What Drives U.S. Import Price Inflation?

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As economies re-opened following the end of the COVID-19 pandemic, inflation rose sharply in many countries. This experience prompted a debate about the underlying causes, with one side arguing it was due to demand-side factors arising from sizeable fiscal stimulus packages and pent-up consumer demand for goods, while the other side claimed it was due to supply-chain disruptions. Understanding the underlying causes of this inflation is particularly important for monetary policy. However, separating demand and supply factors empirically is challenging [cf. Ball, Leigh and Mishra (2022); Comin, Johnson and Jones (2023); di Giovanni et al. (2022); Gagliardone and Gertler (2023)]. In this paper, we discuss the international transmission mechanism and ask how much import price inflation was driven by global factors versus domestic demand. To this end, we exploit the entire network of world multilateral product-level trading relationships, with over 25 million observations, to identify the sources of U.S. import price inflation.

We identify the U.S. demand component by running a weighted least squares regression of the 4-quarter change in log export price as the dependent variable on exporter-product-time and importer-product-time fixed effects with 4-quarter lag export value weights for every quarter from 2017 to 2022. This estimation framework ensures that our fixed effects aggregate to match observed import price inflation, enabling us to perform an exact decomposition of import price changes. All of these fixed effects are normalized relative to the median country-product effect. We refer to the sum of the median exporter and median importer effect as the common global component and interpret this as the average price movement. We term the weighted sum of the coefficients on the individual exporter fixed effects the "idiosyncratic supply shock" because they only contain movements in export prices due to exporter-specific factors relative to the average. Analogously, the weighted sum of the coefficients on the importer fixed effects reflects movements in export prices due to importer-specific factors relative to the average, so we call this term the "idiosyncratic demand shock."

Our results show that the common component tracks aggregate price movements closely in the post-COVID-19 period until the end of 2022. Thereafter, import price inflation fell sharply and was almost entirely driven by idiosyncratic supply shocks. Aggregate world import price inflation peaked at 11 percent in 2021:Q2, with the 4-quarter change falling to 2 percent by the end of 2022. Idiosyncratic world demand shocks played almost no role throughout the sample. By contrast, we find a more significant role for idiosyncratic demand shocks when we focus on U.S. import prices.

While the main driver of U.S. import prices is the common global shock for most of the post-COVID-19 period, idiosyncratic U.S. demand shocks lowered prices at the beginning of 2021 and then pushed them up in the second half of 2022. This result is consistent with the higher-than-expected consumer demand in the U.S. during this

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period. We also find that idiosyncratic world supply shocks contributed positively to U.S. import price inflation during most of the post-COVID-19 period. This suggests that some of the U.S.'s largest trading partners continued to experience global value chain issues. Delving further into different product types, we find that the commodity-based categories (fuels, foods, and industrial supplies), which comprise around a third of U.S. imports, are driven mainly by the common global component. In contrast, the idiosyncratic components play a much larger role in the import prices of differentiated products, with supply mattering more for capital goods and demand mattering more for consumer goods.

I. Data

Our primary data source is the 6-digit Harmonized System (HS) bilateral trade data from the United Nations COMTRADE dataset, which is available at a monthly frequency. We aggregate the data to a quarterly frequency to smooth out noise. Our sample of countries is the top fifty exporters to the U.S. in 2017 and all EU countries regardless of size. This set of 52 countries (including the U.S.) accounts for over 92 percent of U.S. import value.[1] The UN COMTRADE data lacks observations for some countries and time periods, so we supplemented it with data from S&P Global, Global Trade AnalyticsSuite (GTAS) where possible. The data include export values and quantities. We proxy for export prices using the unit values defined as the ratio of values to quantity.[2] We end up with a sample of 25.7 million observations, where an observation is defined at the exporter-importer-HS6-quarter level.

II. Empirical Specification

Our regression specification projects four-quarter log price changes for industry h from exporter i to importer j in quarter t, $\Delta_4 \log P_{hijt}$, on importer country-industry-time fixed effects, α_{hjt}, and exporter country-industry-time fixed effects, β_{hit}:

$$(1) \qquad \Delta_4 \log P_{hij,t} = \alpha_{hjt} + \beta_{hit} + \epsilon_{hijt},$$

where $\Delta_4 \log P_{hijt} \equiv \log(P_{hij,t}) - \log(P_{hij,t-4})$. We recover these coefficients using weighted least squares with 4-quarter lagged export value weights. The coefficients on the fixed effects isolate the change in export prices due to conditions in the importer and exporter countries, respectively, for every HS6 industry.

The fixed effects coefficients are estimated relative to an arbitrary numeraire, but it makes them easier to interpret if we normalize them to be deviations from their median values.[3] We define the idiosyncratic demand shock to be $\tilde{\alpha}_{hjt} \equiv \hat{\alpha}_{hjt} - \bar{\alpha}_{ht}$, where $\bar{\alpha}_{ht}$ is the median value of $\hat{\alpha}_{hjt}$ in period t. Similarly, we define the idiosyncratic supply shock as $\tilde{\beta}_{hit} \equiv \hat{\beta}_{hit} - \bar{\beta}_{ht}$, where $\bar{\beta}_{ht}$ is the median value of $\hat{\beta}_{hit}$ in period t. The global shock is defined to be the sum of the median demand and median supply shocks, $G_{ht} \equiv \overline{\alpha}_{ht} + \overline{\beta}_{ht}$. An attractive feature of this normalization is that demand shocks only arise from idiosyncratic price movements in the importing country; supply shocks only arise from idiosyncratic

[1] We use exporter-reported data, which report on a consistent free-on-board basis (FOB). We do not use the importer-reported data because countries do not report values consistently, with some reporting values inclusive of the cost of insurance and freight (CIF) and some FOB.

The HS product classifications are revised every five years. For our analysis, we need to have all countries report on the same basis, so we only include countries that report in the HS 2012 classification, and we make a time-consistent concordance over the 2012, 2017, and 2022 classifications. Out of the top fifty exporters, three countries were dropped from the sample because they reported in an older HS revision (Venezuela, Iraq, Bangladesh), and six countries were dropped because of missing data (Saudi Arabia, Russia, Israel, Nigeria, Honduras, and the Philippines).

[2] About 9 percent of the observations did not report quantities. Since unit values are not meaningful measures of prices if countries report quantities are not measured in the same units, we dropped the 1.6 percent of the observations (1.1 percent of the values) where this condition was violated. We also dropped observations with extreme movements in unit values, i.e., those in which the ratio of unit values in t relative to $t-4$ was greater than three or less than a third.

[3] We choose the median rather than the mean as the average value to avoid contamination by outliers following the approach in (Amiti and Weinstein, 2018).

price movements in the exporting country; and the global shock only depends on the median movements of prices for a product globally.

The idiosyncratic demand component will be larger whenever an importer starts paying relatively more than other importers for a given product, which we interpret as evidence of a demand shock. The idiosyncratic supply component will be larger whenever an export starts charging systematically higher prices for a product than other exporters across destination countries, which we interpret as a measure of supply shortages. We emphasize that this is a definitional convention and that mapping these reduced-form objects into primitive shocks requires a structural model, as we develop in (Amiti, Itskhoki and Weinstein, 2024).

We obtain a decomposition of the aggregate import price index for country j (in this paper, the United States), using equation (1), by forming a weighted average of the estimated coefficients across all product categories h and suppliers i to country j:[4]

$$\begin{aligned} \Delta_4 \log P_{jt} &\equiv \sum_{h,i} w_{hij,t-4} \Delta_4 \log P_{hij,t} \\ &= \sum_{h,i} w_{hij,t-4} \tilde{\alpha}_{hjt} \\ &+ \sum_{h,i} w_{hij,t-4} \tilde{\beta}_{hit} \\ &+ \sum_{h,i} w_{hij,t-4} G_h, \end{aligned} \tag{2}$$

where P_{jt} is the country j import price index; the weights, $w_{hij,t-4}$, are 4-quarter lagged export value weights; and $w_{hij,t-4}$ equals the export value of product h shipped to country j from country i divided by total imports by country j. We can also decompose world import price inflation by taking a weighted average of equation (2). Let $w_{j,t-4}$ be the value of country j's imports divided by the value of world imports. Aggregate world import (or, equivalently, export) price inflation is given by

$$\begin{aligned} \Delta_4 \log P_t &\equiv \sum_{j} w_{j,t-4} \Delta_4 \log P_{jt} \\ &= \sum_{j} w_{j,t-4} \sum_{h,i} w_{hij,t-4} \tilde{\alpha}_{hjt} \\ &+ \sum_{j} w_{j,t-4} \sum_{h,i} w_{hij,t-4} \tilde{\beta}_{hit} \\ &+ \sum_{j} w_{j,t-4} \sum_{h,i} w_{hij,t-4} G_h. \end{aligned} \tag{3}$$

The left-hand sides of equations (2) and (3) are the growth rates of j and world import prices, respectively. Importantly, the three terms on the right-hand side of each equation sum to the corresponding inflation rates exactly. In other words, these equations let us decompose import price inflation into the contributions of idiosyncratic demand and supply components, $\tilde{\alpha}_{hjt}$ and $\tilde{\beta}_{hit}$, and global shocks, G_h, where the weights determine the importance of each shock for inflation.

III. Empirical Results

World Import Price Inflation

Figure 1 plots each of the three components in 3 and provides a decomposition of world import price inflation, shown by the black line. We see that world import prices (expressed in dollars) declined in 2019 and 2020 (until Q4). This trend reversed with the opening of economies following the COVID-19 lockdowns. Import prices started to increase in 2020:Q4, with world import price inflation peaking at 11 percent in 2021:Q2 and falling to 2 percent by the end of 2022. Interestingly, the global component (the blue bars) tracks these price movements closely until the end of 2022, when the idiosyncratic world supply became the only force for continued import price inflation. The idiosyncratic world demand component hardly plays a role in determining movements in world import prices. In other words, world import price inflation appears to have been largely driven by global forces, not idiosyncratic shocks to supply and demand in major ex-

[4] We do a similar decomposition for aggregate world trade prices by aggregating equation 2 further across importing countries j.

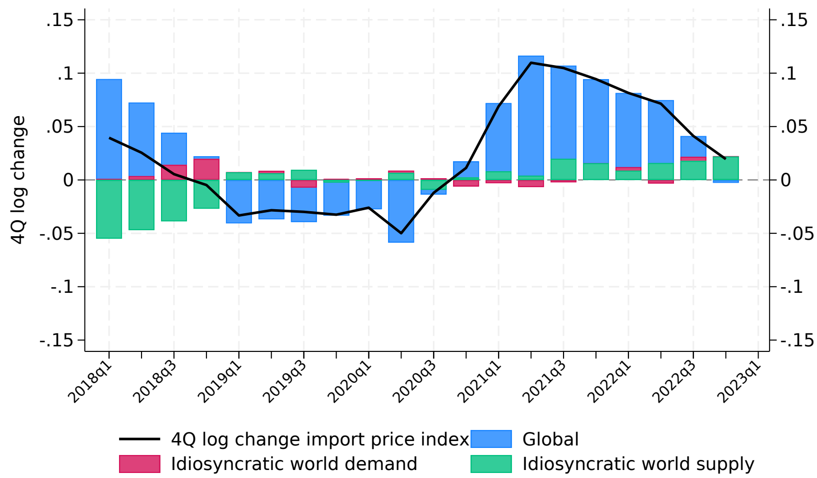

FIGURE 1. DECOMPOSITION OF WORLD IMPORT PRICE INFLATION

Note: Authors' calculations based on data from UN Comtrade and GTAS. The 4-quarter log change in export unit values at the HS6-exporter-importer-country are aggregated up to the quarter level using 4-quarter lagged export value weights. The decomposition of the change in the world import price inflation is shown in the three bars is explained in the text.

porting or importing countries.

U.S. IMPORT PRICE INFLATION

Next, we provide a decomposition of U.S. aggregate import prices based on equation (2). The change in import price inflation is a weighted average of the change in unit values of products imported by the U.S. In this figure, the idiosyncratic demand shock is a weighted sum of the U.S.-product idiosyncratic demand shocks, and the idiosyncratic world supply shock for the U.S. is the weighted sum of all the exporters to the U.S. across all products. The global U.S. shock only differs from the aggregate world one due to the different weights of each HS6 product for world exports rather than exports to the U.S.

Figure 2 shows the growth in U.S. aggregate import price inflation (black line) hit a lower peak than world inflation (in Figure 1), reaching a maximum of 9 percent in 2021:Q2. However, U.S. import price inflation remained elevated, staying above 5 percent in 2022:Q4. As with the world plot, we see that the global shock accounted for most of the increase in U.S. prices post-COVID until the middle of 2022 (when global import price inflation subsided), and idiosyncratic U.S. demand and supply components became responsible for virtually all of U.S. import price inflation.

U.S. IMPORT PRICES BY END-USE CATEGORY

In order to better understand these dynamics, we disaggregate our data further and look at specific U.S. suppliers and individual product categories. We do this by grouping the detailed HS6 products according to the Bureau of Labor Statistics (BLS) end-use categories: fuels, foods, industrial supplies, autos, capital goods, and consumer goods. In Figure 3, we see that the commodity-based categories (fuels, foods, and industrial supplies) in the top row, which comprise around a third of U.S. imports, are driven mainly by the common global component. This is in line with the commodity price boom post-COVID and, in particular, the peak levels of oil prices reached around Russia's invasion of Ukraine in 2022.

Idiosyncratic components play a more significant role in accounting for import price inflation of differentiated products, as

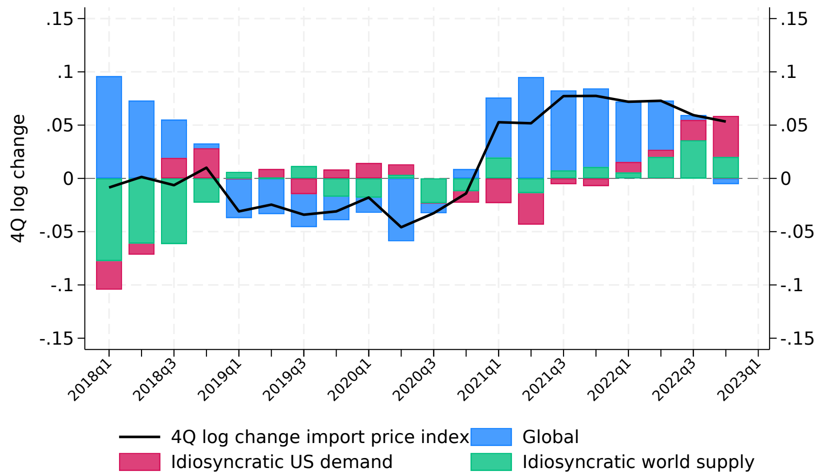

Figure 2. Decomposition of 4-Quarter Growth in Aggregate US Import Prices

Note: Authors' calculations based on data from UN Comtrade and GTAS. The 4-quarter log change in U.S. import unit values at the HS6-exporter-importer-country are aggregated up to the U.S. country-quarter level using 4-quarter lagged export value weights. The decomposition of the change in U.S. import price inflation into the three bars is explained in the text.

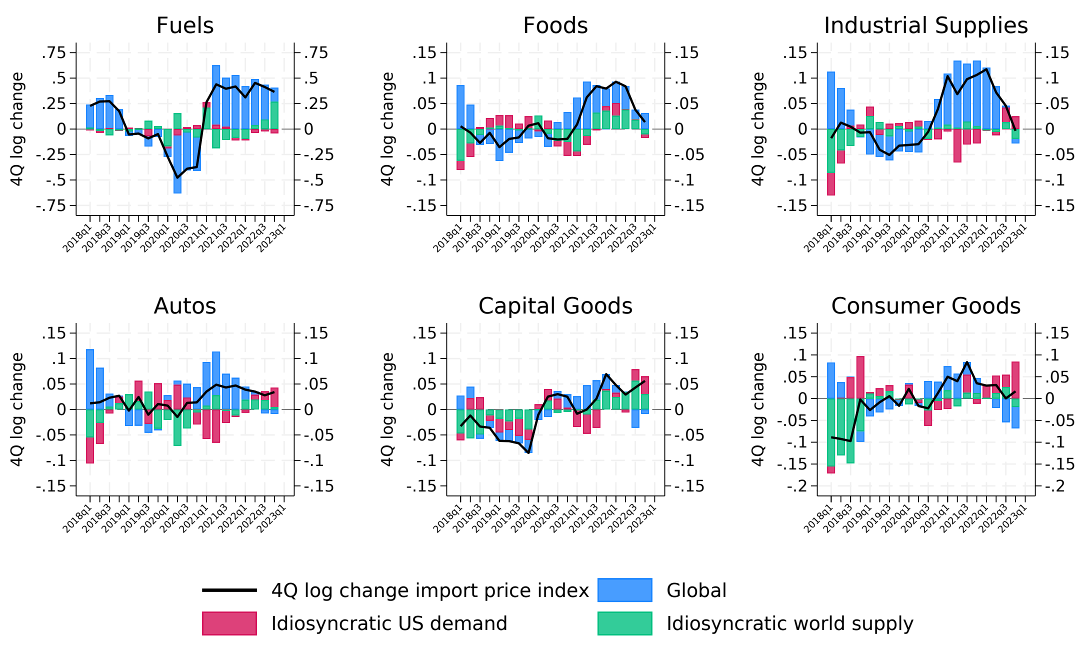

Figure 3. US Import Prices by End Use Categories

Note: Authors' calculations based on data from UN Comtrade and GTAS. The 4-quarter log change in U.S. import unit values at the HS6-exporter-importer-country are aggregated up to the U.S. country-end-use-quarter level using 4-quarter lagged export value weights. The decomposition of the change in world import price inflation into the three bars is as explained in the text. The value share of each end-use category based on 2018 values is fuels 8%; foods, feeds, and beverages 8%; industrial supplies and materials 14%; capital goods 27%; autos, parts, and engines 18%; and consumer goods 26%.

one can see in the bottom row. Specifically, the idiosyncratic supply shocks had substantial impacts on capital goods inflation, while the U.S. idiosyncratic demand mattered substantially for consumer goods inflation. Interestingly, consumer durables in the autos end-use category partially reflect both of these patterns. Finally, we zoom in further into these differentiated end-use categories to identify specific products and exporters that drove inflation in 2022. For consumer goods, the top products with large U.S. idiosyncratic demand shocks, as captured by $\tilde{\alpha}_{hjt}$ in 2022:Q4, were LED displays, cellular and wireless telephones, medicaments and pharmaceuticals, video games, diamonds, lighting, and motorcycles. For capital goods, the top product categories and source countries with positive idiosyncratic supply price shocks, as captured by $\tilde{\beta}_{hit}$, in 2022:Q3 were data processing machines, LED and other electrical machines, tripods, and reception and transmission apparatus from China, Hong Kong, Korea, and Thailand, as well as communication apparatus and air conditioning machines from Mexico. These price spikes probably partially reflect the semiconductor shortages that were widely reported as the pandemic came to an end.

IV. Conclusion

This paper develops a simple method for decomposing export and import price inflation into idiosyncratic demand and supply components as well as a global component. We find that world import prices were largely driven by a common global factor. This global price shock largely explains U.S. import price inflation through the second quarter of 2022. Thereafter, it appears that U.S. import inflation deviated from global trends and was driven more by idiosyncratic demand and supply shocks hitting the U.S. economy.

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