Global Supply Chain Disruptions and Inflation During the COVID-19 Pandemic

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We investigate the role supply chain disruptions during the COVID-19 pandemic played in U.S. producer price index (PPI) inflation. We exploit pre-pandemic cross-industry variation in sourcing patterns across countries and interact it with measures of international supply chain bottlenecks during the pandemic. We show that exposure to global supply chain disruptions played a significant role in U.S. cross-industry PPI inflation between January and November 2021. If bottlenecks had followed the same path as in 2019, PPI inflation in the manufacturing sector would have been 2 percentage points lower in January 2021 and 20 percentage points lower in November 2021. (JEL F13, F14, F44)

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1 INTRODUCTION

The COVID-19-pandemic recession and recovery have been unique compared with previous recessions, largely due to policies that led to behavioral changes. Lockdowns meant people were traveling less both for work and for leisure, eating out less, and going to fewer entertainment venues, among other things. At the same time, work from home and fiscal stimulus packages increased the demand for certain goods such as technological goods, cars, and furniture. These changes resulted in an overall shift away from consumption of services and toward consumption of durable goods.

The rapid increase in the demand for durable goods, together with the global nature of the pandemic, has exposed vulnerabilities in the current production structure of these goods. Over the past several decades, production of durable goods has become more fragmented, relying heavily on global value chain (GVCs).[1] Instead of doing everything in-house, firms can outsource parts of their production processes to other countries. Figure 1 shows that GVC participation has been rising steadily over time, though it has plateaued in recent years (see Antrás, 2020).

While GVC participation has advantages, as firms can benefit from outsourcing production to regions with a comparative advantage, it comes with risks (Santacreu and LaBelle, 2021a,b). Shocks

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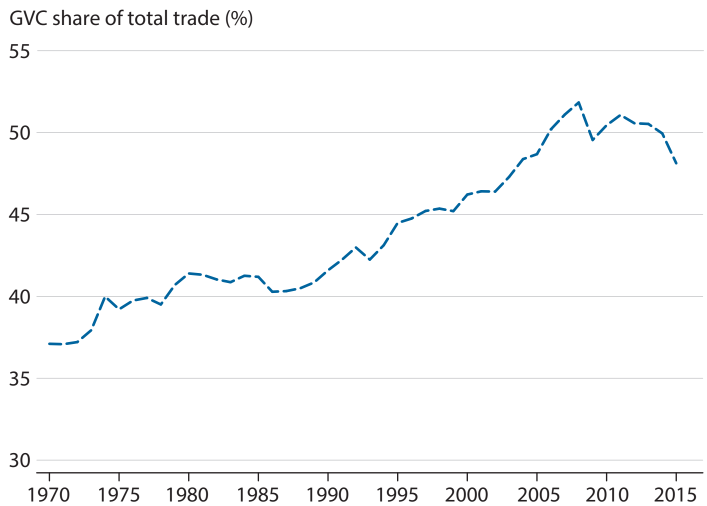
Figure 1

GVC Participation Over Time, 1970-2015



NOTE: The figure represents the evolution in the share of total trade that requires inputs from at least two countries.
SOURCE: World Bank *World Development Report 2020*.

that hit a particular stage of the production process can propagate along the chain and expose firms dependent on inputs from these regions. Some of these risks did materialize during the current pandemic through global lockdowns (Leibovici, and Santacreu, and LaBelle, 2021), low vaccination rates in emerging countries (Çakmaklı et al., 2021), and large shipping costs and disruptions in some key ports, putting additional pressure on supply chains.[2]

These risks can be exacerbated when supply chains rely heavily on critical inputs from one or a few regions. Take the example of semiconductors. The advancement of technology in nearly every product has made semiconductors a vastly important input for the entire economy; however, their production largely relies on a few countries, such as Taiwan and China. A sharp increase in the demand for products that use this input may create large bottlenecks in semiconductor-dependent industries. Therefore, due to the global nature of supply chains, even a relatively small demand shock to a critical sector can propagate into a larger supply/demand disruption. This mismatch between supply and demand puts upward pressure on prices. In this article, we address the following question: To what extent has the global nature of supply chain disruptions contributed to producer price index (PPI) inflation across U.S. sectors?[3]

The main challenge to answer this question is the limited access to real-time data on supply chain disruptions. We rely on the Purchasing Managers' Index data from S&P Global. These data, which are available with a subscription, comprise monthly surveys sent to senior executives at private firms in 44 countries. We focus on two measures from this survey that capture supply chain disruptions: backlogs and supplier delivery times. Backlogs measure how much the number of unfulfilled new orders has changed from the previous month; delivery times measure how much the average time it takes for suppliers to deliver inputs has changed from the previous month. Each variable represents a rate of change over the previous month, and both capture demand and supply effects.

Higher backlogs typically indicate that demand is increasing at a rate producers cannot meet, while the opposite indicates unused production capacity resulting from a lack of demand. Hence, backlogs measure how quickly suppliers can keep up with demand. The same logic applies to delivery times. As such, these measures can be used to infer demand and supply mismatches that contribute to price increases and inflation.

We begin by documenting three salient features of the data on supply chain disruptions. First, bottlenecks have become worse since January 2021, as implied by an increasing number of unfulfilled orders and longer delivery times. Second, backlogs and delivery times track PPI inflation quite well, with each having a correlation of about 90 percent for the period January 2020 to November 2021. Third, supply chain disruptions and their contribution to PPI inflation have been heterogeneous across industries. Backlogs increased sharply in the automobile and technology equipment industries. These increases were followed by large increases in PPI inflation. In the pharmaceutical industry, however, bottlenecks remained relatively steady, which were reflected in a steady increase in PPI inflation over the same period. These results suggest that the supply and demand mismatch was worse in the technology equipment sector and the automobile and auto parts sector than in the pharmaceutical sector.

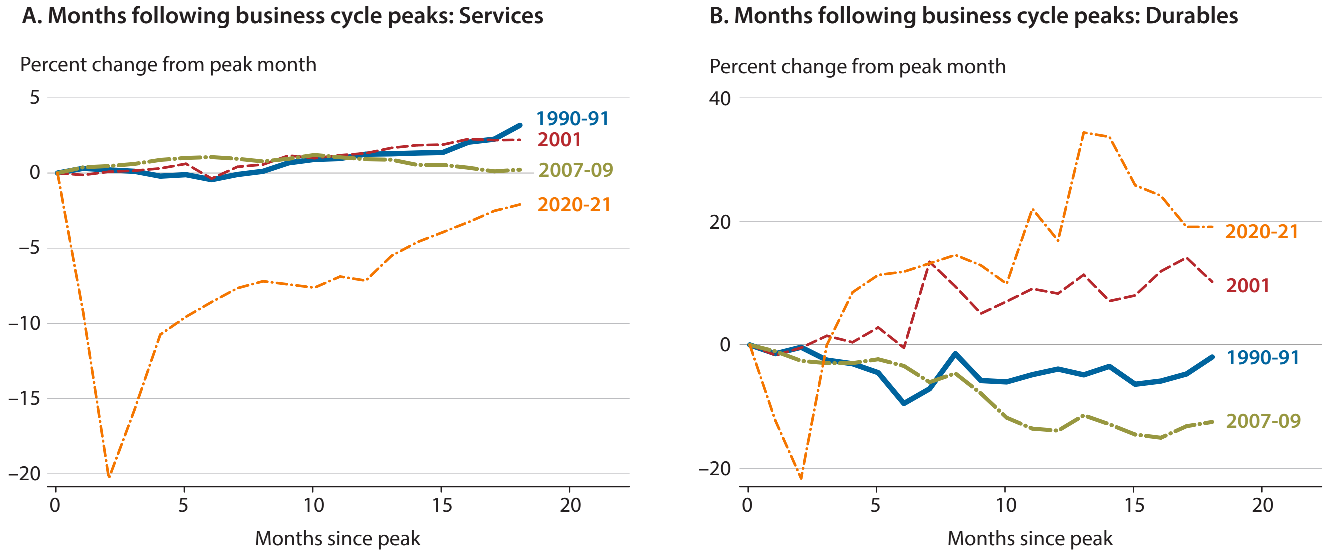
We then ask the following question: Did U.S. industries more exposed to global supply chain disruptions experience higher PPI inflation over this time period? To answer this question formally, we construct measures of industry exposure to supply chain disruptions, both domestic and foreign.[4] In particular, we exploit heterogeneous variation in an industry's sourcing patterns across countries and interact it with our measures of supply chain disruption: changes in backlogs and in delivery times, respectively. If an industry in the United States relies heavily on intermediate inputs from a country where supply chain disruptions are severe, this industry will be more exposed. We consider both the manufacturing and non-manufacturing sectors. To the extent that for each industry we keep the value-added shares fixed at the levels in 2018, the interaction with the bottleneck variables in our exposure measure captures the role of the supply shock in that particular industry.

Our empirical strategy consists of regressing industry PPI inflation on our measures of domestic and foreign exposure, including industry fixed effects. We focus on the period January 2021 to November 2021. We find that both domestic and foreign exposure have a positive effect on industry PPI inflation. However, only foreign exposure is statistically significant. These results hold when using either backlogs or supplier delivery times as the measure of disruption. Moreover, the effects of global supply chain disruptions on PPI inflation are larger if the exposure variables are lagged by one month, suggesting that supply chain disruptions have a delayed impact on inflation. We then conduct the same regression analysis but separate the industries into manufacturing and non-manufacturing sectors. In the non-manufacturing sector, both domestic and foreign exposure have a positive and statistically significant effect on PPI inflation. In the manufacturing sector, however, only foreign exposure is statistically significant.

Finally, we ask the following question: What would PPI inflation have been during 2021 if backlogs in each country had followed their 2019 path? To answer this question, we do a back-of-the-envelope calculation in which we take the results from our regression analysis and compute a counterfactual PPI inflation rate using the data on bottlenecks from 2019. We find that PPI inflation in the manufacturing sector during 2021 would have been 2 percentage points lower in January and 20 percentage points lower in November 2021.

Figure 2

Consumption Patterns During Recessions



NOTE: The figure shows the evolution of real consumption in services (Panel A) and nondurable goods (Panel B) 18 months after the business cycle peaks of the 1990-91, 2001, 2007-09, and 2020-21 recessions.

SOURCE: FRED®, Federal Reserve Bank of St. Louis; National Bureau of Economic Research; and authors' calculations.

Our results show that supply chain disruptions during the COVID-19 pandemic recession and recovery have been unprecedented. The shift in demand toward durable goods consumption and the heavy reliance on foreign suppliers to produce these goods has created a mismatch between supply and demand resulting in price increases. Sectors that rely more heavily on foreign inputs from countries that faced stronger disruptions experienced larger increases in PPI inflation.

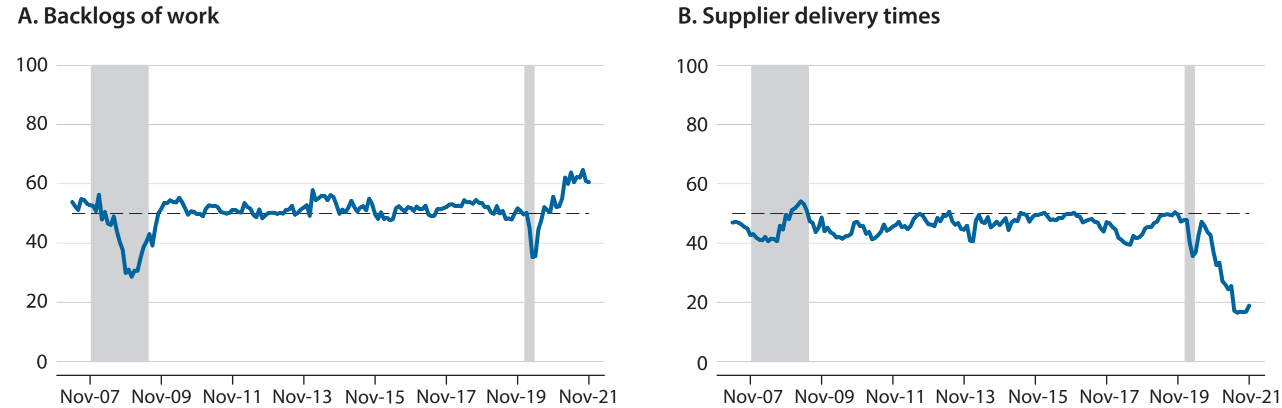
This article complements a short but growing literature on inflation and supply chain disruptions. Ha, Kose, and Ohnsorge (2021) analyze the driving forces of global inflation, focusing on the 2020 global recession. Comin and Johnson (2020) study the role of trade integration and offshoring on inflation. Leibovici and Dunn (2021) discuss the extent to which supply chain disruptions account for the recent rise in inflation, focusing on the case of semiconductors. Finally, Amiti, Heise, and Wang (2021) study the effects of rising import prices on U.S. producer prices.

2 SUPPLY CHAIN DISRUPTIONS DURING COVID-19

The COVID-19 recession and recovery have been different from previous recessions and recoveries along several dimensions. One is related to consumption: There has been a shift in consumption away from services and toward durable goods. Figure 2 plots for the COVID-19 recession and recovery and three earlier ones, the evolution of real consumption of services (Panel A) and durable goods (Panel B) for 18 months after the business cycle peak (with consumption normalized to 1 in each business cycle peak).[5]

Figure 3

Delivery Times and Backlogs Over Time, May 2007-November 2021



NOTE: The figure shows the monthly evolution of backlogs (Panel A) and supplier delivery times (Panel B) in the United States. Gray bars indicate recessions as determined by the NBER.

SOURCE: S&P Global.

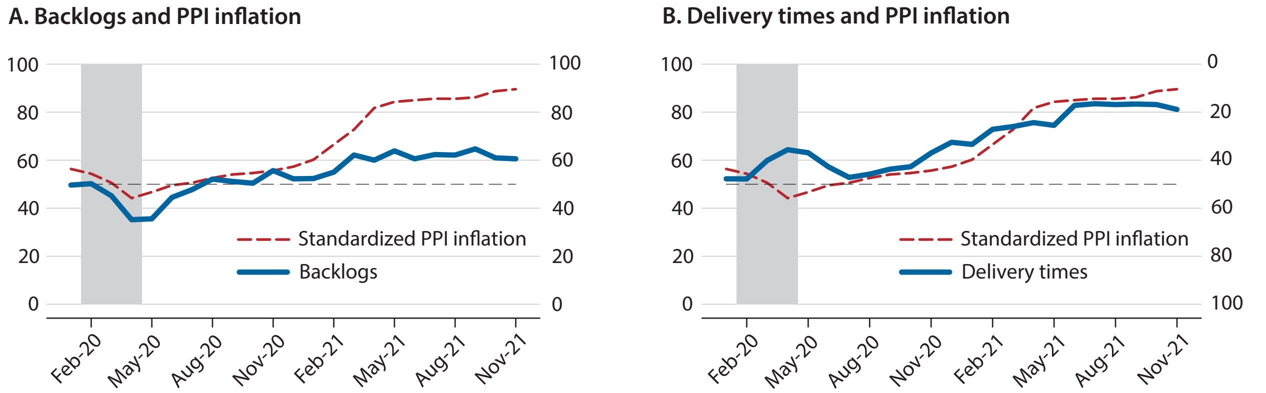
During a typical recession, services consumption tends to remain stable. In contrast, the COVID-19 recession was characterized by a sharp decline in consumption of services during the first months (over 20 percent in April 2020 from the peak in February 2020), which started recovering steadily after the initial shock. This recovery was helped when lockdowns were lifted and vaccines became widely available. Durable goods consumption, on the other hand, tends to drop and stay low for the duration of a recession and into the recovery, as consumers typically postpone consumption of these types of goods. During the COVID-19 recession, however, there was an initial sharp drop in durable goods consumption as expected; however, durables consumption recovered quickly and remained 19 percent higher than the peak even 18 months later.

The shift of demand toward durables consumption, together with the fact that production of these goods takes place along complex supply chains, has translated into large bottlenecks. We show evidence of supply chain disruptions by plotting the evolution of backlogs (i.e., new orders that have not been completed or started yet) and supplier delivery times (i.e., the time it takes for a manufacturer to receive inputs from suppliers) from May 2007 to November 2021 in Figure 3. Index values greater than 50 represent increased backlogs (or lower delivery times) relative to those in the previous month, with the reverse being true for index values less than 50.[6]

Backlogs of work (Panel A) and supplier delivery times (Panel B) during the COVID-19 recession and recovery have behaved differently than during the Great Recession. The previous recession represents, in many ways, a typical demand shock: The rate of change of delivery times slightly increased before quickly recovering (see Figure 3). By the end of the recession in June 2009, delivery times had been actually getting shorter on a monthly basis for the previous six months. During this time, backlogs were gradually disappearing as the recession deepened. In fact, there were no month-over-month backlog increases, denoted by index values greater than 50 from May 2008 to October 2009, four months after the recession officially ended. For the COVID-19 recession, delivery times consistently worsened on a monthly basis but this rate flattened starting in June 2021. At the same

Figure 4

Backlogs, Delivery Times, and PPI Inflation, January 2020-November 2021

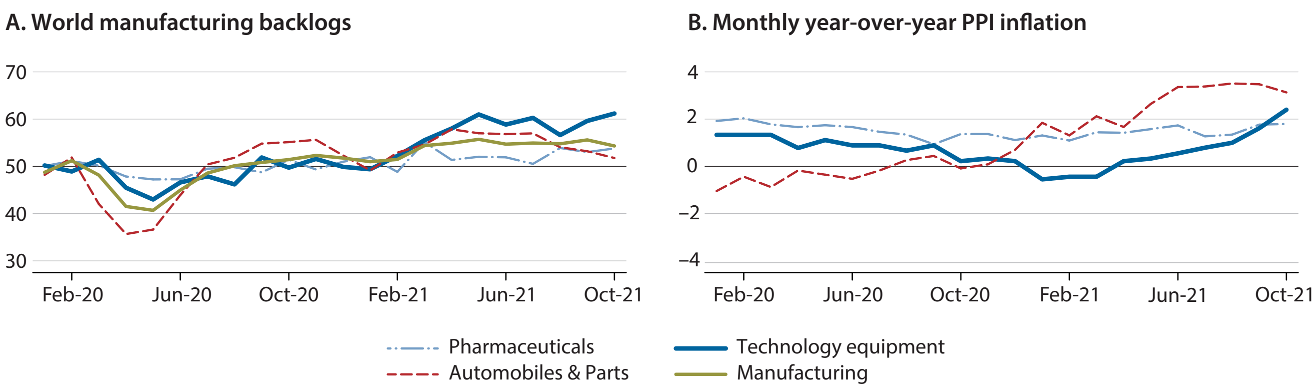


NOTE: The figure shows the monthly evolution of backlogs and PPI inflation (Panel A) and suppliers' delivery times and PPI inflation (Panel B) in the United States. Delivery times are plotted on the right *y*-axis with an inverted scale so that higher values represent longer delivery times. Gray bars indicate the COVID-19 recession as determined by the NBER.

SOURCE: S&P Global, BLS, and authors' calculations.

Figure 5

Backlogs and PPI Inflation by Sector, January 2020-October 2021



NOTE: The figure shows the monthly evolution of world backlogs (Panel A) and US PPI inflation (Panel B) for three sectors: automobiles and parts, technology equipment, and pharmaceuticals.

SOURCE: S&P Global, BLS, and authors' calculations.

time, backlogs initially experienced the typical loosening associated with a drop in demand before the supply chain shocks caused an even larger distortion and forced higher levels of backlogs. Backlogs have consistently worsened on a monthly basis since August 2020.

These findings illustrate an unprecedented supply and demand mismatch, contributing to price increases and, hence, inflation. Focusing on the period from January 2020 to November 2021, Figure 4 shows that bottlenecks, measured either with backlogs (Panel A) or delivery times (Panel B; the y-axis is inverted so that higher values represent longer delivery times) track current PPI inflation closely.[7] Indeed, the correlation of PPI inflation with backlogs and with delivery times between January 2020 and November 2021 are each about 90 percent.

The evidence reported in Figure 4 masks large cross-sector heterogeneity. Figure 5 plots backlogs (Panel A) for the world in three manufacturing sectors: automobiles and auto parts; technology equipment; and pharmaceuticals.[8] The world automobile and auto parts sector started experiencing tightening of supply chains by July 2020, which manifested as consistent increases in the monthly rate of change in backlogs. Strong demand for cars in the months following the start of the pandemic, paired with disruptions in the supply of certain key inputs such as semiconductors, led to large supply chain disruptions in this sector. In the case of the technology equipment sector, unused capacity remained relatively stable for months after bottoming out before beginning to tighten at a steep slope after the turn of the new year. The COVID-19 pandemic substantially increased demand for computers and electronics, as people started working from home and fiscal stimulus increased consumption of these goods. As a result, PPI inflation increased substantially in these sectors (Panel B). The pharmaceutical sector behaved differently from the automobile and auto parts sector and the technology equipment sector: Bottlenecks and PPI inflation remained relatively steady in comparison. Hence, sectors that faced worse supply chain disruptions (i.e., automobile and auto parts, and technology equipment) also experienced steeper price increases.[9]

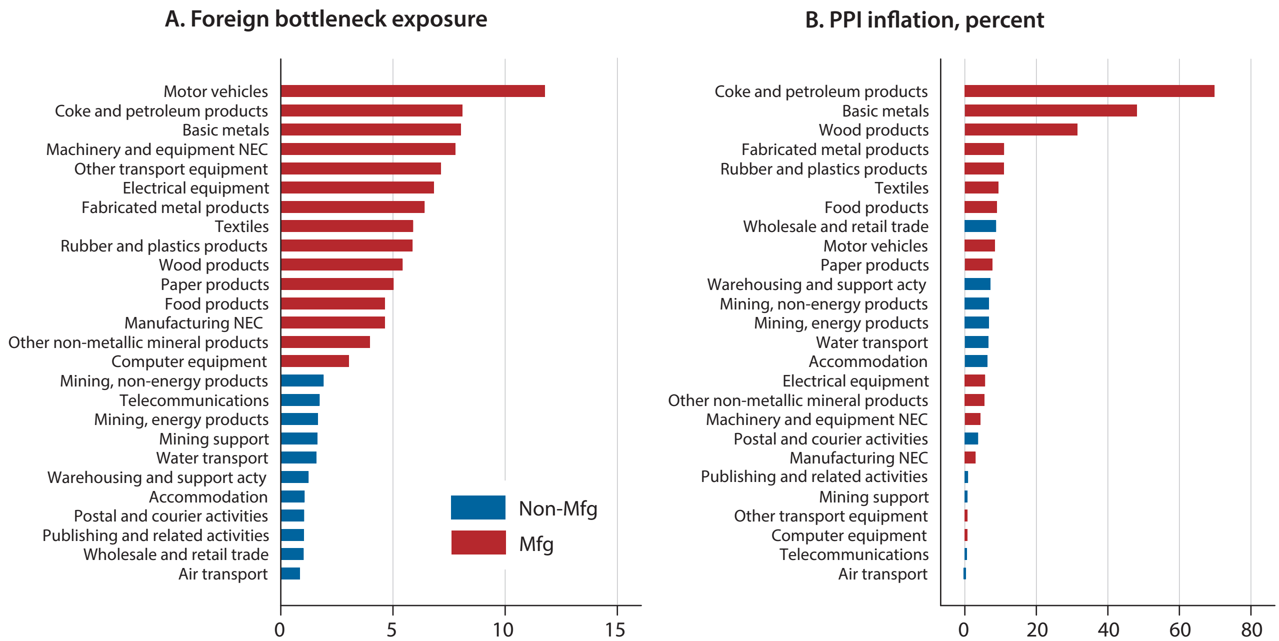
3 GLOBAL SUPPLY CHAIN DISRUPTIONS AND PPI INFLATION

In this section, we investigate the channels through which an exposure to global supply chain disruptions may have contributed to inflation during the COVID-19 pandemic. Bottlenecks in an industry can be driven by domestic or foreign factors or both. For instance, if an industry relies heavily on intermediate inputs from countries that experience more bottlenecks, that industry will be more exposed to foreign supply chain disruptions. If demand for that industry's products increases quickly, then foreign exposure may lead to price increases. In this section, we ask the following question: To what extent did exposure to domestic and foreign supply chain disruptions contribute to U.S. PPI inflation between January and November 2021? To answer this question we construct, for each industry of the United States, a domestic measure and a foreign measure of exposure to supply chain disruptions. Our empirical strategy consists of regressing PPI inflation on the exposure measures.

We follow the same methodology employed in Leibovici, Santacreu, and LaBelle (2021) and compute for each industry in the United States a measure of GVC participation—the share of gross exports (GE) produced with foreign value added (FVA) in 2018—for 32 countries and 26 industries, 15 of which correspond to the manufacturing sector.[10] This measure captures how much of the U.S. GE in a particular industry rely on intermediate imports from other countries. We then interact

Figure 6

Average Foreign Bottleneck Exposure and PPI Inflation, January-November 2021



NOTE: The figure shows for 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, S&P Global, BLS, and authors' calculations.

this variable with a measure of supply chain disruptions for each foreign supplier.[11] Our conjecture is that industries that are more exposed to global bottlenecks through GVCs experienced larger increases in PPI inflation.[12]

Industry *i*'s exposure to foreign (f) bottlenecks at time t, E_{it}^{f}, is computed as

$$E_{it}^{f} = \sum_{j=1}^{N} \frac{\mathrm{FVA}_i^j}{\mathrm{GE}_i} B_t^j, \tag{1}$$

where $\frac{\mathrm{FVA}_i^j}{\mathrm{GE}_i}$ is the share of GE from industry i that are composed of value added from country j in that industry; B_t^j represents bottlenecks, either backlogs or delivery times, in country j at time t; and N is the number of foreign suppliers. A period is a month. We restrict the analysis to the period January 2021 to November 2021.

Similarly, we compute a measure of industry 's exposure to domestic bottlenecks defined as

$$E_{it}^{d} = \frac{\mathrm{DVA}_{\mathrm{i}}^{\mathrm{US}}}{\mathrm{GE}_i} B_t, \tag{2}$$

where $\frac{\mathrm{DVA}_i^{\mathrm{US}}}{\mathrm{GE}_i}$ is the share of value added embedded in U.S. GE supplied by the United States itself. B_t is the U.S. bottleneck variable, either backlogs or delivery times.

Table 1

Exposure to Supply Chain Disruptions and PPI Inflation: Backlogs vs. Delivery Times, January-November 2021

	Backlogs	Delivery times (inverse)
Domestic exposure	0.00569 (0.004)	0.00314 (0.003)
Foreign exposure	0.239*** (0.071)	0.255*** (0.070)
Constant	–0.598*** (0.115)	2.272*** (0.565)
Industry FE	YES	YES
N	286	165
R^2	0.752	0.756

NOTE: FE, fixed effects. Standard errors are in parentheses. *** $p < 0.001$.
SOURCE: Authors' calculations.

Figure 6 plots our measure of foreign exposure computed in equation (1) (Panel A) and PPI inflation (Panel B) for the 26 industries in the United States, averaged for January to November 2021. Manufacturing industries are, on average, more exposed to foreign bottlenecks than services industries. In the manufacturing sector, motor vehicles, coke and petroleum products, and basic metals are the most exposed industries. The reason is twofold. On the one hand, these industries rely heavily on foreign intermediate inputs. On the other hand, the main suppliers in these industries have faced strong supply chain disruptions during the pandemic. Consistent with the measure of foreign exposure, manufacturing industries experienced higher PPI inflation than services industries. In the manufacturing sector, the coke and petroleum products industry and the basic metals industry are among the industries with the highest increases in prices. Therefore, there appears to be a positive correlation between exposure to foreign supply chain disruptions and PPI inflation.

3.1 Empirical Strategy

Next, we study more formally the extent to which domestic and foreign exposure to supply chain disruptions may have contributed to U.S. PPI inflation. In particular, we conduct the following linear regression:

$$\pi_{it}^{\text{PPI}} = \alpha_0 + \alpha_1 E_{it}^{f} + \alpha_2 E_{it}^{d} + I_i + u_{it}, \tag{3}$$

where π_{it}^{PPI} represents the year-over-year PPI increase in industry i at time t; E_{it}^{f} is exposure to foreign bottlenecks at time t; E_{it}^{d} is the exposure to domestic bottlenecks in industry i; I_i captures industry fixed effects; and u_{it} is the error term.

Table 1 reports the results. Foreign exposure, both in terms of supplier delivery times and backlogs, has a statistically significant effect on PPI inflation. For backlogs, increasing the month-over-month backlogs by 1 percent increases the industry inflation rate by 0.24 percentage points, while the same increase for delivery times causes an increase of about 0.26 percentage points. The

Table 2

Exposure to Supply Chain Disruptions and PPI Inflation: Lags, January-November 2021

	Backlogs	Delivery times
Domestic exposure	0.00755* (0.004)	0.00029 (0.004)
Foreign exposure	–0.154 (0.094)	0.0630 (0.087)
Domestic exposure (t – 1)	0.00340 (0.003)	0.00069 (0.004)
Foreign exposure (t – 1)	0.260*** (0.078)	0.205* (0.118)
Constant	–0.628*** (0.145)	2.356*** (0.664)
N	260	150
R^2	0.824	0.819

NOTE: Standard errors are in parentheses. * $p < 0.05$, *** $p < 0.001$.

SOURCE: Authors' calculations.

Table 3

Exposure to Supply Chain Disruptions and PPI Inflation: Manufacturing vs. Non-manufacturing, January-November 2021

	Manufacturing	Non-manufacturing
Domestic exposure	–0.00015 (0.005)	0.0161*** (0.003)
Foreign exposure	0.309** (0.099)	0.397** (0.122)
Constant	–3.549*** (0.978)	–1.355*** (0.172)
Industry FE	YES	YES
N	165	121
R^2	0.747	0.574

NOTE: FE, fixed effects. Standard errors are in parentheses. ** $p < 0.01$, *** $p < 0.001$.

R-squared is about 75 percent. Exposure to domestic bottlenecks, either measured as backlogs or delivery times, has no statistically significant effect on an industry's PPI inflation. This result may be capturing the high costs of restructuring a global supply chain that relies heavily on foreign suppliers. High fixed costs of setting up global supply chains could be resulting in stronger downstream production effects. For example, an industry heavily dependent on imported intermediates may not be able to efficiently identify new sources for those inputs.

Since supply chain disruptions may have a delayed effect on PPI inflation, we conduct the same regression in equation (3) but lag the domestic and foreign exposure measures. The results are reported in Table 2. Foreign supply chain disruptions get propagated to domestic PPI inflation with a one-month lag. This result is robust to the use of both backlogs and delivery times as the measure of supply chain disruptions.[13] Hence, supply chain disruptions tend to have a delayed impact on PPI inflation.

Table 3 reports the results with the industries separated into manufacturing and non-manufacturing sectors. Data on delivery times are only available for manufacturing sectors. Hence, we focus on backlogs as a measure of supply chain disruptions in Table 3. Notably, domestic exposure is only statistically significant when restricting the sample to the non-manufacturing sector. This result may reflect the fact that non-manufacturing sectors typically rely far less on FVA than manufacturing sectors do. Therefore, they are more susceptible to domestic fluctuations overall. In the manufacturing sector, both domestic and foreign bottlenecks have a positive effect on PPI inflation, but the effect is only significant for foreign bottlenecks. The R-squared is about 75 percent in the manufacturing sector and 58 percent in the non-manufacturing sector.

Our results suggest that global supply chain disruptions, which reflect a mismatch between demand and supply shocks, can propagate to domestic PPI inflation. The propagation is larger in those sectors where GVCs are more important.

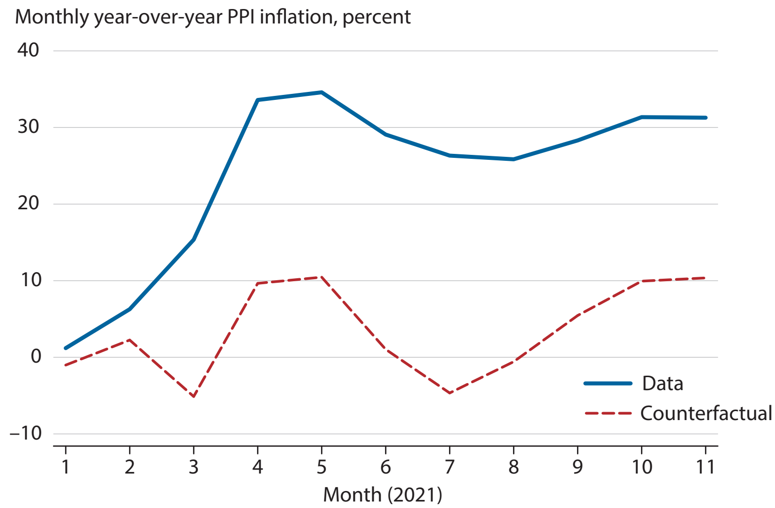
3.1.1 Back-of-the-Envelope Calculation. We now ask the following question: What would PPI inflation have been during 2021 if bottlenecks in each country had followed their 2019 path? To answer this question, we compute for each U.S. industry in the manufacturing sector a counterfactual PPI inflation rate that uses country-level data on supply chain disruptions from January to November 2019. The focus is on the manufacturing sector, which has experienced worse supply chain disruptions due to its higher dependence on GVCs.

We proceed in several steps. First, we recalculate our measures of domestic and foreign exposure in equations (2) and (1), using country-level backlogs for each month of 2019. These counterfactual measures capture the exposure of each U.S. manufacturing industry through GVC participation if backlogs had followed the same paths of monthly changes as in 2019. Second, we substitute these measures into equation (3), using the estimated coefficients and industry fixed effects from the first column of Table 3. The result is a counterfactual measure of PPI inflation for each manufacturing industry from January to November 2021. Third, we compute aggregate manufacturing PPI inflation, both in the data and in the counterfactual, as a weighted average across industries' PPI inflation in each month of 2021. The weights are provided by the BLS for December 2020.[14]

Figure 7 plots the evolution of year-over-year monthly manufacturing PPI inflation from January to November 2021, both in the data (solid line) and in the counterfactual (dashed line). PPI inflation is always lower in the counterfactual than in the data, suggesting that bottlenecks during 2021 significantly contributed to inflation. Differences between the data and the counterfactual were larger between June and September 2021 and then started narrowing in October 2021. In particular, we find that manufacturing PPI inflation would have been 2 percentage points lower in January 2021 and 20 percentage points lower in November 2021 if the monthly change in bottlenecks had followed the 2019 path.

Figure 7

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



SOURCE: BLS and authors' calculations.

4 CONCLUSIONS

In this article, we investigated the role of global supply chain disruptions in PPI inflation across U.S. industries during the COVID-19 pandemic. We find that exposure to foreign bottlenecks through GVCs played a significant role in transmitting the effects of supply chain disruptions to U.S. prices. Our findings are driven by a combination of demand and supply shocks and the heterogeneous exposure to these shocks across industries. Industries that rely on inputs from countries whose production has been most affected by disruptions also experienced large price increases due to the inability to keep up with demand. Whether the inflation caused by supply chain disruptions is temporary (i.e., a rise in the cost of living) or a more permanent phenomenon will depend—absent any policy intervention—on the ability of supply chain disruptions to ease in order to meet the higher demand. The unequal distribution of vaccines in emerging countries, the rise of new variants, and disruptions in shipping could add some additional pressure on supply chains, creating pessimism about inflation disappearing in the near future. ■

NOTES

1 See Santacreu and LaBelle (2021a,b) for a discussion on the rise of GVCs.

2 See Leibovici and Dunn (2021).

3 We focus on PPI inflation rather than consumer price index inflation, as the channels explored in the article (bottlenecks and delivery times) are likely to have a more direct effect on producer prices. Increases in producer prices may then be passed onto consumers with a lag. As such, the PPI serves as a leading indicator for the consumer price index.

4 We follow the methodology developed in LaBelle, Leibovici, and Santacreu (2021).

5 The plot shows monthly real consumption expenditures by major product type as reported on BEA release Table 2.8.3 of durable goods, seasonally adjusted; the date of the business cycle peak for each of the four recessions is from the National Bureau of Economic Research (NBER) Business Cycle Dating Committee (https://www.nber.org/research/business-cycle-dating). Plotting total consumption (i.e., including both durables and non-durables consumption) shows a similar evolution as that of durables consumption, but the changes are less striking (see Barnes, Bauer, and Edelberg, 2021).

6 Data are from S&P Global, which surveys upper-level executives in different industries across the world. The questions asked focus on the level of different aspects of production compared with one-month ago. The results are summarized into a diffusion index: 50 indicates no change; values above (below) 50 signal an expansion (contraction).

7 We use the BLS PPI year-over-year change rate as our measure of PPI inflation. We then standardize it to bring the scale in line with the S&P Global data. In particular, we first de-mean and divide by its sample standard deviation; second, we multiply the resulting series by the standard deviation of the S&P Global backlogs measure and add the mean.

8 We do not have data on sectoral backlogs for the United States; instead we use S&P Global data that only report disaggregated data for a few countries. To the extent that these countries have a similar production structure as the United States, we can assume that cross-sector bottlenecks in the United States follow the same pattern.

9 A value that goes from 42 to 47, for example, does not mean that bottlenecks are increasing but rather that the rate of loosening of the supply chain is slowing down.

10 Data are from the OECD Trade in Value Added (TIVA) dataset, which reports the value-added content from each origin country in the production of U.S. goods and services that are consumed worldwide.

11 Note that the backlog and delivery time measures are at the country-period level, whereas the FVA measure is at the country-sector level.

12 The list of countries is Australia, Austria, Brazil, Canada, China, Colombia, the Czech Republic, France, Germany, Greece, Indonesia, India, Ireland, Italy, Japan, Kazakhstan, Korea, Malaysia, Mexico, Myanmar, the Netherlands, the Philippines, Poland, the Russian Federation, Spain, Switzerland, Taiwan, Thailand, Turkey, the United Kingdom, the United States, and Vietnam.

13 The results (not included here) are robust to including two-month lags.

14 See https://www.bls.gov/ppi/#tables.

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