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Abstract

This study offers new insights into exchange rate pass-through (ERPT) using U.S. import price indexes by country-of-origin, covering two decades of monthly data. Focusing on the largest U.S. trading partners, our analysis shows that ERPT is more muted than previously estimated, with freight costs having no measurable impact on import prices and foreign production costs exerting only limited influence. We also observe significant heterogeneity in countries' short-run responses, shaped by differences in trade composition and pricing strategies. Consistent estimates across common dynamic panel estimators underscore the robustness of these findings. The results suggest that exchange rate fluctuations may have a weaker direct effect on U.S. inflation than earlier studies implied, underscoring the need to reconsider current models of pricing behavior and inflation dynamics.

JEL Codes: C23, E31, F31, F14

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

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Resumen

Este estudio ofrece nuevas perspectivas sobre traslación del tipo de cambio (ERPT, por sus siglas en inglés) utilizando los índices de precios de importación de EE.UU. por país de origen, cubriendo dos décadas con datos mensuales. Al centrarnos en los principales socios comerciales de EE.UU., nuestro análisis muestra que el ERPT es más atenuado de lo que se había estimado previamente, con los costes de transporte sin un impacto significativo en los precios de importación y los costes de producción extranjeros ejerciendo solo una influencia limitada. También observamos una heterogeneidad significativa en las respuestas a corto plazo de los países en la muestra, moldeada por diferencias en la composición comercial y las estrategias de fijación de precios. Las estimaciones consistentes entre los estimadores dinámicos de panel más comunes subrayan la solidez de esta evidencia. Los resultados sugieren que las fluctuaciones del tipo de cambio pueden tener un efecto directo más débil en la inflación de EE.UU. de lo que estudios anteriores implicaban, lo que resalta la necesidad de reconsiderar los modelos actuales de determinación de precios y dinámicas inflacionarias.

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, known as exchange rate pass-through (ERPT), is pivotal in understanding how external shocks influence domestic inflation, competitiveness, and economic activity. Since Campa and Goldberg (2005), hereafter CG, established a quantifiable estimate, discussions around their estimates of ERPT have been central in international macro debates, highlighting key determinants such as exporters' pricing strategies and distribution costs. ERPT also varies across industries and firms (Amiti et al. (2014), Berman et al. (2012)), with implications for monetary policy, often depending on the prevailing inflation regime (Taylor (2000), Forbes et al. (2018)).

Given evolving trade and inflation dynamics, this paper revisits ERPT with updated data on U.S. import prices at the country-of-origin level. We extend traditional models by incorporating two new channels: foreign production costs, proxied by producer price index (PPI) inflation, and freight costs, which have grown more volatile due to supply chain disruptions and rising energy prices. By accounting for these factors, we aim to offer a more comprehensive understanding of how external shocks, particularly exchange rate movements, impact import prices.

Our analysis employs recent empirical techniques, including the Pooled Bewley (PB) estimator outlined by Chudik et al. (2023), to estimate long-run relationships in heterogeneous panels. Using updated data, we find that long-run ERPT has decreased since 2004, while short-run pass-through remains negligible for most countries, with notable exceptions like Canada, Mexico, and the U.K. We also find significant heterogeneity in PPI inflation pass-through, though freight costs have minimal influence on import prices.

The paper proceeds as follows: Section 2 discusses the data and model; Section 3 presents results on short- and long-run pass-through; Section 4 concludes with policy implications.

2 Methods

2.1 Data

We use U.S. import price indexes for all goods by country of origin, as reported by the Bureau of Labor Statistics. These indexes, extending back to December 2003, are available for Canada, China, France, Germany, Japan, Mexico, the United Kingdom, and the European Union. 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.

2.2 Panel Data Estimators

To conduct inference in the long- and short-run between our three covariates and the import price index, we assume, that the log-difference of the import price index, $\pi^I_{i,t}$, is defined as:

$$\pi^I_{i,t} = \beta_{0,i} + \sum_{j=1}^{J} \beta_j x_{j,i,t} + \epsilon_{i,t}, \tag{1}$$

where $x_{j,i,t}$ are the log-differences of the exchange rate, foreign PPI, and freight costs, and $\epsilon_{i,t} \sim I(0)$. We can rewrite equation (1) in its ARDL(1,1,1,1) representation as:

$$\pi^I_{i,t} = \theta_i + \sum_{j=1}^{J} \psi_{j,i} x_{j,i,t-1} + \sum_{j=1}^{J} \gamma_{j,i} x_{j,i,t} + \lambda \pi^I_{i,t-1} + \alpha_{i,t}. \tag{2}$$

Manipulating Equation (2) and writing it in error-correction form yields equation (3):

$$\Delta\pi^I_{i,t} = -\phi_i(\pi^I_{i,t-1} - \beta_{0,i} - \sum_{j=1}^{J} \beta_j x_{j,i,t-1}) + \sum_{j=1}^{J} \psi_{j,i} \Delta x_{j,i,t} + \alpha_{i,t}. \tag{3}$$

In the equations above, 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.

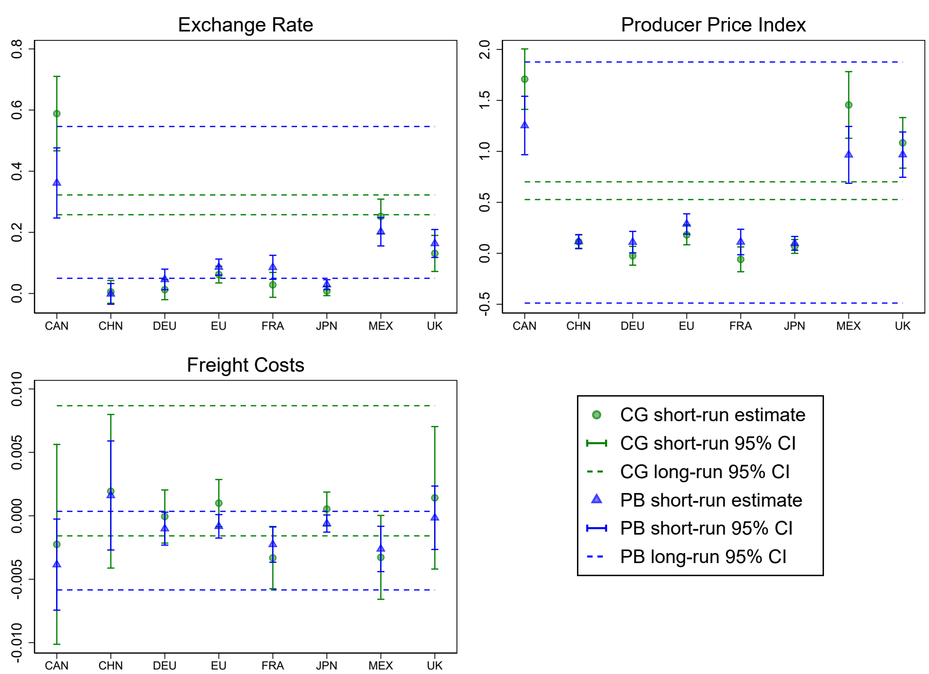
A variety of estimators can be used to estimate these coefficients in a panel data setting, each with its own limitations. These include the Panel Dynamic OLS (PDOLS) estimator by Kao and Chiang (2001), the Mean Group (MG) estimator by Pesaran and Smith (1995), the Pooled Mean Group (PMG) estimator by 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. Our empirical approach, particularly with the PB estimator, differs from that of CG in that we leverage the variation across the entire panel of countries, estimating coefficients within a single equation. In contrast, CG applies time series regressions country by country and aggregates the resulting coefficients. In the following sections, we prioritize the PB estimator with bootstrap bias correction.

3 Results

3.1 Time Series Versus Panel Methods

Figure (1) 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-through of exchange rate fluctuations is 0.30, less than half the pass-through for PPI inflation, which is 0.68 (as shown in Table (A1)). Notably, compared to the CG approach, our results suggest greater uncertainty in the long-run pass-through of these variables to import price inflation.

Figure 1: 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).

Interpreting the size of these coefficients highlights their economic significance. For instance, 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.

3.2 Cross-country Heterogeneity

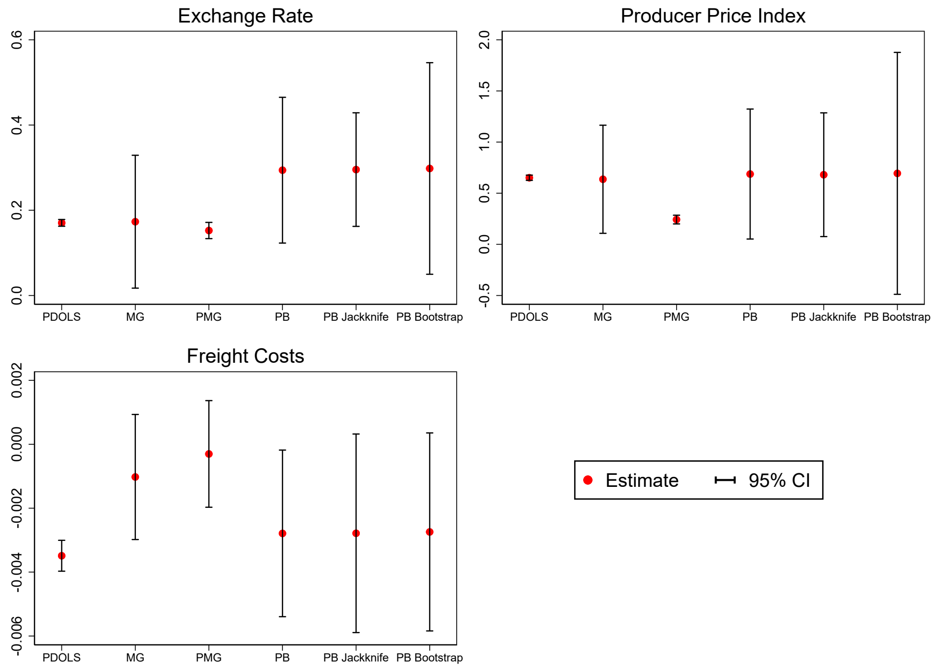
Figure (1) reveals considerable heterogeneity among the short-run dynamics, as detailed in Table (A2). For China, the EU, France, Germany, and Japan, the short-run pass-throughs of exchange rate and PPI fluctuations are minimal or statistically indistinguishable from zero. In contrast, we observe larger 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.

3.3 Robustness

Our results are broadly consistent across the various panel data estimators we employ (Figure (2)). 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 across 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

Figure 2: 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).

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.

4 Discussion

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

4.1 Freight costs and import prices

While freight costs are essential for bringing foreign goods to U.S. markets, our analysis finds no economically significant evidence that fluctuations in freight costs lead to meaningful changes in import price inflation. Despite periods of heightened volatility in freight costs, particularly during recent global supply chain disruptions, our results indicate that these costs are absorbed along the supply chain. This finding aligns with the broader literature on trade costs, which often demonstrates that distribution and logistical expenses tend to be absorbed by the markup rather than reflected in import prices. Consequently, freight costs do not appear to be a primary driver of import price dynamics in the U.S.

4.2 Production costs at the factory gate

Our results indicate that PPI inflation can influence import price inflation, but the statistical evidence for a strong relationship is mixed. While increases in production costs logically should lead to higher import prices, our findings suggest that exporters often absorb a portion of these costs rather than fully passing them on to U.S. consumers. This behavior may reflect pricing-to-market strategies, in which foreign producers adjust their prices based on demand conditions in the U.S. market rather than solely on cost fluctuations.

Furthermore, we observe heterogeneity in pass-through behavior across countries, indicating that exporters respond differently to changes in production costs. For example, some exporters may prioritize long-term market share and absorb cost increases to maintain competitive pricing, while others may adjust prices more rapidly in response to cost shocks due to operating with tight margins. This variance underscores the complexity of pass-through dynamics and suggests that production costs are not uniformly transmitted.

4.3 Exchange rate pass-through

One of the central contributions of our study is the ability to analyze exchange rate pass-through (ERPT) using country-level import price inflation data, which was unavailable in earlier research. CG's analysis relied on aggregate import price data without distinguishing between countries of origin. In contrast, our study benefits from disaggregated data, enabling a more precise assessment of how exchange rate fluctuations affect import prices for major U.S. trading partners.

Applying the same methodological framework as CG to this country-level data reveals that our ERPT estimates are smaller than those reported in their original study and vary across countries in the short run. However, when we employ advanced techniques that leverage the cross-sectional dimension of our data and address potential biases in standard panel methods, our estimates of ERPT become more uncertain. This suggests that earlier findings may have overstated the impact of exchange rate fluctuations on long-term and short-term import price inflation.

Nevertheless, we find strong evidence that exchange rate pass-through is statistically significant, although its economic impact appears modest. This reinforces CG's conclusion that external shocks from exchange rate movements are not the dominant force behind import price dynamics. A key contribution of our study is the identification of significant heterogeneity in exchange rate pass-through across different countries in the short term. For instance, economies like the United Kingdom and those sharing direct land borders with the U.S., such as Canada and Mexico, exhibit higher ERPT. This suggests that geographical proximity and the institutional frameworks of trade agreements like NAFTA/USMCA may enhance the sensitivity of import prices to exchange rate movements.

One plausible explanation for this finding is that countries such as Canada, Mexico, and the U.K. may have a higher proportion of firms engaged in producer-currency pricing, setting prices in local currency rather than dollars, making them more sensitive to dollar fluctuations. This contrasts with economies where local-currency pricing is more prevalent, resulting in lower pass-through as exchange rate fluctuations are absorbed by margins or markups.

Additionally, the composition of traded goods may play a role. Canada and Mexico's trade is heavily dominated by commodities—such as food and energy-related components—typically priced in dollars. For example, food and live animals constituted 8.2% and 7.0% of U.S. imports from Canada and Mexico, respectively, while mineral fuels accounted for 29.4% of U.S. imports from Canada. In contrast, food and live animals made up no more than 2.4% of imports from other countries in our sample, and mineral fuels no more than 5.2%. Consequently, the co-movement of the dollar and commodity prices may help explain the higher observed pass-through for these countries.

4.4 Conclusion

In short, our findings offer a nuanced perspective on the accounting drivers behind import price dynamics in the U.S. While freight and production costs do influence import prices, their pass-through is limited, either due to absorption along the supply chain or strategic pricing behavior by exporters. Although exchange rate pass-through is statistically significant, it appears less economically important than previously thought, and this holds true in both the long- and short-run.

Moreover, our study highlights the heterogeneity of pass-through across countries, suggesting that geographic proximity, trade agreements, and the nature of traded goods play crucial roles in determining the extent of price adjustments.

These findings have significant implications for policymakers, particularly regarding inflation dynamics and monetary policy. Understanding the factors that shape import price behavior is essential for assessing inflationary pressures and formulating appropriate policy responses in a globalized economy. Future research should further explore the role of firm-level pricing strategies and the composition of traded goods to enhance our understanding of these complex dynamics.

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Appendix. Supplementary Tables

Table A1: 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).

Table A2: Short-run model 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 A1. The models above are fit by OLS, separately for each country.