# Trade and Inflation: Evidence from the United States

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**Abstract**

This paper analyzes the role of domestic and foreign sectoral shocks in explaining the recent evolution of US inflation. Industry-specific demand and supply shocks are identified by using spatial differences in the timing of COVID-related mobility restrictions and fiscal support combined with data on patterns of specialization in production and consumption. Domestic sectoral shocks played a significant role in explaining the rise in prices charged by domestic producers. Despite the concerns about imported inflation, we find that imports, in fact, have attenuated the effect of domestic sectoral shocks on US Inflation.

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## Introduction

In early 2021 the United States experienced a sudden rise in the rate of consumer price index (CPI) inflation as it emerged from the COVID-19 pandemic. The increase was led by a surge in goods prices (Figure 1.) During the early phase of the pandemic there was a shift in preference in favor of goods. At the same time, goods have a higher import content than services, leaving them more exposed to foreign shocks. And indeed, policymakers and analysts frequently blamed disruptions in international supply chains for curbing the supply of goods, while strong consumer demand hit against supply constraints, leading to high inflation.

Starting in early 2021, concomitant with the rise in consumer price inflation, prices charged by domestic and foreign producers increased, but the former rose much faster, reversing the trend in 2020 (Figure 2). This stylized fact may suggest that import prices actually played a dampening role in US inflation; had prices charged by importers risen in parallel with those by domestic producers, US inflation could have increased even more.

At the same time, a number of shocks and policy changes hit the US and global economies. Lockdowns restricted mobility domestically and in its trading partners. In addition, unprecedented fiscal actions supported economies during the pandemic. These fiscal actions amounted to $11.7 trillion, or close to 12 percent of global GDP, as of September 11, 2020 (IMF, 2020.) In particular, the United States introduced several legislations including the American Rescue Plan Act (ARP) passed in March 2021—the $1.9 trillion Biden stimulus plan with enhanced unemployment benefits and stimulus checks.

A significant body of work has established that these shocks affected different sectors and locations differently (Guerrieri et al., 2022; di Giovanni et al., 2023), however there is little holistic evidence on how these shocks were propagated to prices. This paper uses high frequency (monthly) matched industry-level trade and domestic production and prices data to study the transmission of domestic and foreign sectoral shocks to prices of domestically produced goods and imports in the US.

### Related literature

The paper is related to several strands of literature. The macro literature on explaining US inflation during the pandemic has focused mostly on food and energy shocks, and domestic labor market tightness (e.g. Ball, Leigh, and Mishra, 2022; Bernanke and Blanchard, 2023). Bernanke and Blanchard (2023), for example, attribute the inflation surge to “sharp increases in commodity prices, reflecting strong aggregate demand and sectoral price spikes, resulting from changes in the level and sectoral composition of demand together with constraints on sectoral supply”. This paper contributes to the literature in two ways: first by establishing the importance of domestic sectoral shocks in explaining the inflation surge in the US, and second, by exploring how trade played a role, and whether it amplified or mitigated the effects of domestic sectoral shocks on inflation.

Another strand of the literature zooms into particular drivers of the recent surge in US inflation, for example supply chain bottlenecks (Comin, Johnson, and Jones 2023; Labelle and Santacreu 2022); domestic fiscal support (di Giovanni et al., 2023, Lin, 2023). Some specific industries (auto or chip) have been studied too but a systematic analysis is still lacking. This paper covers this gap. We also contribute to this literature by looking holistically at both trade and domestic producer prices.

Finally, a vast literature focuses on transmission of shocks (di Giovanni, Levchenko, and Mejean, 2022; Gabaix, 2011). Amiti, Itshoki and Weinstein, 2024, use cross-country data, and construct instruments that separate global shocks from idiosyncratic demand and supply shocks and find the largest contributor to domestic inflation are global shocks. Finally, Comin et al. (2024) investigate the impact of an import constraint on inflation, following an increase in domestic demand. Using a simple theoretical model, they argue that import constraints may not explain the observed import price inflation in the US. We contribute to this strand of literature by using US in the pandemic as a case study to analyze the propagation of domestic and international shocks to both domestic and import prices.

## Methodology

We use an identification strategy based on the interaction between spatial specialization of consumption and production across industries, the timing of when the COVID-19 pandemic hit a country or a state, and the size of state-specific fiscal stimulus. This Bartik-style shift-share approach is not new, but its use is particularly helpful to identify the sectoral shocks around COVID-19. The specialization in demand and supply is predetermined and the timing of the pandemic is exogeneous.[1]

### *Sectoral supply shocks*

Sectoral supply shocks are measured at a monthly frequency by weighted averages of de facto pandemic restrictions (proxies by Google mobility indices) at the state level in the US (for domestic supply shocks), and at the trading partner-country level (for foreign supply shocks). The weights are the shares of the state in industry production for domestic shocks, or of partner countries in imports in that industry for foreign shocks.

The identification comes from the pre-pandemic cross-country (or cross-state) differences in sectoral specialization interacted by the country- (or state-) specific intensity of mobility restrictions.

More specifically, domestic and foreign supply shocks for industry *k* and month *t* are measured by Equations (1) and (2) respectively:

$$\Delta \mathrm{d\_supply}_{\mathrm{kt}} = \sum_s \frac{wage\ bill_{sk,2017}}{\sum_j wage\ bill_{jk,2017}} \Delta \ln(mobility_{st}) \tag{1}$$

*s* denotes state. $wage\ bill_{sk,2017}$ denotes industry *k* wage bill in a state *s* in 2017.

$\Delta \ln(mobility_{st}) = \ln(mobility_{st}) - \ln(mobility_{s0})$. $mobility_{s0}$ is google mobility index at workplace by state in 2020m2 (the earliest available data).

[1] In principle, the pattern of trade specialization and the spread of the covid-19 pandemic could be correlated if the diffusion of the pandemic followed trade routes.

$$\Delta f\_supply_{kt} = \sum_i \frac{US\ import_{ik,2017}}{\sum_i US\ import_{ik,2017}} \Delta \ln\left(mobility_{it}\right) \quad (2)$$

Where US $import_{ik,2017}$ denotes US import value in industry k from country $i$ in 2017. $\ln(mobility_{it}) = \ln(mobility_{st}) - \ln\,(mobility_{s0})$. For countries excluding China, $mobility_{s0}$ is google mobility index at workplace in country I in 2020m2 (the earliest available data.) For China, google mobility indices do not exist, so we use Baidu mobility instead.

The intuition is that the relative supply in a sector would decline when states where that sector has a larger share of pre-pandemic production face higher pandemic restrictions. For example, consider the auto sector. The relative supply in the auto sector would decline compared to other sectors when pandemic restrictions increased in Michigan. Similarly, relative foreign supply in a specific sector would decline when countries from where goods in that sector are mostly imported from face higher pandemic restrictions. For example, consider the machinery sector. The relative foreign supply of machinery would decline in early stages of the pandemic when mobility restrictions increased sharply in China.

***Sectoral demand shocks***

The identification of sectoral demand shocks comes from the pre-pandemic cross-country (or cross-state) differences in consumption interacted with the country- (or state-) specific intensity of mobility restrictions.

Like supply shocks, demand shocks are also computed at a monthly frequency, with weighted averages of fiscal support, proxied by domestic and foreign consumption measures, which we could gather at high frequency. The weights are the pre-pandemic shares of state (for domestic shocks) in retail shipments (to proxy for domestic retail consumption) or partner countries (for foreign shocks) in total US exports, in that industry. More specifically, domestic and foreign demand shocks for industry *k* and month *t* are measured by Equations (3) and (4) respectively.

$$\Delta \text{d\_demand}_{\text{kt}} = \sum_s \frac{shipment_{sk,2017}}{\sum_j shipment_{jk,2017}} \Delta \ln(retail\ sales_{st}) \tag{3}$$

where *s* denotes state as before. $shipment_{sk,2017}$ denotes retail shipment to state *s* of industry *k* goods in 2017, $\sum_j shipment_{jk,2017}$ is the total retail shipments for industry *k* in 2017. The ratio is a proxy for the pre-pandemic patterns of retail consumption; and

$\Delta \ln(retail\ sales_{st})=\ln(retail\ sales_{st}) - \ln\left(retail\ sales_{s,the\ same\ month\ in\ 2019}\right)$

$$\Delta \text{f\_demand}_{\text{kt}} = \sum_s \frac{US\ export_{ik,2017}}{\sum_i US\ export_{ik,2017}} \Delta \ln(import_{it}) \tag{4}$$

where $US\ export_{ik,2017}$ denotes US export to country *i* in industry k in 2017, $\sum_i US\ export_{ik,2017}$ is the total exports in industry *k* in 2017. The ratio represents a proxy for pre-pandemic patterns of foreign demand, and $\Delta \ln(import_{it}) = \ln(import_{it}) - \ln\ (import_i, the\ same\ month\ in\ 2019)$

The intuition for the demand shocks is that the relative domestic demand in a specific sector increases when states where that sector has a larger share of pre-pandemic consumption received big demand shocks. Similarly, relative foreign demand in a sector increases when countries where that sector has a larger share of pre-pandemic exports received more demand shocks. For example, consider California which typically has a large share in the consumption of pharmaceuticals; relative demand for pharmaceuticals would increase if government paychecks went to Californians during the pandemic. Similarly, relative demand for electronic sector would increase with a rise in fiscal support to consumers in Mexico, which comprises a large export market for US electronics. Table 1 provides a summary of the construction of all the four shocks used in the empirical framework.

***Empirical specification***

The demand and supply shocks are considered together in an empirical specification which is specified as follows:

$$\Delta \ln(ppi_{kt}) = \alpha\Delta \mathrm{d}_{\mathrm{supply}_{\mathrm{kt}}} + \beta\Delta \mathrm{f}_{\mathrm{supply}_{\mathrm{kt}}} + \gamma\Delta \mathrm{d}_{\mathrm{demand}_{\mathrm{kt}}} + \delta\Delta \mathrm{f}_{\mathrm{demand}_{\mathrm{kt}}} + \mathrm{s}_{k} + \pi_{t} + \epsilon_{kt} \quad (5)$$

Where $\Delta \ln(ppi_{kt}) = \ln(ppi_{kt}) - \ln\,(ppi_{k,the\ same\ month\ in\ 2019})$. $\mathrm{s}_{k}$ and $\pi_t$ denote industry and time fixed effects. Due to data availability reasons, we focus on manufacturing goods, which comprises a significant fraction of domestic goods production and imports (93% and 95% respectively). Equation (5) is estimated at the level of NAICS 4-digit industry, at monthly frequency during the period of 2020m1 to 2022m10.

**Results**

The results from estimating Equation (5) are reported in Table 2. Column [1] uses the sample from 2021m1-2022m12 (period of inflation surge), while Column [2] uses the sample from 2020m1-2022m12 (includes the period with the start of the pandemic, before the surge inflation). The estimated coefficients of the shocks are of expected signs – positive and negative on demand and supply shocks respectively. *Positive* demand shocks in a sector – both domestic and foreign – are associated with higher inflation in that sector, while *negative* supply shocks – again both domestic and foreign, lead to higher inflation. While the coefficient estimates for all the four shocks are statistically significant for the period from 2021-2022, the demand shocks are statistically indistinguishable from zero for the sample period including 2020, perhaps because inflation itself was muted at the start of the pandemic.

The estimated magnitude of the shocks reveals interesting insights; with much smaller magnitudes for foreign shocks compared to domestic ones. Focusing on Column [1], a one percentage point higher foreign demand shock in a sector is associated with 1.4 percentage point higher producer price inflation on average; while a shock to domestic demand on average matters four times more for the inflation rate. Supply shocks – both domestic and foreign - tend to have a smaller effect compared to demand shocks. A one percentage point negative foreign supply shock increases the inflation rate by less than one percentage point, whereas a domestic shock matter eighteen times more. Using the distribution of shocks (see Table A1), while a domestic demand shock in the interquartile range of its distribution is associated with 0.37-0.74 pp higher produce price inflation rate, a foreign demand shock in its interquartile range is associated with an increase of only half the magnitude. Similarly, while a domestic supply shock in the interquartile range is associated with a higher produce price inflation rate of 0.33-0.45 percentage points, a foreign supply shock has a negligible effect on producer prices.

Overall, the findings so far suggest little evidence of transmission of sectoral shocks in US' trading partners into domestic prices. In other words, we do not find evidence for domestic inflation to have a significant component of imported sectoral shocks.

**Next steps**

The analysis so far has focused on the first round impact of shocks. We clearly identified demand and supply shocks at high frequency. The signs on the coefficients are consistent with the demand / supply shock interpretation. And the findings that import prices contributed less than expected to domestic inflation is interesting. This is the first (contemporaneous) effect of shocks on prices. It does not consider second-round effect.

The next steps will focus on the analysis of the propagation of the shocks. This involves potentially two venues:

a. Using input output tables which impose a structure on the propagation of the shocks;
b. Using lags in the regression.

Other papers (some surveyed in a previous section) also asked the similar questions on the role of domestic vs. foreign shocks. The key difference is the identification method. Some used an (atheoretical) var approach; some use a model. Our paper uses shocks using the peculiarity of the covid pandemic which hit randomly some states and countries.

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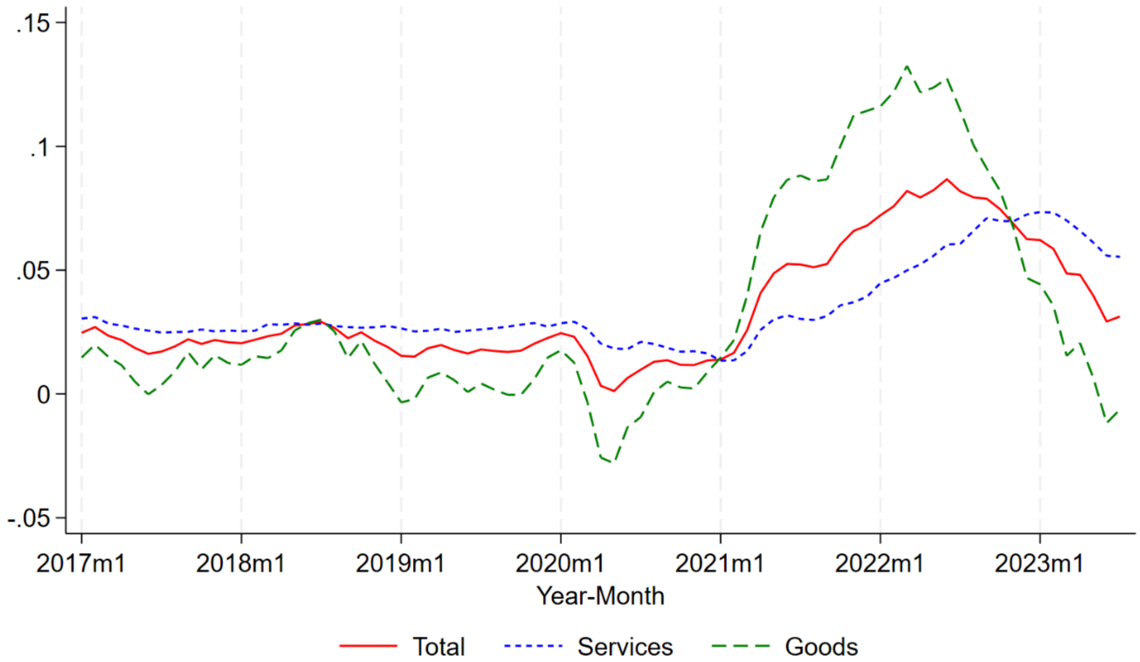
Figure 1. CPI Inflation in the United States




Notes: This figure shows the year-on-year CPI inflation using BLS data.

Figure 2. Import and Domestic Price Changes in the Pandemic

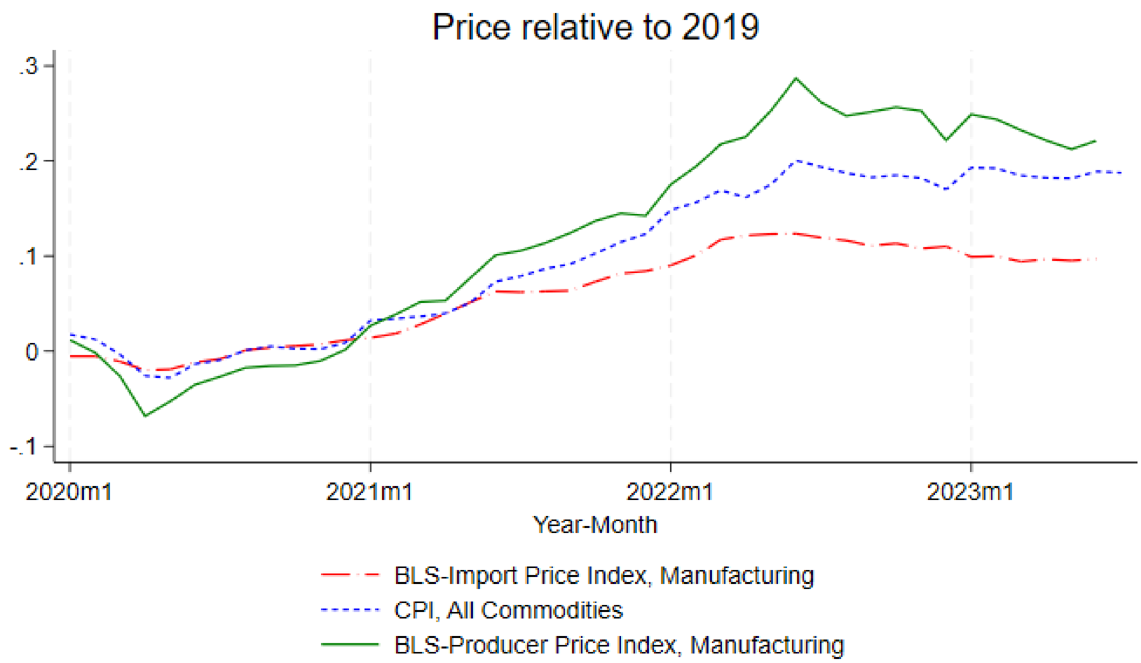


Table 1. Identification of sectoral shocks

| | Domestic | Foreign |
|---|---|---|
| Demand | Retail sales in state *s* in the US at time *t* * pre-pandemic share of *s* in retail sales in industry *k*<br>$\Delta \mathrm{d\_demand}_{\mathrm{kt}} = \sum_s \frac{shipment_{sk}}{\sum_j shipment_{jk}} \Delta \ln(retail\ sales_{st})$<br>Intuition: relative (domestic) demand for a specific sector rises if states which usually consumed more from that sector experienced a larger boost in consumption (likely from larger government support in that state). | Import demand in US' partner country *I* at time *t* x pre-pandemic share of US' imports from *i* in industry *k*<br>$\Delta \mathrm{f\_demand}_{\mathrm{kt}} = \sum_s \frac{US\ export_{ik}}{\sum_i US\ export_{ik}} \Delta \ln(import_{it})$<br>Intuition: relative (foreign) demand for a specific sector rises if countries where US has a large export share experienced a greater boost in consumption (likely from larger government support in that country) |
| Supply | Pandemic restrictions in US state *s* at time *t* * pre-pandemic share of state *s* in payroll in industry *k*<br>$\Delta \mathrm{d\_supply}_{\mathrm{kt}} = \sum_s \frac{wage\ bill_{sk,2017}}{\sum_j wage\ bill_{jk,2017}} \Delta \ln(mobility_{st})$<br>Intuition: relative domestic supply in a specific sector declines if states where that sector typically has a larger share of payroll have lower mobility (higher pandemic restrictions). | Pandemic restrictions in US' partner country *i* at time *t* * pre-pandemic share of US' imports in industry *k* from country *i*<br>$\Delta \mathrm{f\_supply}_{\mathrm{kt}} = \sum_i \frac{US\ import_{ik,2017}}{\sum_i US\ import_{ik,2017}} \Delta \ln(mobility_{it})$<br>Intuition: relative foreign supply in a specific sector declines if countries from where goods are mostly imported from have lower mobility (higher pandemic restrictions). |

Table 2. US Producer Prices and Sectoral Demand and Supply Shocks

| variables | [1]<br>2021-2022<br>Δln(ppi) | [2]<br>2020-2022<br>Δln(ppi) |
|---|---|---|
| Δd_demand | 5.380* | 2.689 |
| | (2.785) | (2.344) |
| Δd_supply | -1.450** | -1.107 |
| | (0.563) | (0.685) |
| Δf_demand | 1.361*** | 1.708** |
| | (0.422) | (0.661) |
| Δf_supply | -0.079* | -.145* |
| | (0.047) | (0.080) |
| Observations | 1,848 | 2,436 |
| R-squared | 0.874 | 0.771 |
| Year-Month FE | Y | Y |
| Industry FE | Y | Y |

Notes. Table 2 reports results from estimating Equation (5). The sectoral shocks are defined in Equations (1)-(4). Standard errors are clustered at the industry level, and are denoted in parentheses. ***, **, and * denote statistical significance at 1, 5 and 10 percent levels respectively.

**Table A1**

**Summary statistics**

| variable | Obs | Mean | Std. dev. | Min | Max | 25pct | 75pct |
|---|---|---|---|---|---|---|---|
| Δln(ppi) | 2040 | 0.148 | 0.126 | -0.08 | 0.526 | 0.049 | 0.214 |
| Δd_demand | 2020 | 0.119 | 0.084 | 0.004 | 0.421 | 0.068 | 0.138 |
| Δd_supply | 1870 | -0.275 | 0.052 | -0.425 | -0.158 | -0.31 | -0.23 |
| Δf_demand | 1932 | 0.186 | 0.092 | -0.044 | 0.336 | 0.113 | 0.261 |
| Δf_supply | 1848 | -0.173 | 0.135 | -0.688 | 0.027 | -0.232 | -0.087 |