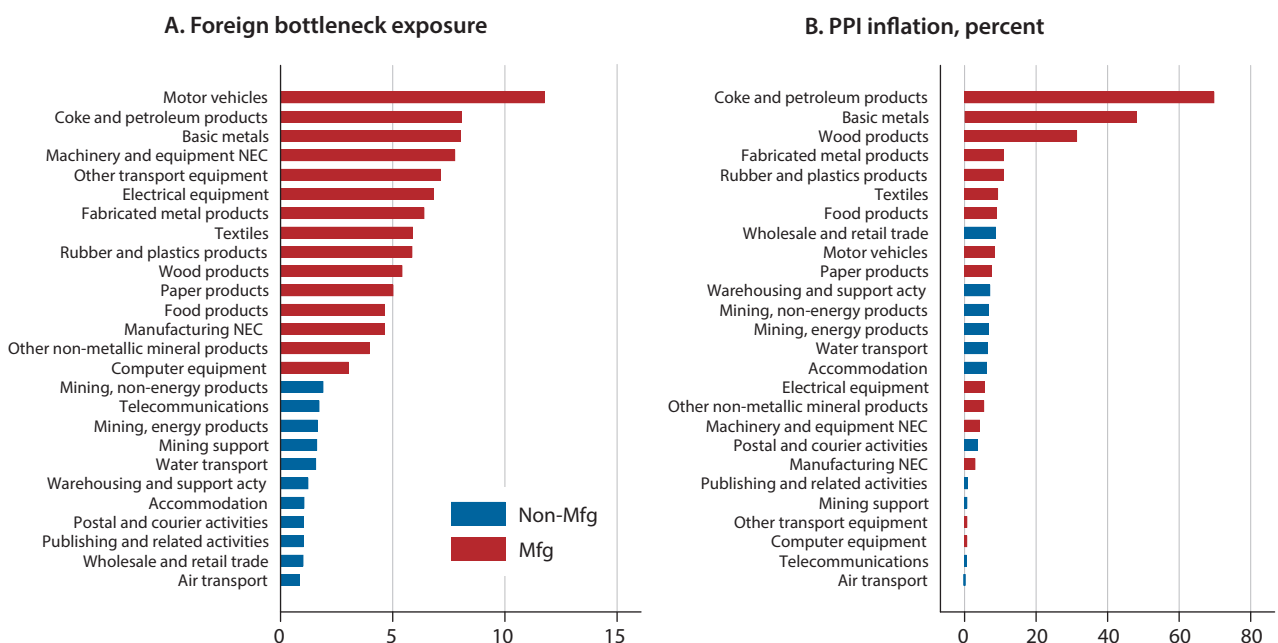
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Producer price index (PPI) inflation—the change in input costs to producers—increased substantially during the COVID-19 pandemic, and this increase was heterogeneous across industries. The manufacturing sector was, on average, more severely hit than services. There was also large heterogeneity within the manufacturing sector itself: Coke and petroleum, basic metals, and wood products have seen the highest price increases, whereas computer equipment and other transport equipment experienced the lowest price increases (Figure 1). What factors contributed to the rapid increase in PPI inflation and the large industry heterogeneity? Authors Santacreu and LaBelle explore this question in detail in their 2022 article for the Federal Reserve Bank of St. Louis *Review*.¹ This essay summarizes their main findings and examines the challenges ahead for supply chains and PPI inflation.

To What Extent Did Supply Chain Disruptions Contribute to Inflation?

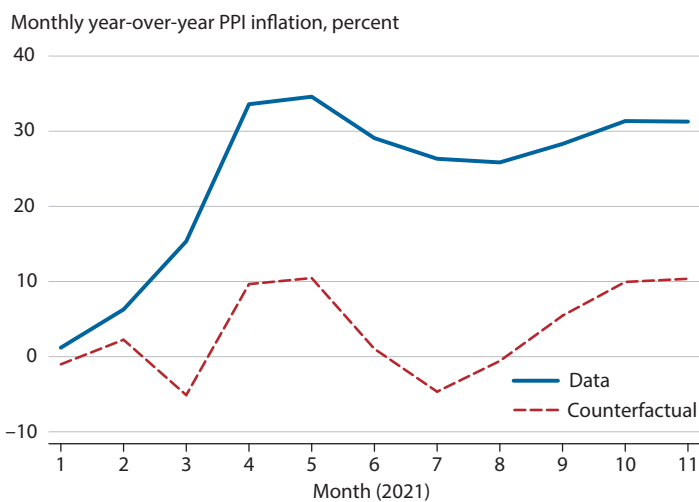
The COVID-19 pandemic was characterized by a shift in the composition of consumption—away from services and toward durable goods. This is an important shift because the production of durables goods is organized into complex global value chains: Firms source necessary intermediate goods along different stages of production from around the world based on the comparative advantage of the source country. During COVID-19, the global nature of the crisis and subsequent government policies implemented worldwide to contain the spread of the virus (e.g., labor shortages, shipping crises, and lockdowns) made it difficult for firms to scale up production to meet the rapid increase in demand, leading to bottlenecks, long delivery times, and upward pressure on prices.

Figure 1
Average Foreign Bottleneck Exposure and PPI Inflation, January–November 2021



NOTE: The figure shows 26 U.S. industry averages for exposure to foreign backlogs (Panel A) and year-over-year PPI inflation (Panel B). Red bars represent manufacturing industries; blue bars represent non-manufacturing services industries. NEC, not elsewhere classified; acty, activity.
 SOURCE: TIVA, IHS Markit, BLS, and authors' calculations.

Figure 2
Manufacturing Year-Over-Year PPI Inflation in the Data and in the Counterfactual, January–November 2021



SOURCE: BLS and authors' calculations.

Santacreu and LaBelle (2022) quantify the extent to which these supply chain disruptions contributed to PPI inflation, disentangling how the effects of domestic and foreign bottlenecks propagated through global value chains. For 26 industries in the United States, they construct a measure of domestic and foreign exposure to supply chain disruptions between January and November 2021. Their measure of bottlenecks is from the Purchasing Managers' Index by S&P Global, and it captures whether the number of unfulfilled new orders and suppliers' delivery times increased, decreased, or remained stable compared with the previous month. They then combine this measure with the share of inputs that industries source from each country. Based on this metric, industries that source a high share of their inputs from countries experiencing long delays or large bottlenecks can be vulnerable to foreign supply chain disruptions.

Supply chain disruptions have contributed to large increases in PPI inflation during the COVID-19 pandemic.

Panel A of Figure 1 shows the results of this measure of exposure across U.S. industries. The manufacturing sector is more exposed than the services sector, with the most-exposed manufacturing industries being motor vehicles, coke and petroleum, and basic metals. Panel B of the figure shows that, in general, the industries most exposed to

foreign bottlenecks also experienced higher increases in PPI inflation between January and November 2021. For instance, the coke and petroleum and basic metal industries are the second and third most-exposed and the highest and second-highest PPI inflation industries, respectively.

In a more formal econometric analysis, Santacreu and LaBelle (2022) regress the year-over-year monthly change in the PPI on their measures of domestic and foreign exposures to supply chain disruptions (controlling for time-invariant industry characteristics) for each U.S. industry in their sample for January to November 2021. Their main findings are as follows:

- (i) Manufacturing industries were, on average, more exposed to foreign bottlenecks than services industries;
- (ii) manufacturing industries experienced higher PPI inflation than services industries;
- (iii) exposure to foreign bottlenecks was a more important contributor to PPI inflation than exposure to domestic bottlenecks; and
- (iv) supply chain disruptions had a delayed effect on PPI inflation, peaking one month after exposure.²

Finally, the authors use these results to do a back-of-the-envelope calculation where they ask the following question: How would PPI inflation have been different during 2021 if global bottlenecks behaved as in 2019? Figure 2 shows that, for the subset of industries, PPI inflation would have been 2 percentage points lower in January 2021 and 20 percentage points lower in November 2021.³ Hence, supply chain disruptions have been an important source of PPI inflation during the COVID-19 pandemic.

What Are the Challenges Ahead?

Supply chain disruptions seem to be slowly easing: Supply is increasing to meet demand and delays in ports are improving. However, there are some challenges ahead. Sanctions imposed during the Russian invasion of Ukraine have put extra pressure on energy prices and caused the re-routing of shipping, contributing to uncertainty about future supply chain disruptions.

These past disruptions and current concerns (i.e., sanctions imposed on Russia and COVID-related lockdowns in China) have led firms to rethink their global sourcing strategies, including re-shoring or near-shoring parts of the production process, perfectly diversifying across suppliers, and increasing the inventory of critical goods. However, restructuring supply chains is costly: Breaking previously established relationships with existing suppliers and

establishing them with new ones has a large cost, and some inputs are specific to one or a few countries. As a result, restructuring supply chains may lead to industries being more resilient whenever supply chains are disrupted, but that could occur at the expense of an increase in production costs. ■

Notes

¹ Santacreu, Ana Maria and LaBelle, Jesse. "Global Supply Chain Disruptions and Inflation during the COVID-19 Pandemic." *Federal Reserve Bank of St. Louis Review*, Second Quarter 2022, 104(2), pp. 78-91; <https://doi.org/10.20955/r.104.78-91>.

² Regression is a statistical method used to determine the strength of the relationship between one dependent variable (e.g., PPI inflation in the context of this article) and a series of other variables (e.g., our measures of exposure).

³ Total manufacturing inflation is computed as a weighted average of PPI inflation across the manufacturing industries from Figure 1B using as weights the Bureau of Labor Statistics (BLS) "Relative importance of commodities included in the Producer Price Index for Final Demand, December 2020."