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From Ports to Prices: The Inflationary Effects of Global Supply Chain Disruptions

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From Ports to Prices: The Inflationary Effects of Global Supply Chain Disruptions
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ABSTRACT: This paper examines the inflationary effects of shipping delays.We construct a novel measure of port-to-port shipping time using real-time AIS maritime data and link itwith granular port-level trade and item-level price data. We document substantial heterogeneity in goods imports across ports and regions, variation in exposure to delays, and aggregate price responses to congestion shocks. Exploiting cross-product variations in exposure, we estimate both the average and dynamic effects of shipping delays on consumer prices, finding that a 100-hour delay raises inflation by roughly 0.5 percentage points at its five-month peak.

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WORKING PAPERS

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1 Introduction

Global supply chains have made the world more interconnected than ever before, providing households and firms unprecedented access to goods, resources, and markets. However, this interconnectedness also creates vulnerabilities, as disruptions in one part of the value chain can quickly ripple across countries and sectors. Events such as natural disasters, trade wars, military conflicts, labor strikes, and pandemics can severely hinder the smooth flow of goods, resulting in delays, shortages, and increased costs (Alessandria et al., 2023; Bai et al., 2024). How do such supply chain disruptions affect the domestic economy? This paper studies the effects of a major supply chain disruption during the COVID-19 crisis on US inflation, focusing on shipping delays largely driven by port congestion.

Shipping delays, a critical disruption in global supply chains, can have widespread economic impacts, as ocean shipping is the primary mode of transportation for about 80% of global trade. Using a novel measure of shipping delays linked to granular port-level trade and item-level price data, this paper exploits cross-product variation in exposure to shipping delays to estimate their effects on domestic inflation dynamics.

2 Data

Our analysis draws on three main data sources: granular port-level trade data from the USA Trade Online database, maritime traffic data derived from the Automatic Identification System (AIS) and detailed item-level price data from the Bureau of Labor Statistics (BLS).

2.1 Granular Level Import Data

The USA Trade Online database provides monthly import values at the HS 6-digit level for all US ports disaggregated by transportation mode. For our analysis, we focus on 93 US mainland seaports over the period 2017–2023 and compute the import shares by product for each mainland seaport.[1]

2.2 Maritime Traffic Data

The real-time maritime traffic data are drawn from the AIS. Transponders—mandatory for nearly all cargo vessels—broadcast high-frequency information on vessel type, location, speed, and

[1]BLS domestic price data are available at the item level, which often corresponds to multiple HS 4-digit codes. We construct a concordance between HS 4-digit codes and BLS item categories to link the import data to item-level price data.

draught, which is collected by terrestrial stations and satellites to enable global tracking of ship movements. Building on the machine-learning–based methodology of Cerdeiro et al. (2020), which identifies port boundaries and reconstructs port-to-port voyages, we construct port-to-port travel time measures for all US ports over the period January 2017 to July 2023.[2] To focus on global manufacturing supply chains, we restrict the sample to vessels engaged in goods transportation.

For each vessel arriving at a US port, we measure shipping time from its previous foreign port of call through its departure from the port. We then construct monthly port-level indicators of shipping delays by aggregating vessel-level shipping times to the port–month level using a simple average, and expressing them relative to their level 12 months earlier.

2.3 Domestic Price Data

Domestic price data come from the BLS Consumer Price Index at the item level. Our analysis includes 99 items at monthly frequency,[3] covering household consumption categories such as food and beverages, apparel and footwear, recreational goods, household equipment and furnishings, motor vehicles, medical care goods, education and communication products, and personal care products.

3 Stylized Facts

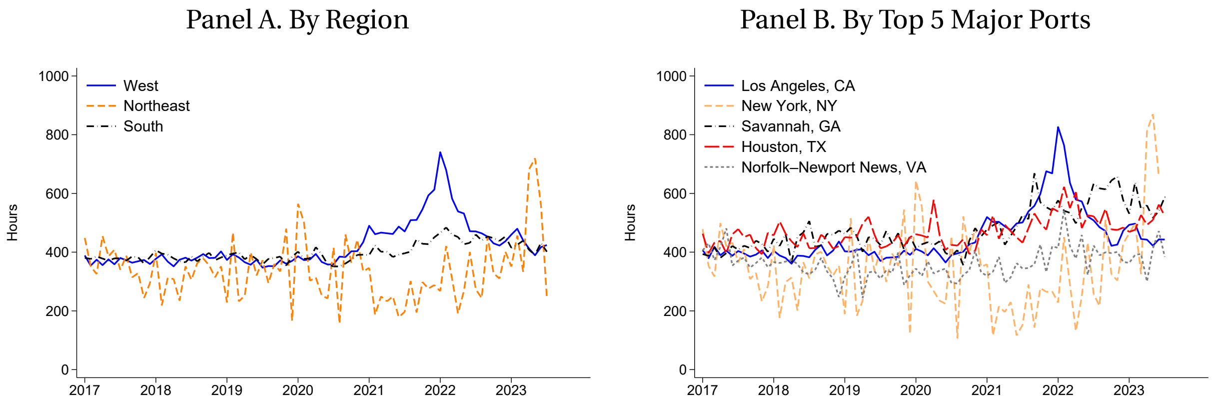
By combining granular port-level import data with real-time maritime traffic data and detailed domestic price data, we document three stylized facts.

First, import shares vary substantially across regions and major ports, both within and across product categories, providing the basis for our empirical strategy to identify the causal effect of shipping delays on US CPI. For each product category, we calculate how import shares are distributed across ports. Within the same product category, import shares differ substantially across major ports—including those located in the same region. For example, in the case of footwear and headgear, West Coast ports dominate overall, but there remains notable variation among them: the Port of Los Angeles accounts for roughly 54% of US imports in this category, followed by Long Beach (10%), Seattle (4%), and Tacoma (4%). Across product categories, otherwise similar products often enter the United States through different port gateways. For instance, while footwear and headgear are heavily concentrated on the West Coast, textile products exhibit

[2] Since our focus is on international trade, we exclude voyages whose origin and destination ports are both within the United States.

[3] The BLS CPI basket includes roughly 200 item strata covering goods and services. Our analysis focuses exclusively on goods.

Figure 1: Average Shipping Time



Note: The figure plots average shipping time for vessels arriving at major gateway regions (left panel) and the five largest US ports (right panel) from January 2017 to July 2023. Port-level average shipping time is the simple average across vessels, while regional average is weighted by each port's 2017 import share to proxy for port size. Source:Cerdeiro et al. (2020); and author's calculations.

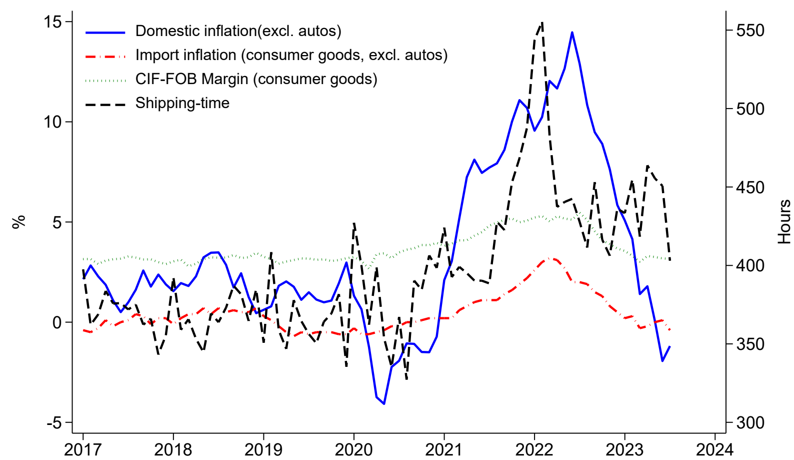
a much more dispersed import pattern, with 36% entering through Los Angeles, 18% through Newark, 11% through Savannah, 5% through Long Beach, and 5% through Charleston.

Second, shipping delays vary widely in both intensity and timing across ports. Figure 1 plots the average shipping time for vessels arriving at the major gateway regions (left panel) and the five largest US ports (right panel) from January 2017 to July 2023. [4] Relative to the pre-congestion period, West Coast ports experienced the most pronounced increase in shipping time. Average shipping time in the West—about 400 hours before the pandemic—began rising in early 2021, peaked at roughly 700 hours in early 2022, and gradually returned to normal by 2023. Congestion was considerably milder in the South and the Northeast. While Northeast ports exhibit no clear congestion episode, southern ports show a modest but noticeable rise in shipping time. Among the five largest US ports, the Port of Los Angeles experienced the sharpest increase in delays, followed by Savannah, Houston, and Norfolk. The timing of peak congestion varies across ports: Savannah saw its most severe bottleneck in mid-2021, improved temporarily, and then faced another buildup around mid-2022. In contrast, Los Angeles, Houston, and Norfolk reached their peak congestion around early 2022.

Finally, US inflation rises substantially during periods of prolonged shipping delays. Figure 2 plots aggregate price changes against aggregate average shipping time between January 2017 and July 2023. Domestic consumer inflation rose sharply during the congestion episode, peaking

[4] Port-level average shipping time is calculated as the simple average across vessels arriving at each port, whereas regional average shipping time is computed as an import-value–weighted average, using each port's 2017 import value as weight to proxy for port size.

Figure 2: Inflation and Shipping Time



Note: The figure shows domestic inflation (blue solid line), import inflation (red dash-dot line), transport costs (green dotted line), and shipping time (black dashed line) from January 2017 to July 2023. Domestic inflation is measured as the year-on-year percentage change in the CPI for all goods excluding automotives, while import inflation is measured as the year-on-year percentage change in the BLS Import Price Index for consumer goods excluding automotives. Transport costs are proxied by the CIF–FOB margin, computed as (CIF/Customs Value) – 1 for consumer goods using data from USA Trade Online. Aggregate average shipping time is calculated as an import-value–weighted average across ports, with weights given by each port's 2017 import value to proxy for port size. Source: Bureau of Labor Statistics (BLS); USA Trade Online; Cerdeiro et al. (2020); and authors' calculations.

at approximately 15% in mid-2022, while import-price inflation remained much more muted, reaching only about 3% earlier that year. Shipping and insurance costs were stable at around 4% of import value before the pandemic, and increased only slightly to about 5% during the congestion.

4 Impacts of Shipping Delays on Domestic Consumer Price Inflation

Motivated by the stylized facts that products enter the United States through different ports and that congestion intensity varies across ports, we develop an empirical strategy that exploits cross-product variation in exposure to shipping delays to estimate its average effect on product-level inflation. We construct a monthly product-level measure of shipping delay, by weighing each port p's change in shipping time by the share of total US imports of good g that enter the US through port p in 2017, prior to the US-China trade war and COVID-19–related shipping disruptions. More specifically, $\Theta_{gt} = \sum_p s_{gp} \cdot \Delta\tau_{pt}$, where s_{gp} denotes the share of product g's imports that enter through port p, constructed using import share from year 2017. τ_{pt} is the average shipping time of vessels arrived at port p in period t and $\Delta\tau_{pt}$ is the change in shipping time relative to its level 12 months earlier. Shipping time is measured in units of 100 hours. [5]

We then estimate the impact of shipping delays at the product–month level on product-level inflation using the following specification,

$$\pi_{gt} = \alpha + \beta \cdot \Theta_{gt} + \gamma_t + \mu_g + \delta X_{gt} + \varepsilon_{gt}, \tag{1}$$

where π_{gt} is the 12-month log change in the price index of product g at time t, and γ_t and μ_g represent time and product fixed effects, respectively. β is the parameter of interest, captures the overall average effect of shipping delays on product-level inflation. To account for the possibility that product-time–specific demand and supply shocks simultaneously affect prices, the control vector X_{gt} includes a Bartik-style fiscal stimulus measure to proxy for demand shocks and a China tariff exposure measure to capture product-level supply shocks.[6]

Table 1 presents the estimated coefficients. Column (1) uses the contemporaneous congestion shock, while Column (2) considers the effect of a one-month lagged congestion shock. Column (3) examines the response of consumer prices excluding oil, and Column (4) further controls for other product–time level supply and demand shocks.

The empirical results suggest that a 100-hour shipping delay increases consumer goods inflation by 1.194 percentage points. We obtain similar magnitudes if we use the lagged measure of shipping delay or exclude oil products from the analysis. Furthermore, controlling for product-time level supply and demand shocks does not materially change the estimated effect, suggesting that these results reflect the impacts of shipping delays rather than other product-level shocks.

We then estimate the dynamic responses of consumer inflation to shipping delays, using the local projection methodology of Jordà (2005). Specifically, the empirical setting is

$$\pi_{g,t+h} = \beta_h \Theta_{g,t} + \sum_{p=1}^{P} \rho_{h,p} \pi_{g,t-p} + \sum_{q=1}^{Q} \theta_{h,q} \Theta_{g,t-q} + \alpha_g + \gamma_t + \varepsilon_{g,t+h}, \tag{2}$$

where $\pi_{g,t+h}$ denotes the inflation of product g at $t+h$ (expressed in percentage points). We control for inflation lagged 1 to 12 months ($P = 12$) and shipping delays lagged 1 to 6 months ($Q = 6$). As the local projection specification removes feedback effects between inflation and shipping delays, the estimated dynamic responses β_h in Equation (2) typically differ from the

[5] At the peak of shipping delays, aggregate average shipping time increased by nearly 200 hours.

[6] The fiscal stimulus shock is constructed by combining state-level excess refundable tax credits from the BEA CAINC35 table with pre-pandemic (2017) state-level absorption shares for product g from the Commodity Flow Survey, while the China tariff exposure measure is computed by multiplying the product-level tariff by each product's 2017 import share sourced from China.

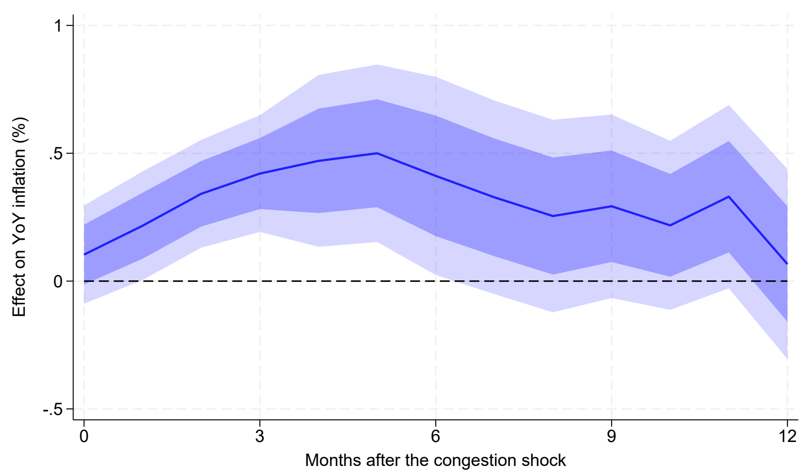
Table 1: Effects of Shipping Delays on Consumer Price Inflation

	(1) All Consumer Goods	(2) All Consumer Goods	(3) Drop Oil	(4) Drop Oil With Controls
Shipping Delay	1.194		1.249	1.420
	(0.326)		(0.327)	(0.350)
Lagged Shipping Delay		1.135		
		(0.307)		
Observations	6,499	6,402	6,432	5,494
R-squared	0.304	0.303	0.347	0.354
Number of Items	97	97	96	82
Product FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

Note: The table reports the overall effects of shipping delays on consumer inflation. Inflation is measured in percentage points, and shipping delays are expressed in 100-hour units. Robust standard errors, clustered at the product level, are reported in parentheses.

baseline estimate β in Equation (1). Figure 3 shows that inflation peaks about five months after the shock before gradually tapering off. At its peak, a 100-hour shipping delay raises consumer inflation by about 0.5 percentage points.

Figure 3: Dynamic Effects of Shipping Delays on Consumer Inflation



Note: The figure reports local projection estimates of the response of consumer inflation to shipping delays. The solid line plots the estimated impulse response $\hat{\beta}_h$ at horizon h. Dark and light shaded areas indicate 68 percent and 90 percent confidence intervals, respectively.

5 Conclusion

This paper studies the inflationary effects of shipping delays. We construct a novel measure of port-to-port shipping time using real-time maritime traffic data from the AIS and combine it with granular port-level trade data and domestic item-level price data. We document three stylized facts regarding the heterogeneity in goods imported across ports and regions, the variation in exposure to shipping delays, and the aggregate price responses to congestion shocks. Motivated by these facts, we exploit cross-product variation in exposure to shipping delays to estimate both the average and dynamic effects of shipping delays on consumer prices. We find that a 100-hour shipping delay raises consumer inflation by approximately 0.5 percentage points at its five-month peak. In a companion paper (Jiao et al., 2025), we further investigate the channels through which shipping delays transmit to consumer prices using both empirical evidence and quantitative analysis.

References

Alessandria, George, Shafaat Yar Khan, Armen Khederlarian, Carter Mix, and Kim J Ruhl. 2023. "The aggregate effects of global and local supply chain disruptions: 2020–2022." *Journal of International Economics*, 146: 103788.

Bai, Xiwen, Jesús Fernández-Villaverde, Yiliang Li, and Francesco Zanetti. 2024. "The causal effects of global supply chain disruptions on macroeconomic outcomes: evidence and theory." *NBER Working Paper Series No. 32098.*

Cerdeiro, Diego A, Mr Diego A Cerdeiro, Andras Komaromi, Yang Liu, and Mamoon Saeed. 2020. "World seaborne trade in real time: A proof of concept for building AIS-based nowcasts from scratch." *IMF Working Papers 2020, 057.*

Jiao, Yang, Ting Lan, Yang Liu, and Xinrui Zhou. 2025. "Shipping Delays and Domestic Inflation: Uncovering the Transmission Channels." *Unpublished mimeo.*

Jordà, Òscar. 2005. "Estimation and inference of impulse responses by local projections." *American Economic Review*, 95(1): 161–182.

PUBLICATIONS

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