What Imports to Import Prices?*

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Abstract

This study examines exchange rate pass-through (ERPT) to U.S. import prices over two decades, analyzing data by country-of-origin and industry. We find significant heterogeneity in ERPT, with higher pass-through for commodities priced in dollars and key U.S. trading partners like Canada and Mexico. While short-term exchange rate fluctuations have limited effects, foreign production and transportation costs play a more substantial role. Over time, both costs and exchange rates exert greater influence on import prices. The dominance of low pass-through industries in U.S. trade explains the muted aggregate effects reported in prior studies. However, advanced panel estimation techniques suggest traditional time series analyses likely underestimated aggregate ERPT. Our findings underscore the need to account for sectoral variations in import price models to more accurately capture the impact of foreign economic shocks on U.S. import prices.

JEL Codes: C23, E31, F31, F14.

Keywords: Import prices, Exchange rate pass-through, dynamic panel estimation, sectoral heterogeneity.

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Resumen

Este estudio analiza la repercusión del tipo de cambio (ERPT por sus siglas en inglés) en los precios de importación de EE. UU. a lo largo de dos décadas, utilizando datos desglosados por país de origen e industria. Encontramos una heterogeneidad significativa en el ERPT, con una mayor repercusión en las materias primas cotizadas en dólares y en los principales socios comerciales de EE.UU., como Canadá y México. Si bien las fluctuaciones a corto plazo del tipo de cambio tienen efectos limitados, los costes de producción y transporte en el extranjero desempeñan un papel más relevante. A largo plazo, tanto estos costes como los tipos de cambio ejercen una mayor influencia sobre los precios de importación. La preponderancia de industrias con baja repercusión del tipo de cambio en el comercio estadounidense explica los efectos agregados atenuados observados en estudios previos. No obstante, el uso de avanzadas técnicas de estimación en panel sugiere que los análisis tradicionales de series temporales probablemente subestimaron el ERPT agregado. Nuestros hallazgos resaltan la importancia de considerar las variaciones sectoriales en la modelización de los precios de importación para evaluar con mayor precisión el impacto de los shocks económicos externos en los precios de importación de EE.UU.

Códigos JEL: C23, E31, F31, F14.

Palabras Clave: Precios de Importación, Traslación del Tipo de Cambio, Estimación Dinámica de Panel.

1 Introduction

The transmission of exchange rate movements to import prices, commonly known as exchange rate pass-through (ERPT), plays a pivotal role in understanding how external shocks–particularly fluctuations in foreign exchange rates–affect domestic inflation, competitiveness, and economic activity. Throughout this paper, we will refer to the transmissions of variable movements to import prices as pass-throughs, but one should keep in mind that they can also be called elasticities. Since Campa and Goldberg (2005), hereafter CG, established a quantifiable estimate of ERPT, their work has become foundational in international macroeconomic discussions. It has highlighted key determinants such as exporters' pricing strategies, market structure, and distribution costs. A critical aspect of ERPT is its variation across industries and firms, as noted in studies like Amiti et al. (2014) and Berman et al. (2012), which demonstrate that pass-through rates differ substantially depending on the type of goods or services involved. This variation has significant implications for monetary policy, particularly in terms of its ability to influence inflationary pressures through exchange rate adjustments. The effect of exchange rate movements on import prices can also depend on the prevailing inflation regime, as explored by Taylor (2000) and Forbes et al. (2018), which underscores the role of domestic inflation expectations in determining the responsiveness of import prices to exchange rate shocks.

Despite the extensive literature on ERPT, much of the existing research has either relied on aggregate data or focused on specific industries or countries in isolation. This paper contributes to the literature by revisiting ERPT using a richer dataset that includes U.S. import prices at the country-of-origin level, allowing us to investigate ERPT both at the country level and across specific industries. One of the key findings of our analysis is that ERPT is highly heterogeneous, with significant variation not only across countries but also across industries within the U.S. economy. This sectoral diversity suggests that simple aggregate models may overlook important distinctions that could provide a more nuanced understanding of ERPT dynamics.

We also present evidence that ERPT tends to be stronger among commodities that are quoted in dollars and traded on international markets, which is consistent with the hypothesis that the pricing behavior of internationally traded goods is more directly influenced by exchange rate movements. These goods, often characterized by standardized prices and market-driven pricing mechanisms, respond more immediately to currency fluctuations. In contrast, industries with more localized pricing structures, such as services or differentiated products, exhibit weaker pass-through rates. Additionally, our findings suggest that exchange rate pass-through is more pronounced among the U.S.'s closest trading partners, particularly those that are geographically and economically proximate. These countries, such as Canada and Mexico, are more deeply integrated into the U.S. supply chain and may have greater economic and trade linkages, leading to stronger transmission of exchange rate movements to import prices.

Another key result of our study is that while short-run exchange rate pass-through tends to be small and statistically insignificant for the majority of countries, foreign production costs–proxied by producer price index (PPI) inflation—-demonstrate a more substantial pass-through effect. This finding indicates that while exchange rate fluctuations may not have an immediate impact on import prices, changes in foreign production costs can have a more pronounced effect, particularly in the medium to long term. We find that the long-run effects of both exchange rate movements and foreign production costs on U.S. import prices are significant, highlighting the persistence of these shocks over time. This suggests that external shocks, while not always immediately apparent in import price dynamics, can have enduring effects on the cost structure of imported goods.

Our analysis also reveals that the majority of U.S. trade is concentrated in industries that exhibit relatively low exchange rate pass-through. This observation helps explain why aggregate ERPT, when viewed at the macroeconomic level, appears relatively muted. However, by applying novel empirical techniques, including the Pooled Bewley (PB) estimator proposed by Chudik et al. (2023), we demonstrate that previous studies relying on time-series data may have underestimated ERPT, particularly when it comes to accounting for cross-sectional heterogeneity across countries and industries. The use of panel estimation techniques allows us to capture this variation more effectively, offering new insights into the magnitude of pass-through that would be difficult to detect with more traditional methods.

The implications of these findings are far-reaching. By highlighting the significant sectoral diversity in ERPT, our study suggests that the degree of pass-through should not be treated as a uniform phenomenon across all goods or industries. Instead, a more granular approach, which incorporates industry-specific and country-specific dynamics, is essential for understanding how exchange rate movements and other external shocks are transmitted through the economy. This insight calls for the incorporation of sectoral heterogeneity into the workhorse import price models used by policymakers and researchers alike. Doing so will enable a more nuanced and accurate understanding of the economic consequences of foreign shocks, particularly for domestic import prices. As global trade patterns continue to evolve, accounting for these factors will be crucial in developing a comprehensive framework for analyzing how fluctuations in exchange rates and foreign production costs influence the

U.S. economy.

In summary, our study offers novel empirical evidence that improves our understanding of ERPT by considering both country-specific and industry-specific dynamics. The findings underscore the importance of sectoral diversity in the transmission of foreign shocks and call for a more detailed approach to modeling ERPT that incorporates these variations. As such, this research provides an important step forward in enhancing our understanding of how external shocks, including exchange rate movements and changes in foreign production costs, influence domestic import prices and, by extension, broader economic outcomes.

The paper proceeds as follows: Section 2 discusses the data and econometric approach; Section 3 presents novel results on short- and long-run pass-through; Section 4 provides economic intuition and some theoretical and policy lessons from our evidence; Section 5 concludes.

2 Econometric Approach

2.1 Data

The Bureau of Labor Statistics (BLS) reports U.S. import price indexes at varying levels of granularity. Our first set of these import price indexes report prices for all traded goods by the country of origin. These indexes, extending back to December 2003, are available for Canada, China, France, Germany, Japan, Mexico, the United Kingdom, and the European Union. Additional indexes are available for Taiwan and other regions, but the length and quality of those indexes tend to be less reliable. To construct a panel dataset, we merge the import price indexes with bilateral exchange rates (USD/LCU), producer price indexes, and ad valorem freight cost markups, calculated as $(\frac{Imports_{c.i.f.}}{Imports_{f.o.b.}} - 1) \times 100$, for freight and insurance costs by country. In cases where $Imports_{f.o.b.} > Imports_{c.i.f.}$, due to reporting errors, we apply linear interpolation. The dataset covers monthly data from January 2004 to September 2024, all of which are seasonally adjusted.

Additionally, the BLS reports import price series at both the country and industry level for select industries and countries. The list of industries for which we use these data are listed in Table A1. To construct a panel data set that varies at both the country and industry level, we map Canada, China, Mexico, Japan, and the EU's industry-level PPI and freight costs to their import price indexes. The exchange rate does not vary by industry. The industry-level classifications of the import prices indexes roughly follow the NAICS system. Therefore, it is straightforward to map PPI and freight costs for Mexico and Canada. For the remaining countries (China, Japan, and the EU), and China in particular, higher levels of aggregation might be repeatedly matched with multiple industries. Each industry also varies in the number of country of origins for which we have data on import prices. We require that at least two countries of origin report an import price index for an industry to use it. The first import price data begins in January 2012 and ends in December 2024, but some may be shorter. We further require these series to include both pre- and post-pandemic observations to account for varying trends in international price transmission over the pandemic. We consider a total of 14 industries.

2.2 Panel Data Estimators

To conduct inference in the long- and short-run between our three covariates and the import price index, we utilize a dynamic panel data model. This model relates import price inflation (measured as the log-difference of the import price index), $\pi_{i,t}$, to the pass-throughs of the log-differences of the bilateral exchange rate, foreign PPI, and freight costs, $x_{j,i,t}$. We can write our model as an ARDL(1,1) representation in error correction form where j identifies an indicator, i identifies a country, and t identifies time.

$$\Delta\pi_{i,t} = -\phi_i(\pi^I_{i,t-1} - \beta_{0,i} - \sum_{j=1}^{J}\beta_j x_{j,i,t-1}) + \sum_{j=1}^{J}\psi_{j,i}\Delta x_{j,i,t} + \epsilon_{i,t}. \tag{1}$$

In Equation 1, the β_j coefficients represent the long-run relationships between the covariates and import price inflation, while the $\psi_{j,i}$ coefficients capture the short-run, country-specific relationships between the covariates and import price inflation. Additionally, $\epsilon_{i,t}$ is the error term and ϕ_i governs the sensitivity to the error correction term.

A variety of estimators can be used to estimate this model in a panel data setting, each with its own limitations. These include the Panel Dynamic OLS (PDOLS) estimator by Kao and Chiang (2001), the Mean Group (MG) estimator by Pesaran and Smith (1995), the Pooled Mean Group (PMG) estimator by Pesaran et al. (1999), and the Pooled Bewley (PB) estimator by Chudik et al. (2023). While we employ all of these estimators, we ultimately favor the PB estimator due to its analytic solution and readily implementable bias correction strategies. Additionally, we incorporate half-panel jackknife and sieve wild bootstrap bias-corrected versions of the PB estimator. Details of these bias correction methods can be found in Chudik et al. (2023) and Asnani et al. (2024).

We estimate our models on two kinds of data. First, we use the aggregated data, which cover import prices, PPI, and freight costs for all industries, covering all traded goods by country of origin. Second, we estimate our model separately by industry, using variables reporting reported at the industry level (with the exception of the exchange rate) for each country of origin. Essentially, we estimate Equation 1 for aggregate and industry-level data where the panel dimension varies by country of origin. Therefore, our analysis yields long-run pass-throughs for each industry and for the aggregate, as well as short-run pass-throughs at the country and country-industry level.

Our empirical approach, particularly with the PB estimator, differs from that of prior investigations of ERPT like CG in that we leverage the variation across the entire panel of countries, estimating long-run pass-throughs within a single equation. In contrast, CG applies time series regressions country by country and aggregates the resulting coefficients. CG use different covariates to examine ERPT, but their strategy would translate to the following in our context.

$$\pi_t = \alpha + \sum_{j=1}^{J} \sum_{k=0}^{K} \nu_{j,k} x_{j,t-k} + \epsilon_t. \tag{2}$$

Where the long-run pass-through of a given variable, β_j, is given by:

$$\beta_j = \sum_{0}^{K} \nu_{j,k} \tag{3}$$

In the following sections, we favor the PB estimator with and without bias correction and compare our estimates to that of CG and other panel data estimators.

3 Main Findings

The empirical results in Figures 1 through 4 highlight key differences in exchange rate pass-through (ERPT) and foreign cost pass-through across industries. Interpreting these results requires consideration of ancillary evidence. First, import price indexes, primarily based on Free on Board (FOB) foreign producer prices, often exclude trade costs such as freight and insurance, understating their impact on U.S. consumers (Bureau of Labor Statistics, 2024a).[1] Our analysis, incorporating CIF/FOB data, shows that while exporters absorb some trade costs through reduced markups and profit margins, most trade costs are ultimately passed

[1] While the BLS does not provide an exact breakdown of the share of sampled prices reported on an FOB versus Cost, Insurance, and Freight (CIF) basis, it explicitly states that ”[t]he majority of prices used in calculating import price indexes are quoted FOB (Free On Board) Foreign Port” (Bureau of Labor Statistics, 2024a).

on to U.S. consumers, with pass-through estimates remaining negative but small.

Trade costs significantly influence final import price movements, particularly for goods with high transport cost shares, though these shares tend to be modest. Neglecting trade costs risks an incomplete assessment of external shocks on domestic prices, especially given the volatility in global freight costs. Incorporating these costs refines import price models, offering a more comprehensive framework for inflation modeling and policy analysis beyond ERPT.

Additionally, trade invoicing-predominantly in U.S. dollars, covering approximately 95% of U.S. imports and exports (Bureau of Labor Statistics, 2024b)—affects pass-through dynamics.[2] While the U.S. dollar remains the dominant currency in U.S. trade, importers and exporters have the flexibility to invoice transactions in other currencies. Therefore, this suggests that foreign exporters generally operate as either local currency pricing (LCP) firms—setting prices in the destination currency—or as dollar pricing (DP) firms, using the dollar as the dominant transaction currency for international trade. In contrast, U.S. exporters leverage the global role of the dollar and primarily function as producer currency pricing (PCP) firms, setting prices in their domestic currency.

Exchange rate and cost pass-through vary significantly by invoicing strategy: in producer currency pricing (PCP), pass-through is higher, whereas in local currency pricing (LCP) or dollar pricing (DP), firms tend to absorb shocks into their margins particularly when operating under staggered pricing and in response to transitory changes in their cost structure. Consequently, long-run pass-through is generally more pronounced than short-run pass-through also under DP and staggered pricing. Industry-level factors further shape pass-through, with commodity sectors experiencing greater price volatility, sometimes leading to overreactions where pass-through rates exceed unity.

These insights underscore the importance of accounting for trade costs, currency invoicing, and industry characteristics in interpreting our empirical findings.

3.1 Industry and Country Pass-Through

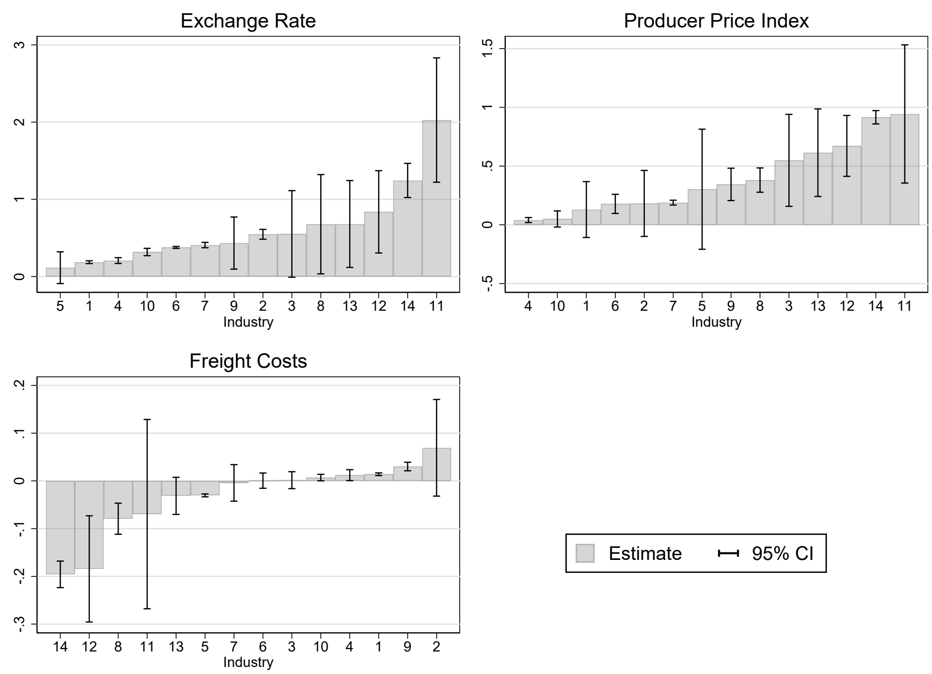
In the short run, as depicted in Figures 2, 3, and 4, the analysis reveals minimal evidence of significant ERPT effects, except for some notable impacts on producer price index (PPI)

[2]However, the BLS does not specifically sample for currency usage, primarily collecting U.S. dollar prices and only accepting foreign currency prices when dollar-denominated values are unavailable. As a result, the U.S. Import and Export Price Indexes are published in dollar terms, making the invoicing data primarily informational rather than a precise measure of trade invoicing practices.

inflation, serving as a proxy for foreign production costs.[3] This limited short-run impact suggests that staggered pricing decisions by importers delay the pass-through of foreign costs and exchange rate fluctuations into import prices. The rationale for this is that most industries adjust their export prices infrequently (staggered pricing), leading to a temporary absorption of cost changes within profit margins.

However, the long-run analysis in Figure 1 uncovers substantial heterogeneity in ERPT across industries. While transport cost proxies exhibit minimal influence—often absorbed by industry markups—the long-run effects of domestic production costs and exchange rate fluctuations are pronounced in specific industries. This heterogeneity underscores the importance of sector-specific pricing strategies, where certain industries exhibit high ERPT over time, while others maintain limited pass-through.

Figure 1: Long-run pass-throughs across industries



Notes: Results are estimated using Pooled Bewley estimator outlined in Chudik et al. (2023) and Asnani et al. (2024). Models are estimated separately by industry. The number of countries available for each industry varies. The panel is unbalanced with the earliest data starting in Jan 2012 and ending in Dec 2024. Industry numbers are defined in Table A1.

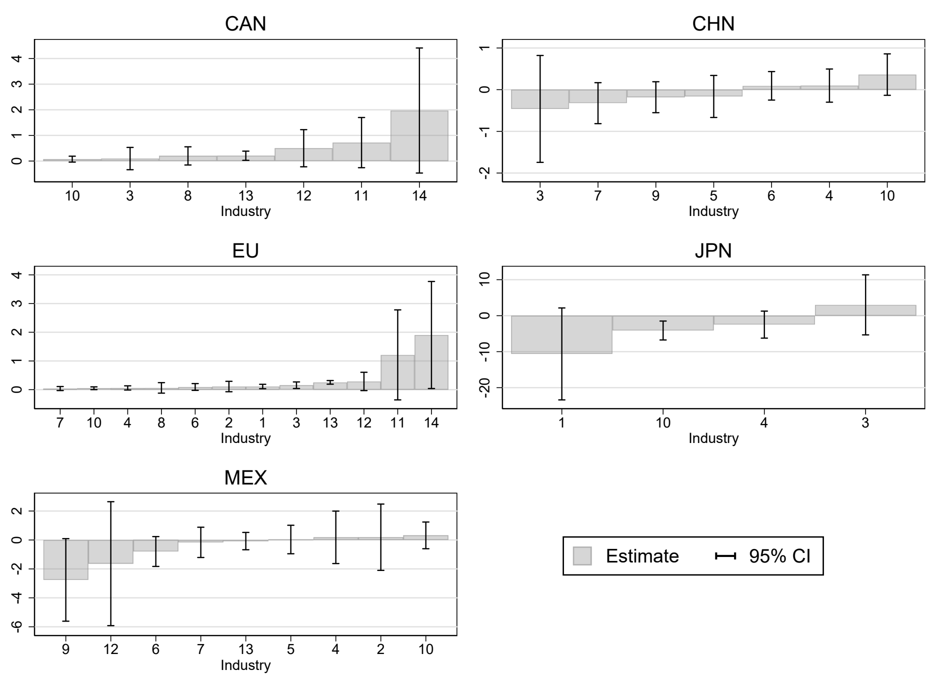
A notable observation is that industries with high ERPT, such as Primary Metals (indus-

[3]The Producer Price Index (PPI) measures the average change over time in the selling prices received by domestic producers for their goods and services. Unlike consumer price indexes, which track retail prices paid by consumers, the PPI captures price movements at earlier stages of production and distribution, reflecting changes in input costs, supply chain dynamics, and overall inflationary pressures.

try 12), Non-Ferrous Metals (industry 11), and Petroleum and Coal Products (industry 14), are predominantly commodity-based, globally priced in dollars, and typically intermediate goods rather than final consumer products. In contrast, industries such as Machinery and Electronics, which are frequently priced in local currencies, demonstrate a lower ERPT.

Industry 13, representing all manufacturing and encompassing approximately 83% of total trade, serves as a robust proxy for aggregate ERPT estimates. The consistency in the ranking of industries between short- and long-run estimates, despite smaller and often statistically insignificant short-run effects, reinforces the sectoral patterns observed.

Figure 2: Short-run exchange rate pass-throughs across industries

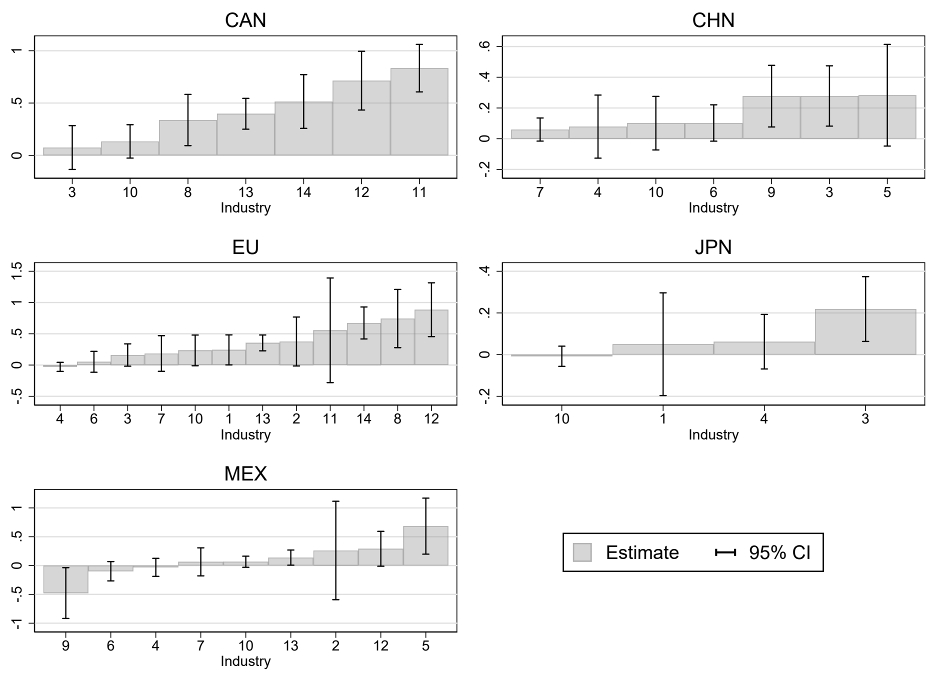


Notes: Results are estimated using Pooled Bewley estimator outlined in Chudik et al. (2023) and Asnani et al. (2024). PB Models are estimated separately by industry. These short-run coefficients are recovered from the long-run estimation in a second stage. The number of countries available for each industry varies. The panel is unbalanced with the earliest data starting in Jan 2012 and ending in Dec 2024. Industry numbers are defined in Table A1.

An intriguing finding is the negative pass-through of transportation costs in industries with high ERPT for exchange rates and PPI inflation. This suggests that while these industries are sensitive to production costs and exchange rate movements, they tend to offset transportation costs within their pricing margins, possibly due to their commitment to foreign markets once production is complete.

The measurement of import prices is critical because it may systematically understate the role of trade costs in shaping final import prices for U.S. consumers. Since most reported import prices exclude freight and insurance costs, standard analyses primarily capture the indirect effects of trade costs—how they influence the prices received by foreign exporters—rather than their full burden on U.S. importers. Our empirical approach, incorporating trade costs through the CIF/FOB ratio, is complicated by the BLS's mixed pricing methodology but largely reveals how variations in shipping and insurance expenses affect prices at the U.S. border. A key implication of our findings is that when higher trade costs correspond to lower observed–largely FOB–import price inflation, exporters likely are absorbing part of the cost increase by compressing markups and profit margins. If trade costs were fully absorbed by exporters, their pass-through would approach -1. Instead, our negative but relatively small estimates indicate that most trade costs are ultimately passed through to U.S. consumers.

Figure 3: Short-run PPI pass-throughs across industries

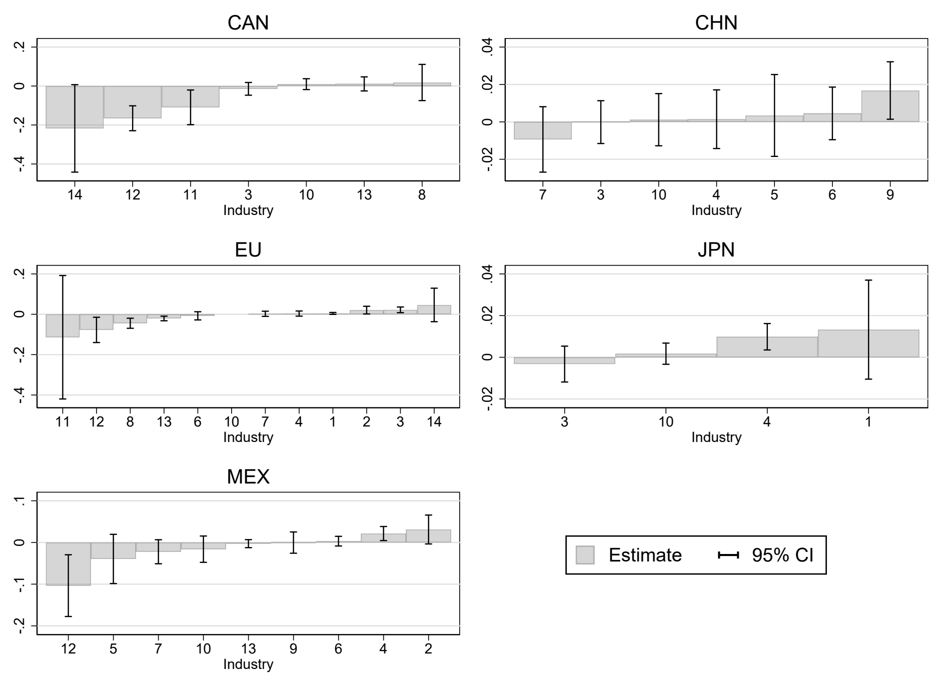


Notes: Results are estimated using Pooled Bewley estimator outlined in Chudik et al. (2023) and Asnani et al. (2024). PB Models are estimated separately by industry. These short-run coefficients are recovered from the long-run estimation in a second stage. The number of countries available for each industry varies. The panel is unbalanced with the earliest data starting in Jan 2012 and ending in Dec 2024. Industry numbers are defined in Table A1.

Given the heightened volatility in global freight costs–exacerbated by supply chain disruptions and energy price fluctuations–ignoring these trade costs risks an incomplete assessment of how external shocks transmit to domestic prices. While exchange rate pass-through is often the main concern of the literature, trade costs can significantly shape final import price movements, particularly for goods with high transport cost shares, though such shares tend to be modest.

The appendix table on page 12 provides the identifiers for each industry, supporting the detailed analysis presented here. This sectoral heterogeneity in pricing decisions highlights the need to consider industry-specific factors when evaluating ERPT, with implications for trade policy, inflation forecasting, and global supply chain management.

Figure 4: Short-run freight cost pass-throughs across industries



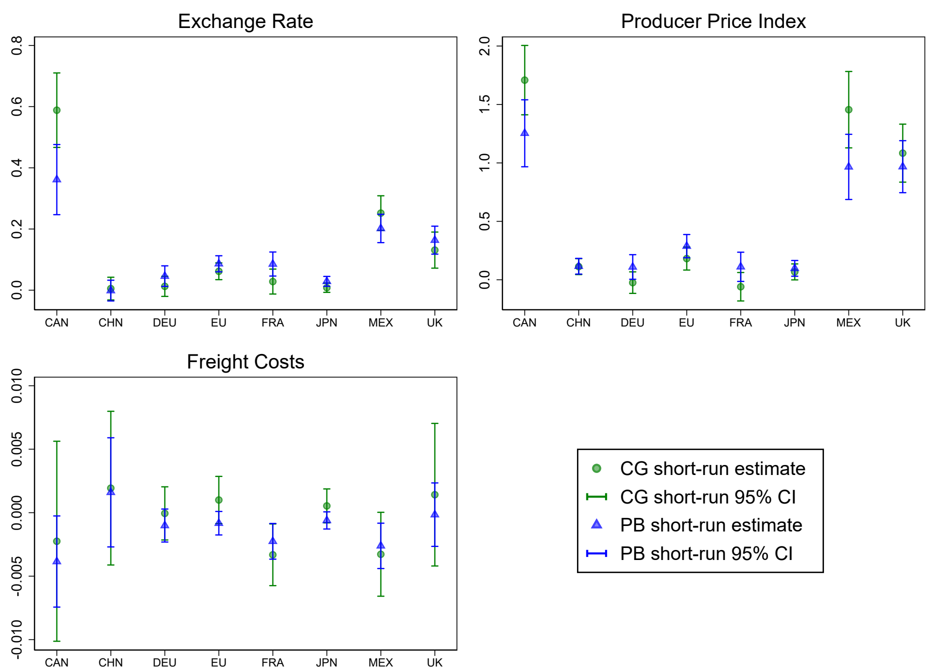
Notes: Results are estimated using Pooled Bewley estimator outlined in Chudik et al. (2023) and Asnani et al. (2024). PB Models are estimated separately by industry. These short-run coefficients are recovered from the long-run estimation in a second stage. The number of countries available for each industry varies. The panel is unbalanced with the earliest data starting in Jan 2012 and ending in Dec 2024. Industry numbers are defined in Table A1.

3.2 Aggregate Pass-Through

In Figure 5 and Table A4 we look at the evidence now at the aggregate level. Here we find that the short-run data display significant differences in pass-through across countries. This, in part, reflects that trade is different from country to country and that accordingly some of the heterogeneity across industries that we documented earlier shows up here in country heterogeneity, at least in the short-run effects.

For China, the EU, France, Germany, and Japan, the short-run pass-throughs of exchange rate and PPI fluctuations are minimal or statistically indistinguishable from zero. In contrast, we observe larger and statistically significant short-run pass-throughs for fluctuations in the exchange rate and PPI for Canada, Mexico, and the U.K. Specifically, the short-run PPI pass-throughs for these three countries are comparable, with values of approximately 0.97 for Mexico and the U.K., and around 1.3 for Canada. Regarding short-run exchange rate pass-throughs, Canada emerges as an outlier, exhibiting a pass-through of 0.36, nearly double that of Mexico (0.20) and the U.K. (0.16). In the short run, the pass-through of changes in freight costs is either economically insignificant–similar to the long-run pass-through–or statistically insignificant as well.

Figure 5: Short-run aggregate pass-throughs to import price inflation



Notes: PB estimates are bootstrapped based on 5000 replications and calculated following Chudik et al. (2023) using Asnani et al. (2024). PB inference is conducted using bootstrapped CIs. CG estimates follow Campa and Goldberg (2005).

Figure (5) shows that while foreign PPI inflation and exchange rate changes can explain import price inflation to some extent, fluctuations in freight costs have minimal pass-through to import price inflation. The estimated long-run pass-throughs, listed in Table 1, of exchange rate fluctuations is 0.30, less than half the pass-through for PPI inflation, which is 0.68 (as shown in Table (1)). Notably, compared to the CG approach, our results suggest greater uncertainty in the long-run pass-through of these variables to import price inflation.

Interpreting the size of these coefficients highlights their economic significance. For in-

Table 1: Long-run dynamic panel model estimates

	PDOLS	MG	PMG	PB	PB Jackknife	PB Bootstrap
Exchange Rate Growth, USD/LCU	0.1704***	0.1732**	0.1525***	0.2940***	0.2954***	0.2981***
	(0.0040)	(0.0795)	(0.0097)	(0.0873)	(0.0680)	(0.0872)
						[0.0498,0.5463]
PPI Inflation	0.6513***	0.6365**	0.2424***	0.6875**	0.6807**	0.6941**
	(0.0130)	(0.2697)	(0.0218)	(0.3242)	(0.3086)	(0.3242)
						[-0.4885,1.8767]
Transportation Costs Growth	-0.0035***	-0.0010	-0.0003	-0.0028**	-0.0028*	-0.0027**
	(0.0002)	(0.0010)	(0.0009)	(0.0013)	(0.0016)	(0.0013)
						[-0.0016,0.0087]
Observations	1976	1976	1976	1976	1976	1976

Asymptotic standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ on an asymptotic basis. Reported confidence intervals in brackets are bootstrapped based on 5000 replications and allow for arbitrary cross sectional dependence of errors. PDOLS, MG, PMG, and PB are estimated following Kao and Chiang (2001), Pesaran and Smith (1995), Pesaran et al. (1999), and Chudik et al. (2023), respectively. PB models are implemented using Asnani et al. (2024).

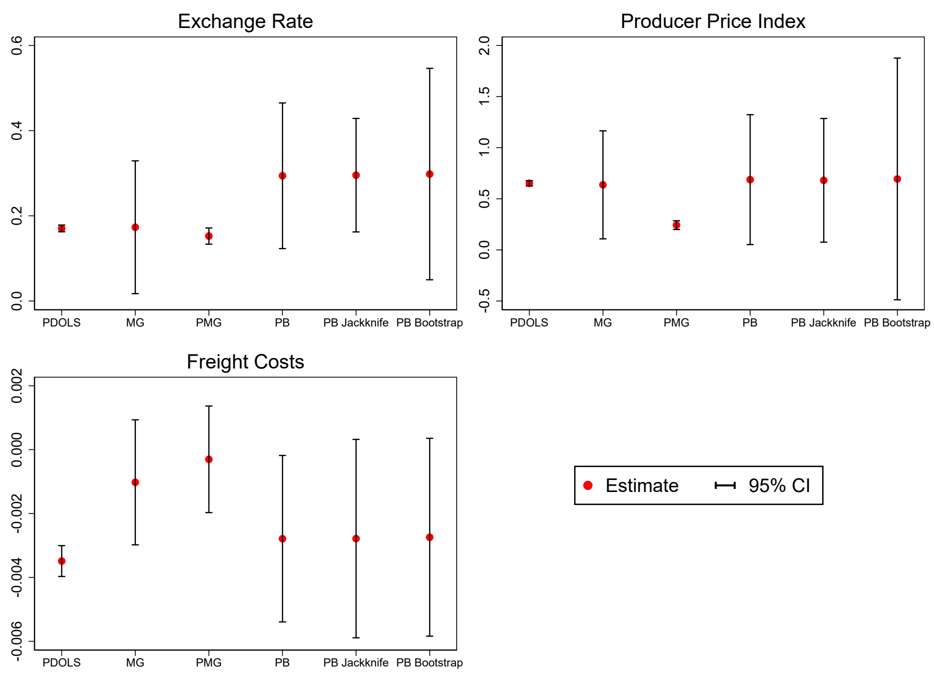
stance, the average month-to-month exchange rate change across the sample is approximately 1.4 percent, implying that, on average, exchange rate fluctuations affect import price inflation by about 0.42 percent in the long run–an effect that can be offset by subsequent exchange rate movements. A similar back-of-the-envelope calculation for the average long-run pass-through of PPI inflation and freight cost changes yields 0.33 percent and 0.04 percent, respectively, suggesting that freight costs have an economically insignificant impact on import price inflation.

3.3 Econometric Method Robustness

Our results are broadly consistent across the various panel data estimators we employ (Figure (6)). All estimators indicate that the long-run exchange rate pass-through (ERPT) is positive and statistically significant; however, there is some moderate–though not concerning–disagreement regarding the long-run pass-through of PPI inflation and changes in freight costs. For every estimator except the PB bootstrapped estimator, we find a positive and statistically significant long-run pass-through for PPI inflation. It is important to note that when conducting asymptotic inference using the PB bootstrap point estimates, the coefficient remains significant at the 5 percent level. Thus, while PPI inflation may have a significant long-run pass-through to import price inflation, this relationship is generally uncertain. Lastly, the statistical significance of the long-run pass-through of changes in freight costs varies between estimators, but all point estimates are negative and economically insignificant.

In general, the PDOLS and PMG estimators produce much tighter confidence intervals than the MG and PB estimators, which may understate the uncertainty surrounding these estimates. This is one reason we prefer the PB results. Additionally, the PB estimates are favored over the MG estimates because they are derived from a single equation estimation, whereas the MG method calculates unweighted averages from separate estimations by country. Despite the relative advantages of these different estimators, our results remain robust across all of them.

Figure 6: Long-run pass-throughs across panel data estimators



Notes: PDOLS, MG, PMG, and PB are estimated following Kao and Chiang (2001), Pesaran and Smith (1995), Pesaran et al. (1999), and Chudik et al. (2023), respectively. PB models are implemented using Asnani et al. (2024).

Our analysis of import price dynamics identifies three main drivers: freight and insurance costs, production costs, and exchange rates. The findings of our study offer new insights and build on the established literature, particularly the work of CG, leveraging new data at the country-of-origin level.

4 Discussion

The structure of pricing decisions and model assumptions plays a critical role in determining economic outcomes, particularly in the context of exchange rate pass-through (ERPT). Models that incorporate sectoral heterogeneity must account for trade costs, import constraints, and price-setting behaviors to accurately capture the complexities of ERPT. The interaction between monopolistic competition, trade intermediation costs, and capacity constraints in logistics affects import prices and inflation dynamics. Notably, whether trade costs are linked to binding constraints or remain independent significantly alters pricing outcomes. Thus, to effectively analyze ERPT, models must integrate these structural elements and sectoral variations, as overlooking them risks misinterpreting the transmission of exchange rate changes to domestic prices.

4.1 Flexible Pricing

Consider a continuum of monopolistically competitive foreign firms indexed by $\omega \in (0,1)$. The foreign firm's marginal cost in U.S. dollars is given by $E_t MC_t^*$, where E_t is the exchange rate and MC_t^* the foreign marginal cost. A per-unit trade cost F_t is incurred for domestic market access.

With flexible prices and local-currency pricing (or dollar-pricing), the foreign firm chooses its price in U.S. dollars, $P_{Ft}(\omega)$, to maximize its profits, taking its costs and aggregate variables as given, and with knowledge of its demand curve:

$$\max_{P_{Ft}(\omega)} \left[P_{Ft}(\omega) - E_t MC_t^* - F_t\right] Y_t^*(\omega) \tag{4}$$

subject to

$$Y_t^*(\omega) = \left(\frac{P_{Ft}(\omega)}{P_{Ft}}\right)^{-\kappa} Y_t^*, \tag{5}$$

where $Y_t^*(\omega)$ is the firm's output, P_{Ft} and Y_t^* are the price and quantity of the composite import good sold in the U.S., and $\kappa > 1$ is the demand elasticity.

The optimal price is:

$$P_{Ft}(\omega) = \left(\frac{\kappa}{\kappa - 1}\right)(E_t MC_t^* + F_t). \tag{6}$$

Note that $P_{Ft}(\omega)$ is the price paid by the U.S. consumer, inclusive of F_t; in trade parlance, this would be a cost, insurance, and freight (CIF) price. The net price that the producer receives is:

$$\tilde{P}_{Ft}(\omega) = P_{Ft}(\omega) - F_t = \left(\frac{\kappa}{\kappa-1}\right)(E_t MC_t^* + \frac{1}{\kappa}F_t). \tag{7}$$

This corresponds to a free on board (FOB) producer price, and it increases with the trade cost because the supplier marks up its total costs ($E_t MC_t^* + F_t$). This standard pricing behavior result gives us already an important insight to match with our empirical findings. Because the free on board (FOB) price received by foreign exporters increases with the per-unit trade cost F_t, foreign firms can respond to rising trade costs by reducing the CIF price charged to U.S. consumers without necessarily lowering the FOB price they receive. This dynamic may help explain why the pass-through of freight cost appears to move in the opposite direction in some industries, as shown in our empirical findings.

4.2 Staggered Pricing

The model is rather standard, allowing us to focus here on the determination of import prices. The continuum of symmetric, monopolistically competitive foreign firms are assumed to set prices in U.S. dollars subject to quadratic costs of price adjustment. We log-linearize the firm's first-order condition for optimal prices to derive the import price Phillips curve:

$$\pi_{Ft} = \left(\frac{\kappa-1}{\phi}\right)(\hat{e}_t + \hat{mc}_t^* - \hat{p}_{Ft}) + \left(\frac{\kappa}{\phi}\right)\left(\frac{P_0}{P_{F0}}\right)\hat{f}_t + \beta\mathbb{E}_t[\pi_{t+1}]. \tag{8}$$

where the hat-notation denotes log deviations from the steady state. Here, π_{Ft} is the inflation rate for consumer import prices in dollars at time t, $\hat{e}_t$ is the log exchange rate, $\hat{mc}_t^*$ is log foreign marginal costs in foreign currency, $\hat{p}_{Ft}$ is the import price in dollars, β is the consumer's time discount rate, and ϕ controls the degree of price rigidity. The term (P_0/P_{F0}) is the steady-state relative price of imports.

Assuming zero trade costs in the steady state ($F_0 = 0$), we define an auxiliary variable $\bar{F}_t = 1 + F_t/P_t$, taking the approximation with respect to $\bar{F}_t$, so $\hat{f}_t = \ln(\bar{F}_t)$. In equation (8), import price inflation responds to changes in both foreign costs when quoted in U.S. currency at the prevailing exchange rate and trade costs.[4] From the import price Phillips curve (Equation (8)), we derive the forward-looking solution for import price inflation as a function of current and expected future values of foreign marginal costs, the exchange rate,

[4] Since foreign producer prices are given by: $\tilde{P}_{Ft} = P_{Ft} - F_t$, foreign producer price inflation is: $\tilde{\pi}_{Ft} = \pi_{Ft} - \left(\frac{P_0}{P_{F0}}\right)(\hat{f}_t - \hat{f}_{t-1})$. Equation (8) suggests that increases in trade costs can contribute to lower the FOB import price inflation rate which reflects what the inflation rate is for foreign producers net of those trade costs.

and trade costs.

$$\pi_{Ft} = \sum_{j=0}^{\infty} \beta^j \mathbb{E}_t \left[\left(\frac{\kappa - 1}{\phi} \right) (\hat{e}_{t+j} + \hat{mc}^*_{t+j} - \hat{p}_{Ft+j}) + \left(\frac{\kappa}{\phi} \right) \left(\frac{P_0}{P_{F0}} \right) \hat{f}_{t+j} \right]. \tag{9}$$

This forward-looking solution highlights that the primary influence on import prices is not merely the current exchange rates, foreign marginal costs, or trade costs, but the accumulated effects of their expected future paths. The direct, short-term impact may be limited if $\kappa > 1$ but arbitrarily close to 1 while $\varphi > \kappa$ is arbitrarily large, when the shift in any of these variables is short-term. However, anticipated long-term changes that are more persistent can significantly shape observed import price dynamics, particularly in certain industries where staggered pricing and expectations play a critical role.

The other important point is that these models assume foreign firms predominantly engage in local-currency or dollar-denominated pricing, consistent with documented patterns among foreign exporters to the U.S. However, pricing strategies that incorporate a mix of producer-currency and local-currency pricing could also influence sectoral pass-through, making them more suitable for certain industries. Therefore, such pricing behavior should be considered when interpreting empirical evidence or using this evidence to inform the calibration of open-economy models.

4.3 Economic Intuition and Implications

While freight costs are crucial for delivering foreign goods to U.S. markets, our analysis finds no economically significant evidence that fluctuations in freight costs drive import price inflation. Despite recent global supply chain disruptions and volatile freight costs, these costs appear to be absorbed along the supply chain, consistent with the broader literature indicating that distribution expenses are often absorbed by markups rather than reflected in import prices.

Our findings suggest that while PPI inflation can influence import price inflation, the relationship is mixed. Exporters often absorb production cost increases, reflecting pricing-to-market strategies based on U.S. demand conditions rather than cost fluctuations. Pass-through behavior varies across countries: some exporters prioritize market share and absorb cost increases, while others adjust prices more rapidly due to tighter margins.

A key contribution of our study is the use of disaggregated, country-level import price data to analyze exchange rate pass-through (ERPT). Unlike previous aggregate-level studies, our approach reveals smaller and more heterogeneous ERPT estimates across countries.

Advanced panel methods highlight uncertainties in ERPT estimates, suggesting previous research may have overstated exchange rate impacts on import price inflation.

Despite this, ERPT remains statistically significant but economically modest, with notable heterogeneity across countries. Higher ERPT is observed in countries like the U.K., Canada, and Mexico, possibly due to geographical proximity, the prevalence of producer-currency pricing in these regions, and trade agreements like NAFTA/USMCA. The composition of traded goods also matters, since Canada and Mexico's exports to the U.S. include significant shares of commodities priced in dollars, such as food, live animals, and mineral fuels, contributing to a higher ERPT.

5 Conclusion

In conclusion, our findings offer a novel and nuanced perspective on the factors influencing import price dynamics in the U.S. By incorporating both country-specific and industry-specific evidence, we highlight significant heterogeneity in exchange rate pass-through (ERPT). While freight and foreign production costs do influence import prices, their pass-through effects are generally limited, often due to absorption along the supply chain or strategic pricing behavior by exporters. Our analysis reveals that exchange rate pass-through, although statistically significant, is less economically important than previously thought, particularly when considering both short- and long-run effects. Notably, short-run pass-through remains minimal and statistically insignificant for most countries, while foreign production costs-—proxied by producer price index (PPI) inflation-—exhibit a more pronounced pass-through, especially over the long term.

We also find that ERPT is more pronounced among commodities quoted in dollars and traded in international markets. This suggests that such goods, which are typically standardized and subject to global price setting, are more directly affected by exchange rate fluctuations. Moreover, we observe that ERPT tends to be stronger among the U.S.'s closest trading partners, particularly those with strong geographical and trade linkages, such as Canada and Mexico. This indicates that geographic proximity, trade agreements, and the nature of traded goods play a critical role in determining the extent of price adjustments across different trading partners.

Importantly, our study reveals that most of the U.S. trade is concentrated in industries with relatively low exchange rate pass-through, which helps explain why aggregate ERPT appears relatively low in existing studies. The application of novel panel estimation techniques, including the Pooled Bewley (PB) estimator, allows us to demonstrate that previous research relying on time-series data may have underestimated the magnitude of pass-through, especially by failing to capture cross-sectional heterogeneity across countries and industries. This methodological advancement provides a more accurate assessment of ERPT, offering new insights into the variability of price transmission across different sectors.

The significant sectoral diversity we observe in ERPT underscores the need for a more granular approach to modeling import price dynamics. Our findings suggest that the incorporation of sectoral heterogeneity into standard import price models is essential for developing a more nuanced understanding of how foreign shocks—-such as exchange rate fluctuations and changes in foreign production costs—-affect domestic import prices. This approach will provide policymakers and economists with a more accurate framework for assessing inflationary pressures and formulating appropriate policy responses in a highly interconnected global economy.

Future research should continue to explore the role of firm-level pricing strategies, the composition of traded goods, and the impact of factors of geographic and trade relationship on ERPT. By incorporating these elements, we can further enhance our understanding of the complex dynamics that shape import price behavior, helping to inform more effective policy and improve economic forecasting in the context of global trade disruptions and external shocks.

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Appendix. Supplementary Tables

Table A1: Industry number crosswalk

Industry number	Import price description	% of 2024 goods trade
1	Agriculture, construction, and mining machines	1.4%
2	Alcoholic beverage and tobacco products	1.0%
3	Chemicals	12.1%
4	Computer and electronic products	16.9%
5	Cut and sew apparel	2.3%
6	Electronic equipment and components	6.0%
7	Fabricated metal products	3.0%
8	Food products	3.6%
9	Household appliances	1.3%
10	Machinery	7.6%
11	Nonferrous metals	2.3%
12	Primary metals	4.1%
13	All manufactured goods	87.2%
14	Petroleum and coal products	1.9%

Notes: The shares of 2024 total goods trade are based on NAICS classification which directly maps into import price index descriptions. Each listed industry can have a varying level of disaggregation.

Table A2: Long-run pass-throughs by industry

	Industry 1	Industry 2	Industry 3	Industry 4	Industry 5	Industry 6	Industry 7
Exchange Rate, USD/LCU	0.1856***	0.5467***	0.5514*	0.2067***	0.1147	0.3770***	0.4075***
	(0.0095)	(0.0325)	(0.2860)	(0.0191)	(0.1049)	(0.0064)	(0.0177)
Producer Price Index	0.1299	0.1819	0.5487***	0.0405***	0.3030	0.1782***	0.1888***
	(0.1213)	(0.1432)	(0.1997)	(0.0109)	(0.2608)	(0.0415)	(0.0105)
Ad Valorem Shipping Costs	0.0139***	0.0693	0.0015	0.0120**	-0.0303***	0.0005	-0.0043
	(0.0014)	(0.0516)	(0.0091)	(0.0058)	(0.0016)	(0.0081)	(0.0195)
Observations	216	126	588	588	201	441	372

Notes: Results are estimated using Pooled Bewley without bias correction estimator outlined in Chudik et al. (2023) and Asnani et al. (2024). Models are estimated separately by industry. The number of countries available for each industry varies. The panel is unbalanced with the earliest data starting in Jan 2012 and ending in Dec 2024. Industry numbers are defined in Table A1.

Table A3: Long-run pass-throughs by industry

	Industry 8	Industry 9	Industry 10	Industry 11	Industry 12	Industry 13	Industry 14
Exchange Rate, USD/LCU	0.6774**	0.4333**	0.3176***	2.0267***	0.8379***	0.6800**	1.2440***
	(0.3279)	(0.1723)	(0.0243)	(0.4108)	(0.2720)	(0.2868)	(0.1129)
Producer Price Index	0.3808***	0.3442***	0.0499	0.9436***	0.6716***	0.6138***	0.9153***
	(0.0527)	(0.0703)	(0.0350)	(0.3001)	(0.1322)	(0.1902)	(0.0290)
Ad Valorem Shipping Costs	-0.0793***	0.0301***	0.0070**	-0.0696	-0.1844***	-0.0314	-0.1958***
	(0.0166)	(0.0046)	(0.0035)	(0.1012)	(0.0568)	(0.0198)	(0.0142)
Observations	294	216	735	126	285	459	138

Notes: Results are estimated using Pooled Bewley without bias correction estimator outlined in Chudik et al. (2023) and Asnani et al. (2024). Models are estimated separately by industry. The number of countries available for each industry varies. The panel is unbalanced with the earliest data starting in Jan 2012 and ending in Dec 2024. Industry numbers are defined in Table A1.

Table A4: Short-run pooled bewley estimates

	Canada	China	Germany	EU	France	Japan	Mexico	UK
Lag of Error Correction Terms	-0.5223***	-0.1400***	-0.5587***	-0.7245***	-0.6362***	-0.2862***	-0.8699***	-1.0712***
	(0.0578)	(0.0308)	(0.0485)	(0.0484)	(0.0527)	(0.0346)	(0.0596)	(0.0602)
Δ Exchange Rate Growth, USD/LCU	0.3615***	-0.0012	0.0460***	0.0863***	0.0856***	0.0289***	0.2018***	0.1636***
	(0.0582)	(0.0172)	(0.0171)	(0.0133)	(0.0200)	(0.0082)	(0.0235)	(0.0232)
Δ PPI Inflation	1.2535***	0.1156***	0.1094**	0.2876***	0.1106*	0.0974***	0.9657***	0.9677***
	(0.1455)	(0.0341)	(0.0534)	(0.0504)	(0.0635)	(0.0342)	(0.1415)	(0.1129)
Δ Transportation Costs Growth	-0.0038**	0.0016	-0.0010	-0.0008*	-0.0023***	-0.0006*	-0.0026***	-0.0002
	(0.0018)	(0.0022)	(0.0007)	(0.0005)	(0.0007)	(0.0003)	(0.0009)	(0.0013)
Observations	246	246	246	246	246	246	246	246

Asymptotic standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ on an asymptotic basis. Error correction terms are derived from the PB bootstrapped model in Table 1. The models above are fit by OLS, separately for each country.