Supply and Demand Shocks, Global Value Chains, and Inflation: Evidence from Trade Microdata

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Abstract

Recent global events underscore the need for micro-founded evidence on how supply and demand shocks transmit to national inflation through global value chains. We develop a framework to analyze how trade-level shocks shape and propagate inflationary pressures through global value chains. Using annual panel data on thousands of products across exporter–importer pairs, we identify structural shocks via sign-restricted VARs and document their evolving distribution and interactions around key global events. We then map these shocks into importer-level exposure indices via international input–output linkages and estimate their dynamic effects on consumer price inflation. Our results highlight the persistent yet context-dependent inflationary effects of global supply shocks, calling for flexible monetary policy based not on historical rules, but on real-time assessments of shock characteristics.

Keywords: Supply shocks, Inflation, Trade microdata, Structural VAR

JEL codes: E31, F14, C32

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1. Introduction

The inflationary episode triggered by the COVID-19 pandemic has cast doubt on the long-standing assumption that supply-side shocks are inherently short-lived. Persisting bottlenecks—including disruptions to international shipping lanes, shortages of globally sourced inputs, and cascading delays across cross-border production networks—forced central banks in both advanced and emerging economies to repeatedly revise inflation forecasts upward. These developments have reignited academic and policy interest in understanding how supply shocks propagate through global production networks and persistently affect inflation outcomes.

While a growing literature has sought to examine the supply and demand forces behind post-pandemic inflation (Comin et al., 2023; Amiti et al., 2024; Giannone and Primiceri, 2024; Shapiro, 2024), much of the empirical analysis remains anchored at the aggregate or sectoral level. These approaches have provided valuable insights into broad inflation dynamics, yet they often overlook the role of transmission mechanisms embedded in global value chains (GVCs). To our knowledge, no existing study identifies structural supply and demand shocks at a highly disaggregated level—involving country-product-time dimensions of international trade—despite their relevance for understanding persistent inflation dynamics across economies. Capturing the cross-sectional distribution of these micro-level shocks is crucial for explaining why inflationary pressures vary in intensity, scope, and persistence across countries and episodes.

This paper addresses these gaps by developing a new micro-founded framework that traces how trade-level supply and demand shocks propagate

to national consumer price inflation through GVCs. We assemble a global panel dataset covering bilateral trade prices and quantities for about 5,000 product categories—classified at the six-digit Harmonized System (HS6) level—across roughly 200 exporting and importing countries from 1995 to 2023. Using sign-restricted structural panel VARs, we identify annual supply and demand shocks at the exporter–importer–product level.

Drawing on these micro-level shocks, we first document how their cross-sectional distribution shifts around major global events—such as the Global Financial Crisis (GFC), the U.S.-China trade war, and the COVID-19 pandemic—via an event-study analysis for key trading nations (the United States, China, and Japan). We then examine how combinations of supply and demand shocks shape inflationary and expansionary pressures over time, shedding light on the dynamic macroeconomic consequences of trade-related disturbances.

In the second part of the analysis, we map these micro-level shocks into country-level exposure indices using international input–output linkages. These indices capture each importer's exposure to supply shocks—typically originating abroad—and to demand shocks—usually driven by domestic conditions. Leveraging this GVC-based aggregation, we estimate panel regressions to examine how importers' exposure to supply and demand shocks—and their interactions—relate to national consumer price inflation across different time periods (pre-, during, and post–GFC). We then estimate the dynamic effects of these shocks on CPI using local projection methods, thereby quantifying their macroeconomic propagation.

Our findings yield four key insights. First, the event-study analysis reveals a distinct divergence in the evolution of supply and demand shocks

following the COVID-19 outbreak. Demand shocks became strongly positive in 2021 but returned toward normal levels by 2023, whereas supply shocks gradually turned negative and have remained persistently so. Both types of shocks exhibit wider cross-sectional dispersion over time, with these patterns broadly shared across the United States, China and Japan—though the shifts are most pronounced for the United States. In contrast, the GFC was marked by a temporary negative demand shock with little evidence of supply-side disturbances, while the U.S.-China trade war under the first Trump administration elicited no significant response in either demand or supply shocks.

Second, in our analysis of inflationary and expansionary pressures, we find that inflationary pressure has followed an upward trend across all three countries since the early 2000s, with signs of flattening in the 2010s. By contrast, expansionary pressure shows no clear trend but moves in tandem with business cycles—dropping during the GFC and surging post-COVID, particularly in the United States.

Third, during the post-GFC period, we find that positive demand shocks and negative supply shocks are both associated with rising consumer price inflation, consistent with basic supply-and-demand theory. The inflationary effect of supply shocks appears particularly strong in this period. However, we do not find compelling evidence that the combination of demand and supply shocks amplifies inflation beyond their individual effects. During the GFC itself, by contrast, demand and supply shocks appear to have interacted in a way consistent with widely held recessionary narratives—where weakened demand leads to reduced production and downward pressure on prices.

Finally, our dynamic analysis using local projections shows that both types of shocks exert statistically significant effects on CPI inflation during the year of the shock and the following year. The inflationary impact of supply shocks tends to peak immediately, while that of demand shocks reaches its maximum with a one-year lag—suggesting a delay in the pass-through from import demand to consumer prices.

These findings challenge the conventional view that supply shocks are inherently short-lived, underscoring the need for inflation models and policy frameworks to account for the persistence of global production disruptions. In particular, COVID-19 represents a rare instance—unmatched by other major economic episodes such as the GFC or the United States–China trade tensions—where supply shocks shifted gradually but persistently in a negative direction, albeit at an unusually large scale. This rarity may have contributed to initial complacency among central banks, reinforcing the belief that such shocks could be "looked through."

Our results suggest that while demand shocks tend to reverse relatively quickly, large-scale supply shocks—especially those rooted in global production networks—may leave more lasting scars. In such cases, standard monetary responses may need to be more persistent and preemptive, even in the absence of strong demand-side pressures.

Moreover, the inflationary consequences of supply and demand shocks through GVCs are highly context-dependent. It was only in the post-GFC period that CPI responses aligned consistently with theoretical expectations; in earlier episodes, these relationships were weaker or even reversed. This highlights a critical challenge for policymakers: the inflationary impact of

external shocks cannot be inferred from their magnitude or breadth alone. Rather than relying solely on stylized rules or past regularities, central banks must remain vigilant and responsive, continuously reassessing inflation risks in real time as global conditions evolve.

The remainder of the paper is organized as follows. Section 2 outlines the empirical framework, including data sources, shock identification, exposure index construction, and the regression specifications. Section 3 presents the empirical findings, from descriptive patterns of micro-level shocks to their macroeconomic effects on consumer prices. Section 4 concludes with key takeaways and policy implications.

2. Empirical framework

This section outlines our empirical strategy for identifying trade-level supply and demand shocks and estimating their macroeconomic effects on consumer prices through global production linkages.

2.1. Data

We combine two high-resolution datasets to construct a micro-to-macro framework. First, we use the BACI trade database provided by CEPII, which harmonizes bilateral trade statistics from UN Comtrade and reports annual trade values and quantities at the HS6 product level for more than 200 countries from 1995 to 2023. Unit values, computed as trade values divided by quantities, serve as proxies for international prices. Second, to quantify how trade shocks transmit through production networks, we use the OECD Inter-Country Input-Output (ICIO) tables. These tables detail international

intermediate input flows across industries and countries and allow us to construct shock exposure measures grounded in the GVC structure.

2.2. Identification of micro-level supply and demand shocks

We identify annual structural supply and demand shocks by estimating sign-restricted structural panel VARs using trade data disaggregated by exporter i, importer j, and HS2 product group k, with HS6 product l as the observational unit. For each triplet (i, j, k), we construct a two-variable panel VAR with one lag:

$$\begin{bmatrix} \Delta \log p_{ijkl,t} \\ \Delta \log q_{ijkl,t} \end{bmatrix} = \alpha_{ijkl} + B_{ijk} \begin{bmatrix} \Delta \log p_{ijkl,t-1} \\ \Delta \log q_{ijkl,t-1} \end{bmatrix} + A_{ijk}^{-1} \begin{bmatrix} u_{ijk,t}^{D} \\ u_{ijk,t}^{S} \end{bmatrix} \tag{1}$$

Here, $p_{ijkl,t}$ and $q_{ijkl,t}$ denote the unit value and quantity, respectively; α_{ijkl} captures product fixed effects; and A_{ijk}^{-1} maps reduced-form residuals into structural shocks. The structural matrix is identified using sign restrictions on impact responses: a positive demand shock raises both price and quantity, while a positive supply shock raises quantity but lowers price. These restrictions are applied at horizon zero, following the agnostic identification strategy of Uhlig(2005).[1]

[1]While we follow the agnostic sign-restriction approach, it is worth noting recent critiques of this method in similar settings. In particular, Baumeister and Hamilton (2022) emphasize that using sign restrictions alone without explicit priors or additional structure can yield wide identified sets and arbitrary point estimates. Without a justified ranking of observationally equivalent outcomes, reported medians or error bands may lack interpretability. To address this concern, we plan to complement this approach with alternative identification strategies: (i) incorporating structural restrictions informed by a

We assume common parameters B_{ijk} and A_{ijk}^{-1} within each (i, j, k) cell, pooling information across HS6 products. This approach yields a panel of annual structural shocks $u_{ijk,t}^{D}$ and $u_{ijk,t}^{S}$ that vary by country pair, product group, and time.

We use the identified micro-level shocks to establish several basic empirical facts. First, we conduct an event study to examine how the distribution of demand and supply shocks shifts around major global disruptions, including the GFC, the U.S.-China trade war under the first Trump administration, and the COVID-19 pandemic. Focusing on key trading economies—the United States, China and Japan—we assess the extent to which observed shock patterns align with widely cited narratives.

Second, to characterize broader macroeconomic implications, we quantify the evolution of inflationary and expansionary pressures based on the joint distribution of shocks. Specifically, we define inflationary pressure for each country and year as the difference in import shares between two types of exporter–product pairs: those experiencing positive demand and negative supply shocks, and those with negative demand and positive supply shocks. This measure captures the net weight of product categories that are expected to exert upward pressure on prices. Similarly, we define expansionary pressure as the difference in import shares between exporter–product pairs experiencing positive demand and positive supply shocks and those with negative demand and negative supply shocks. This measure reflects the net prevalence of

multi-country, multi-sector DSGE model; and (ii) applying an IV-VAR framework that leverages exogenous signals of supply disruptions (e.g., natural disasters, production halts, pandemics, or geopolitical conflicts) as instrumental variables.

products likely to contribute to output expansion. These indicators are constructed annually for the United States, China, and Japan, allowing us to track the changing composition of trade-related pressures over time.

2.3. Exposure to supply and demand shocks through GVCs

To assess the macroeconomic relevance of the identified shocks, we construct country-level exposure measures based on the structure of the GVCs. For each importing country j, we define exposure to demand and supply shocks as:

$$X_{j,t}^{D} = \sum_{i,k} Z_{ijk,t} \cdot u_{ijk,t}^{D}, \quad X_{j,t}^{S} = \sum_{i,k} Z_{ijk,t} \cdot u_{ijk,t}^{S} \tag{2}$$

where $Z_{ijk,t}$ denotes the share of country j's intermediate inputs sourced from product group k in country i at time t, as derived from the OECD ICIO tables. These weights reflect the sectoral and geographical structure of each country's import dependencies in year t, allowing us to map micro-level shocks into country-level exposure.

2.4. Estimating the effects of shock exposure on inflation

We adopt a two-stage empirical strategy to examine both contemporaneous and dynamic effects of trade-related shocks on consumer price inflation.

We begin with a fixed-effects panel regression to assess the average same-period relationship between exposure to supply and demand shocks and national inflation. Specifically, we estimate:

$$\Delta \log \mathrm{CPI}_{j,t} = \alpha_j + \beta^{D} X_{j,t}^{D} + \beta^{S} X_{j,t}^{S} + \beta^{C} X_{j,t}^{D} X_{j,t}^{S} + \varepsilon_{j,t} \tag{3}$$

where α_j denotes country fixed effects. The variables $X_{j,t}^{D}$ and $X_{j,t}^{S}$ represent the exposure of country j to micro-level demand and supply shocks,

aggregated through international input–output linkages that reflect each country's position in GVCs. The interaction term captures potential nonlinear amplification when both types of shocks co-occur.

This static specification provides a useful benchmark for understanding average contemporaneous effects and serves to examine whether the inflationary sensitivity to trade shocks varies across subperiods of interest, such as the post-COVID surge.

To assess how these effects evolve over time, we estimate impulse responses using the local projection method (Jordà, 2005). For each horizon h, we estimate:

$$\Delta \log \mathrm{CPI}_{j,t+h} = \alpha_j^h + \beta_h^D X_{j,t}^D + \beta_h^S X_{j,t}^S + u_{j,t+h} \tag{4}$$

where α_j^h denotes country fixed effects. This specification excludes the interaction term to focus on the marginal effects of each shock type at different horizons.

Together, these two specifications allow us to capture both the static and dynamic transmission of trade-exposed shocks to inflation outcomes, while accounting for cross-country heterogeneity.

3. Estimation and results

This section presents empirical results based on our identification and aggregation strategy. We begin by describing how supply and demand shocks evolved around major global events. We then construct macro-level indicators of inflationary and expansionary pressure using trade-weighted shock classifications. Finally, we examine how these shocks affect inflation across countries, using both panel regressions and local projection methods.

3.1. Event-based patterns in shock distributions

Figures 1–3 illustrate the cross-sectional distribution of estimated demand and supply shocks around three major global disruptions: the COVID-19 pandemic, the GFC, and the U.S.-China trade war under the first Trump administration. For each episode, we visualize year-by-year shifts in the distribution of shocks—focusing on changes in central tendency, dispersion, and asymmetry—for the United States, China, and Japan.

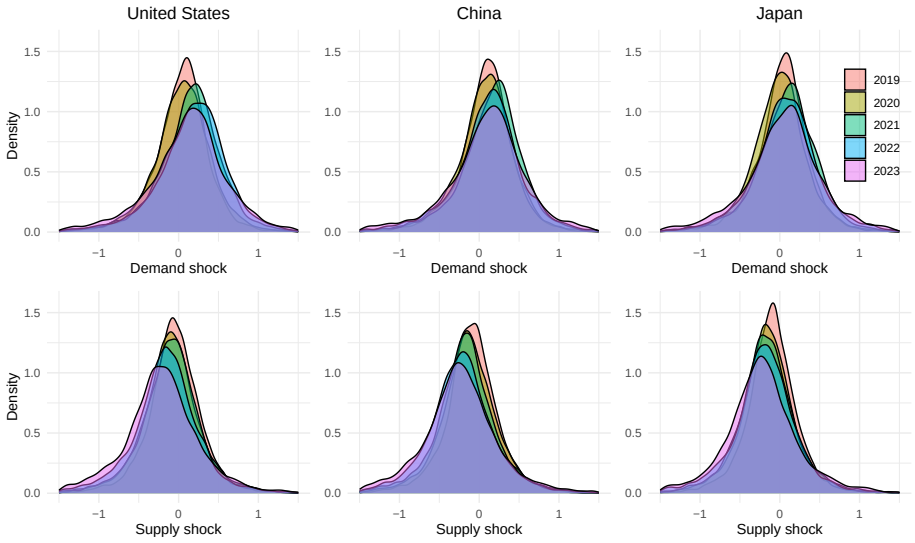


Figure 1: Distribution of demand and supply shocks: COVID-19 period

Note: The figure shows the distribution of estimated demand and supply shocks across years before and after the event, separately for the United States, China, and Japan. Each element of the distribution corresponds to medians of shock estimates at the exporter–HS2 product level.

Figure 1 illustrates the evolution of identified demand and supply shocks over time, highlighting the pronounced divergence observed during the COVID-19 period. Demand shocks exhibited a sharp positive shift during 2021–2022,

particularly in the United States, but this surge proved short-lived and largely normalized by 2023. In contrast, supply shocks shifted persistently leftward, indicating sustained negative effects. Both shocks also exhibit rising cross-sectional dispersion over time. These patterns are broadly similar across countries, though magnitudes tend to be larger in the United States.

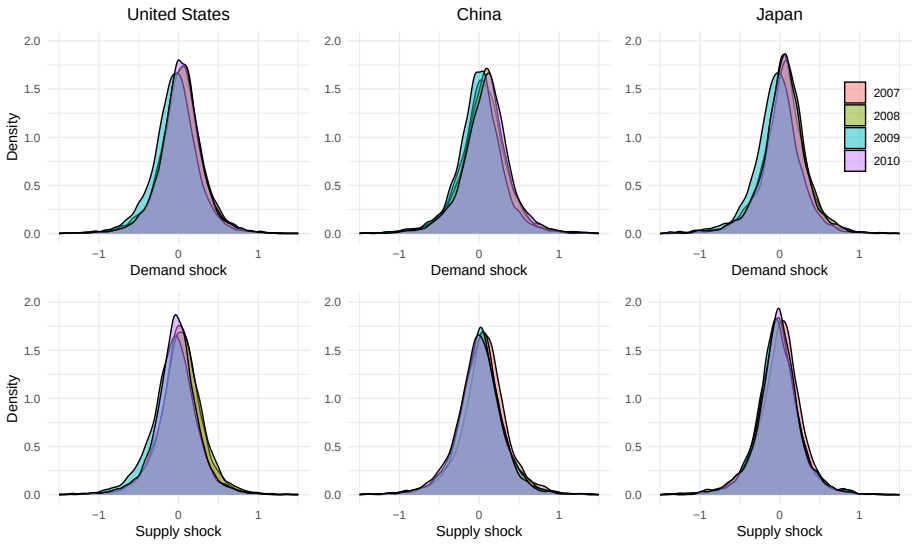


Figure 2: Distribution of demand and supply shocks: Global Financial Crisis

Figure 2 shows that the GFC episode was characterized by a sharp but temporary negative demand shock, with little evidence of concurrent supply-side disturbances. Figure 3 illustrates that during the U.S.–China trade tensions under the first Trump administration, the overall distributions of demand and supply shocks remained largely stable. However, in the United States, both demand and supply shocks exhibited slight shifts in the negative direction, suggesting mild adverse effects concentrated in some product segments.

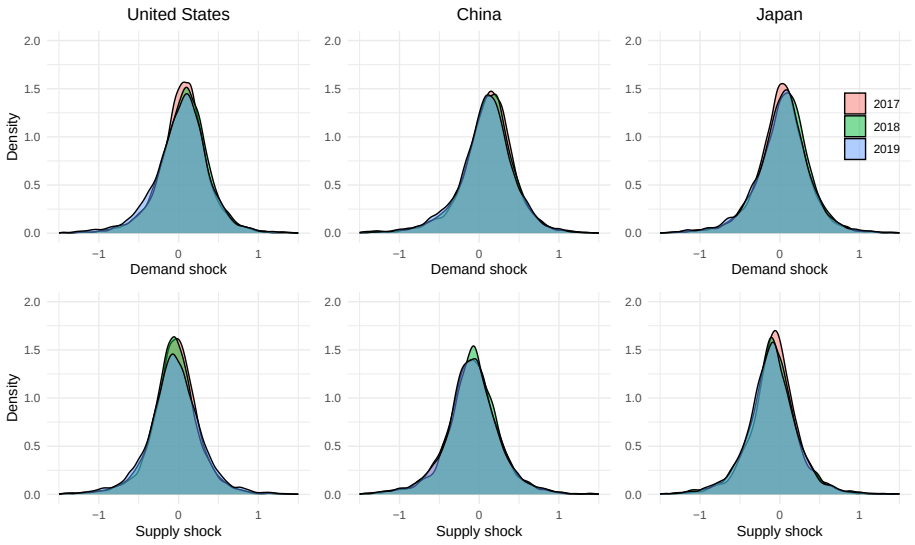


Figure 3: Distribution of demand and supply shocks: U.S.-China trade war

3.2. Cross-sectional classification of shock combinations

To further explore the joint structure of demand and supply shocks, we classify each exporter–product observation into four categories based on the sign combination of the estimated shocks: (1) inflationary ($u^D > 0$, $u^S < 0$), (2) deflationary ($u^D < 0$, $u^S > 0$), (3) expansionary ($u^D > 0$, $u^S > 0$), and (4) contractionary ($u^D < 0$, $u^S < 0$). We then aggregate these into two net indicators: inflationary pressure, defined as the difference in import shares between categories (1) and (2), and expansionary pressure, defined analogously using categories (3) and (4). Both measures are computed annually for the United States, China and Japan using trade-weighted shares.

Several notable patterns emerge. First, net inflationary pressure has shown a gradual upward trend in all three countries since the early 2000s, though the trend appears to flatten in the 2010s. In contrast, net expansionary pressure

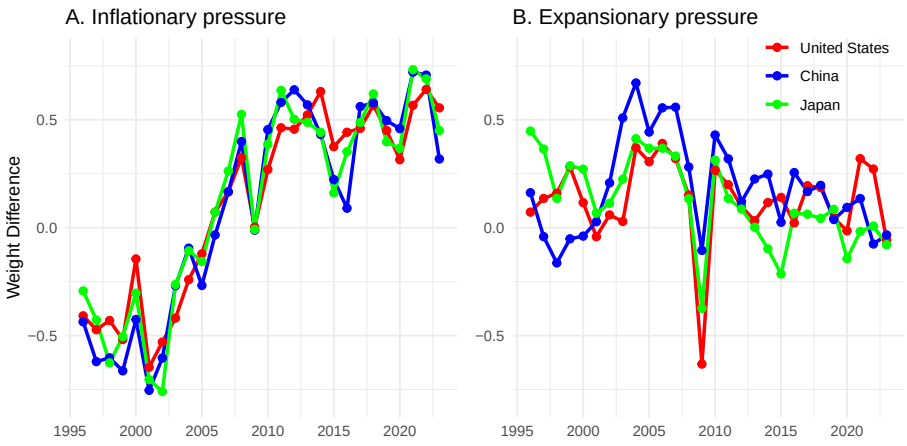


Figure 4: Inflationary pressure and expansionary pressure

Note: The figure shows the time series of inflationary pressure (left panel) and expansionary pressure (right panel) for the United States, China, and Japan. Each measure is constructed by classifying exporter–product pairs into four categories based on the sign of demand and supply shocks, and then taking the difference in import shares between opposing categories. Specifically, inflationary pressure is defined as the share of pairs with positive demand and negative supply shocks minus the share with negative demand and positive supply shocks; expansionary pressure is defined analogously.

does not exhibit a long-run trend but instead tracks the business cycle, with marked drops during the GFC and noticeable rebounds following the COVID-19 pandemic—particularly in the United States. These patterns suggest that the contribution of shock complementarity to inflationary dynamics reflects more of a long-term trend rather than a pronounced surge during the COVID-19 period. Instead, demand and supply shocks appear to have independently driven inflationary pressures across countries and product categories, rather than operating in tandem.

3.3. Effects of shock exposure on inflation

We next turn to regression-based evidence linking shock exposure to inflation outcomes. Table 1 reports results from fixed effects regressions where the consumer price inflation of each importing country is regressed on demand and supply exposure measures, along with their interaction term. The estimation sample covers 47 major importing countries ranked by trade volume.

Table 1 shows that the inflationary effects of demand and supply shocks vary across periods. During the GFC (column 2), positive demand exposure is strongly associated with higher inflation, while supply exposure also enters with a negative and marginally significant coefficient. In contrast, in the most recent period following the COVID-19 pandemic (column 3), supply exposure becomes the dominant driver of inflation, with a larger and more significant effect than in earlier periods. Demand exposure remains positively associated with inflation, though its effect appears somewhat weaker than during the GFC. This shift suggests that trade-related supply shocks have gained prominence in shaping inflation dynamics in recent years.

Table 1: Regression of CPI on shock exposure

Dependent variable:	CPI (year-on-year, %)		
Model:	(1)	(2)	(3)
Period:	1996–2007	2008–2010	2011–2023
Demand shock exposure	-4.054**	2.158***	0.9906**
	(1.906)	(0.3562)	(0.3685)
Supply shock exposure	-0.7114	-2.891*	-2.475***
	(1.898)	(1.503)	(0.8504)
Demand shock exposure	1.601	1.958***	-0.7235
× Supply shock exposure	(1.390)	(0.7226)	(0.6923)
Observations	516	129	562
R^2	0.52807	0.81123	0.51342
Within R^2	0.04784	0.28555	0.07243

Note: Fixed-effects regressions of consumer price inflation on demand and supply exposure measures and their interaction. The sample includes 47 top importing countries by trade value. All models include country fixed effects. Standard errors are clustered at the country level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In contrast, before the GFC (column 1), the estimated effects are less consistent with theoretical predictions: the signs of the demand and supply coefficients are weak or reversed, and the interaction term is insignificant. One possible interpretation is that inflation dynamics in this earlier period were more influenced by exchange rate fluctuations or inflationary pressures in emerging economies, which may have obscured the role of trade-related demand and supply shocks.

Interestingly, the interaction term—intended to capture potential amplification when demand and supply shocks co-occur—is not statistically significant in the post-COVID period (column 3), providing little support for the popular narrative that recent inflation episodes reflect mutually reinforcing demand and supply shocks. However, during the GFC period (column 2), the interaction term is significantly positive, which may reflect a stylized recession pattern in which collapsing demand expectations and declining production jointly contributed to deflationary pressures.

3.4. Dynamic responses via local projections

Finally, we estimate the dynamic inflationary effects of shock exposure using the local projection method described in Section 2. Figure 5 plots the impulse responses of year-on-year CPI inflation to positive demand and negative supply shock exposures over multiple horizons, based on specifications aligned with those in Table 1 but without the interaction term.

The impulse responses reveal that both types of shock significantly affect inflation contemporaneously and into the following year. Exposure to negative supply shocks leads to an immediate and statistically significant increase in CPI inflation, with the effect peaking in the year of the shock and gradually

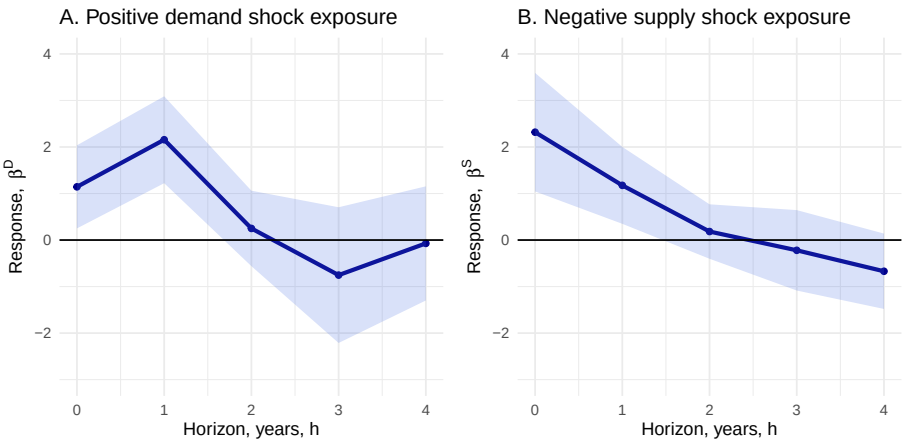


Figure 5: Impulse responses of CPI inflation to shock exposure (2011–2023)

Note: The figure plots impulse responses of year-on-year CPI inflation to demand and supply shock exposure, estimated via local projections. At each horizon, inflation is regressed on exposure measures using the specification consistent with Table 1, except that the interaction term is excluded. The sample is restricted to the period 2011–2023, during which the sign conditions in Table 1 are statistically significant.

fading thereafter. In contrast, demand shocks exhibit a delayed peak response, with the largest effect materializing one year after the initial shock.

This lagged pattern suggests that the inflationary impact of demand-side factors may take time to transmit through international supply chains—possibly due to delays in the pass-through of higher domestic demand into import prices and, subsequently, into final consumer prices. These findings complement the regression-based evidence and reinforce the view that supply-side constraints tend to generate more immediate inflationary pressures, whereas demand shocks, though influential, operate with a temporal lag.

4. Conclusion

This paper develops a micro-to-macro empirical framework to quantify the inflationary effects of international supply and demand shocks transmitted through GVCs. Leveraging disaggregated bilateral trade data from the CEPII BACI database and a sign-restricted panel VAR approach, we identify structural shocks at the exporter–product level and aggregate them using OECD inter-country input-output linkages to construct country-level exposure measures. These exposure variables are then used to trace inflation dynamics via fixed effects regressions and local projections.

Our results reveal distinct patterns in the inflationary consequences of supply versus demand shocks. Supply shocks—especially those concentrated in intermediate goods—tend to be highly persistent and exert sustained upward pressure on consumer price inflation. In contrast, demand shocks have shorter-lived effects, often peaking with a delay and dissipating within one to two years. While economic theory predicts that demand and supply

shocks may jointly amplify inflation, our estimates show limited evidence of such interaction effects in the post-GFC period. Notably, significant amplification was observed only during the GFC, when collapsing demand and constrained supply jointly reinforced disinflationary pressures.

These findings carry important implications for monetary policy. They challenge the conventional wisdom that supply shocks are inherently transitory and can safely be "looked through." In particular, the COVID-19 pandemic represents a rare but powerful episode in which supply shocks shifted gradually and persistently in a negative direction, producing inflationary effects unmatched by prior episodes such as the GFC or the United States–China trade tensions. The unprecedented nature of this supply-side disruption may have contributed to delayed policy responses, as many central banks underestimated the persistence of inflation stemming from global production bottlenecks.

Our results also underscore the critical role of context and timing. Inflationary responses consistent with theoretical expectations—positive demand shocks raising prices, negative supply shocks doing the same—only emerged clearly in the post-GFC period. Earlier episodes display weaker or even reversed relationships, highlighting the limitations of rule-of-thumb diagnostics based on historical regularities. Inflationary risks cannot be inferred solely from the magnitude or breadth of external shocks; they are shaped by the structural context in which these shocks unfold. Recognizing this nuance is essential for crafting timely and effective policy responses in a globalized economy.

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