Asymmetric Trade Costs, Tariffs, and Trade Balance Dynamics

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IMF

December 2025

Preliminary Do Not Circulate

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Abstract

We develop a methodology to identify aggregate export and import costs and decompose them into common and asymmetric components. We validate these measures using quasi-experimental variation from trade policy events, demonstrating that the two components have fundamentally different macroeconomic consequences. Common shocks, which affect export and import costs symmetrically, influence trade openness but have a negligible impact on external balances. In contrast, asymmetric shocks—defined by movements in export costs relative to import costs—drive significant fluctuations in the trade balance, the current account, and the real exchange rate. These asymmetric costs operate through an intertemporal channel, stimulating current consumption and investment and thereby increasing the incentive for international borrowing. *JEL codes:*

F10, F13, F14, F40, F62.

Keywords: import costs, tariffs, trade costs, trade balance, current account, exchange rate

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⋆ We are greatly indebted to George Alessandria, Cian Allen, Rudolfs Bems, Giovanni Dell'Ariccia, Pierre-Olivier Gourinchas, Marcos Mac Mullen, Antonio Spilimbergo, Jaewoo Lee, Nan Li, Josef Platzer, and Robert Zymeck for comments and suggestions. All errors are our own. The views in this paper do not necessarily reflect the views of the International Monetary Fund, its Executive Board, or its management.
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1 Introduction

Understanding the determinants of trade and current account imbalances and exchange rate dynamics remains a fundamental challenge in international macroeconomics; nearly all of their potential drivers and impediments to trade remain contested (Rogoff et al. 2000; Itskhoki et al. 2025a; Ford et al. 2017). This question is increasingly important as the global economy faces a potential reversal of globalization (Fajgelbaum et al. 2020; Colantonea et al. 2022; Gopinath et al. 2025). While quantitative models suggest trade shocks are important drivers of these aggregates, empirical evidence linking trade costs to the current account remains elusive.[1]

In this paper we show empirically that trade cost fluctuations have direct and economically significant effects on trade balances and current account dynamics, even after accounting for exchange rate adjustments. Our empirical strategy is guided by a simple macroeconomic framework. We propose a novel identification method that allows us to estimate aggregate export and import costs for each country relative to the rest of the world. We then decompose these costs into common (symmetric) and asymmetric components. Theoretically, common shocks should have negligible effects on external balances because they affect all countries similarly, providing little incentive for cross-country reallocation of savings. In contrast, asymmetric shocks—which move export and import costs differentially—generate strong incentives for international borrowing and lending, provided these changes are not perceived as permanent.

Our empirical results confirm these theoretical predictions. Common trade shocks affect openness and output but have little impact on trade balances or exchange rates. Conversely, asymmetric trade shocks tend to be transitory and exert a material impact on the exchange rate, the current account, and the trade balance. We find that asymmetric shocks operate primarily by changing the intertemporal relative cost of investment and savings rather than by altering output dynamics. These results help reconcile the mixed findings in the

[1] See (Fitzgerald 2012; Alessandria et al. 2021; Mac Mullen et al. 2023; Reyes-Heroles et al. 2016) for quantitative models showing the relevance of trade barrier for exchange rate, risk sharing and current accounts. See (Boer et al. 2024; Boz et al. 2019; Estefania-Flores et al. 2025; Furceri et al. 2022) for work finding little effect of trade barriers in the aggregate variables of interest. Schmitt-Grohé et al. 2025 provide a recent exception, finding that temporary tariff shocks do impact the trade balance.

literature: failing to distinguish between common and asymmetric shocks introduces a measurement error that biases estimated relationships between trade costs and external balances toward zero.

To identify the common and asymmetric components of trade costs, we develop a novel, model-consistent method to separately estimate aggregate export and import costs. Our approach builds on the intra-temporal conditions standard in international trade models (Armington 1969; Backus et al. 1993; Eaton et al. 2002; Waugh 2010; Alessandria et al. 2021). Separately identifying these costs is typically infeasible using standard gravity-based approaches (Waugh 2010; Eaton et al. 2002). This identification challenge stems from the Lerner symmetry: because export and import costs generate isomorphic effects on trade flows and the terms of trade, they cannot be disentangled using trade data alone (Lerner 1936; Costinot et al. 2019). We resolve this by exploiting information from final expenditure prices. Since export and import costs exert distinct effects on the real effective exchange rate (REER) (Itskhoki et al. 2025b), price data provide the variation necessary for identification .[2]

We decompose the variation in recovered costs into two underlying shocks: a common component and an asymmetric component. We first show theoretically that, under mild conditions, aggregate export and import costs can be mapped into a set of functions governed by these two shocks. Crucially, we demonstrate that standard measures used in the existing literature map exclusively to our definition of common trade costs; consequently, these measures are agnostic to the asymmetric component. We leverage these theoretical results to identify both shocks empirically. This decomposition allows us to align empirical testing with modern theoretical and quantitative frameworks and overcomes a significant hurdle in the literature. While seminal work often assumes symmetric costs (Head et al. 2001) or restricts analysis to one-sided asymmetries (Eaton et al. 2002; Waugh 2010; Boz et al. 2019), our approach provides a treatment consistent with general equilibrium macro models predictions.

We validate our measures by benchmarking them against large, macro-relevant trade

[2] Our methodology relates to Eaton et al. 2016 and Fitzgerald 2024, but we extend the framework to the aggregate level to facilitate the aggregation of bilateral or sectoral trade barriers.

policy events. Our validation strategy consists of two tests. First, we examine the relationship between our estimated import costs and large variations in tariffs.[3] We find that our import cost measure tracks large tariff adjustments closely, providing evidence for the soundness of our empirical identification.

Second, we validate our asymmetric trade cost measure using data from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER).[4] We define "Large Asymmetric Trade Policy Events" (LATPE) as episodes where the number of restrictions on export payments increases significantly relative to those on imports. Our results confirm our identification strategy. Following a LATPE, our measure of relative export-to-import costs increases significantly compared to a control group of countries with stable policy regimes. Crucially, we benchmark our findings against standard approaches in the literature. We find that these alternative measures counterfactually predict a decrease in asymmetric costs following such events. This discrepancy is consistent with our theoretical result that traditional indices, by failing to account for asymmetric components might generate biased estimates of asymmetric trade cost dynamics.

Having validated our measures, we examine the dynamic responses of key macroeconomic aggregates to trade cost shocks. We find that common shocks—those affecting export and import costs symmetrically—primarily influence trade openness with negligible effects on external balances. In contrast, asymmetric shocks drive significant fluctuations in the real exchange rate, the trade balance, and the current account. These results shows that identifying the underlying shock structure into these components is a prerequisite for understanding the macroeconomic impact of trade costs. Failing to distinguish between common and asymmetric components introduces a measurement error that biases estimated trade balance elasticities toward zero.

Our results further reveal that asymmetric trade cost shocks are typically transitory and exhibit hump-shaped dynamics. This finding highlights a mechanism underemphasized in the literature: beyond affecting trade flows, asymmetric costs alter the relative price

[3] Although import costs capture a broad set of distortions—including non-tariff barriers, institutional frictions, and macroeconomic shocks—they should respond to significant tariff changes.

[4] The AREAER dataset allows us to isolate payment restrictions that specifically target either exports or imports.

of international borrowing and lending. Specifically, a temporary increase in export costs relative to import costs raises the effective cost of cross-country saving while lowering the price of import-intensive investment goods. Consequently, the trade balance deteriorates, domestic expenditure rises, and the exchange rate depreciates. Notably, output remains unresponsive to these shocks. This dynamic behavior parallels the effects of unilateral tariffs discussed by Costinot et al. 2025, though our shocks are transitory rather than permanent.

Literature. Our paper contributes to three strands of the international macroeconomics literature. First, we contribute to the growing body of work investigating the drivers of global imbalances and the current account and its relationship with trade frictions (Rogoff et al. 2000; Reyes-Heroles et al. 2016; Alessandria et al. 2021; Fitzgerald 2012; Estefania-Flores et al. 2024; Furceri et al. 2022). While recent quantitative studies highlight the potential for trade frictions to explain trade imbalances response to other shocks, or how they interact with initial net foreign asset positions (Reyes-Heroles et al. 2016; Alessandria et al. 2025; Fitzgerald 2012) we focus on different type of trade barriers' direct impact on these variables. In this set up, the empirical literature has long struggled to find a robust relationship between trade costs and external balances (Boz et al. 2019; Boer et al. 2024; Estefania-Flores et al. 2024; Furceri et al. 2022). We reconcile this tension by demonstrating that the aggregate relationship depends crucially on the composition of trade shocks. By decomposing costs into common and asymmetric components, we show that only the latter drives the intertemporal reallocation that defines current account dynamics. This finding suggests that previous empirical failures likely stem from a measurement error problem, where symmetric shocks—which primarily affect trade volumes rather than balances—mask the effects of asymmetric policy changes that tend to be on average also permanent.

Second, we advance the literature on the identification of trade shocks in general equilibrium models. Building on the structural gravity tradition (Eaton et al. 2002; Waugh 2010; Yotov 2022; Fally 2015; Head et al. 2001), we provide a model-consistent method to separately identify aggregate export and import costs. Unlike standard bilateral approaches that often assume symmetry (Head et al. 2001) or restrict analysis to one-sided barriers (Eaton et al. 2002; Waugh 2010), our framework leverages information from final expenditure prices to overcome the identification challenges that follow from the existence of the

Lerner symmetry. This allows us to provide evidence for the relevance of the asymmetric trade costs mechanism discussed in recent quantitative work on globalization reversal and geopolitical fragmentation (Alessandria et al. 2021; Mac Mullen et al. 2023; Costinot et al. 2025). Our results using the local projection difference-in-differences estimator (Dube et al. 2023) validate these measures against large trade policy events, offering a bridge between structural trade models and reduced-form empirical macroeconomics.

Finally, our findings contribute to the debate on the exchange rate drivers and the transmission of trade policy (Itskhoki et al. 2021; Costinot et al. 2025; Jeanne et al. 2024). We document that asymmetric trade costs are largely transitory and exhibit hump-shaped dynamics, directly influencing the relative cost of cross-country saving and investment. While the seminal work of (Fitzgerald 2012; Reyes-Heroles et al. 2016) emphasizes the importance of trade costs in explaining real trade balances response to other, we show that the *asymmetry* of these costs have direct impacts on key macroeconomic variables and are an important driver of the co-movement between the exchange rate and the current account Alessandria et al. 2021. This provides an empirical counterpart to the theoretical and quantitative predictions highlight the direct role of asymmetric trade cost shocks (Alessandria et al. 2021; Mac Mullen et al. 2023).

Layout. The remainder of the paper is organized as follows. Section 2 discusses the theoretical framework and the construction of our trade cost measures. Section 3 details how we take our measures to the data and outlines the data sources. Section 4 looks at the evolution of the measures over time, and their relationship with different policy events. Section 5 performs validation tests of our measures against trade policy. Section 6 describes our empirical strategy to estimate the measures' impact on different macro variables, discussing our instrumental variable approach in detail and documents our facts. Section 7 the relationship between tariffs and the symmetric and asymmetric trade costs measures. Section **??** concludes.

2 Export and import costs measure

In this section, we establish the theoretical framework used to separately quantify export and import distortions. We first derive the intra-temporal conditions that map observed trade flows and expenditure prices to aggregate trade costs. We then explore the identification assumptions required to decompose these costs into their underlying common and asymmetric components.

2.1 Framework

The world economy consists of a domestic country, d, and a foreign country, f (which we treat as the rest of the world). Each country is populated by a representative consumer with CES preferences over varieties produced in both regions. We denote the elasticity of substitution between domestic and foreign goods by θ. Following the literature, we focus on the intra-temporal trade conditions; our results remain invariant to the specific determinants of the supply side (Anderson 1979; Eaton et al. 2002).

International Trade Distortions. We consider three categories of distortions that drive a wedge between domestic and foreign prices. First, we denote $\tau_t^{d,f}$ as a time-varying iceberg cost: the exporter in country d must ship $\tau_t^{d,f}$ units for one unit to arrive in f (Samuelson 1954). Second, we define $\zeta_t^{d,f}$ as a time-varying trade wedge that captures the friction between the price at customs in country f and the final retail price, $p_t^{R,d,f}$. Finally, we account for a time-invariant home bias parameter, ω, which represents agents' preferences and acts as a constant demand shifter.

Demand. Let C_t^j denote total expenditure in country j and P_t^j the associated price index. Demand in country j for goods produced in country i, denoted by $q_t^{i,j}$, follows from standard CES preferences:

$$q_t^{i,j} = (1-\omega)\left(\frac{p_t^{R,i,j}}{P_t^j}\right)^{-\theta} C_t^j \tag{1}$$

where $p_t^{R,i,j}$ is the retail price and ω is the home-bias parameter. By definition of the trade wedge $\zeta_t^{i,j}$, the retail price is given by, $p_t^{R,i,j} = \zeta_t^{i,j} p_t^{i,j}$. Substituting this into (1) yields:

$$q_t^{i,j} = (1-\omega)\left(\frac{\zeta_t^{i,j} p_t^{i,j}}{P_t^j}\right)^{-\theta} C_t^j \tag{2}$$

Under the assumption that firms equalize marginal revenue across markets and normalizing domestic trade costs to unity, the relationship between the export price and the domestic producer price is governed by the iceberg cost $\tau_t^{i,j}$:

$$\frac{p_t^{i,j}}{p_t^{i,i}} = \tau_t^{i,j}$$

Trade Balance and Trade Costs. We now characterize the relationship between trade distortions, relative prices, and trade flows. This relationship is formalized in Lemma 1.

Lemma 1. *If asymmetric distortions fluctuate—defined as a change in export costs relative to import costs—at least one of the following must adjust: the export-to-import ratio, the real exchange rate, the terms of trade, or relative aggregate expenditures.*

Proof. See Appendix A.1. □

The intuition for Lemma 1 follows from the log-linear relatsionship between the trade ratio ($\frac{exp}{imp}$) and it relationship with the export-import cost ratio. By substituting equation (2) and the definitions of iceberg costs and trade wedges, we obtain:

$$\ln\left(\frac{exp_t^i}{imp_t^i}\right) = -\theta \ln\left(\frac{\zeta_t^{i,j}\tau_t^{i,j}}{\zeta_t^{j,i}\tau_t^{j,i}}\right) - \theta \ln\left(\frac{p_t^{i,i}}{p_t^{j,j}}\right) - \theta \ln\left(\frac{P_t^j}{P_t^i}\right) + \ln\left(\frac{C_t^j}{C_t^i}\right) \tag{3}$$

Equation (3) demonstrates that, conditional on the terms of trade, the real exchange rate, and relative expenditure, asymmetric trade wedges are the fundamental determinants of the trade ratio. While iceberg costs influence the terms of trade—provided prices are measured at the border—the relative wedges encompass a broader set of distortions.

Importantly, note inverting a version of equation (3) using the terms of trade data will allow us to recover the relative trade wedges frictions from observables, but it would it fail to capture the iceberg costs distortion. In the following section, we propose an identification strategy that exploits additional price data to characterize the complete set of potential trade frictions.

2.2 Measuring Trade Costs

Lemma 1 underscores the necessity of decomposing trade frictions into asymmetric and common components to characterize their distinct effects on external balances and real exchange rate dynamics. To achieve this identification, we first derive a sufficient statistic to recover aggregate export and import costs from observable data. We define the export cost from country d to f as:

$$\mathcal{X}_{dt} = \left(\frac{1-\omega}{\omega}\right)\zeta_t^{d,f}\tau_t^{d,f} \tag{4}$$

and the corresponding import cost to country d from f as:

$$\mathcal{M}_{dt} = \left(\frac{\omega}{1-\omega}\right)\zeta_t^{f,d}\tau_t^{f,d} \tag{5}$$

These statistics aggregate the time-varying iceberg costs (τ) and retail-level wedges (ζ) with the structural home-bias parameter (ω). By mapping these wedges to final expenditure shares and price indices, we can identify the total distortionary burden without imposing restrictive assumptions on the underlying production environment.

To estimate these measures, we utilize the intra-temporal expenditure share conditions. Let $\lambda_t^{i,j}$ denote the share of country j's total expenditure on goods produced in country i:

$$\lambda_t^{i,j} = \frac{p_t^{R,i,j}q_t^{i,j}}{P_t^j C_t^j} = (1-\omega)\left(\frac{\zeta_t^{i,j}p_t^{i,j}}{P_t^j}\right)^{1-\theta} \tag{6}$$

Proposition 1. *Under CES preferences with price elasticity $\theta > 1$, the aggregate export and import costs for country d relative to the rest of the world f are given by:*

$$\mathcal{X}_{dt} = \left(\frac{\lambda_t^{d,f}}{\lambda_t^{d,d}}\right)^{\frac{1}{1-\theta}}\left(\frac{P_t^f}{P_t^d}\right) \tag{7}$$

$$\mathcal{M}_{dt} = \left(\frac{\lambda_t^{f,d}}{\lambda_t^{f,f}}\right)^{\frac{1}{1-\theta}} \left(\frac{P_t^d}{P_t^f}\right) \tag{8}$$

where P_t^j denotes the final consumption price index in country j.

Proof. See Appendix A.1. □

The primary innovation of our approach, relative to the existing literature (Head et al. 2001; Eaton et al. 2002; Waugh 2010; Boz et al. 2019), is the explicit use of relative final expenditure prices to break the identification hurdle posed by Lerner symmetry (Lerner 1936). Standard models focusing exclusively on trade allocations cannot separately identify export and import costs because these frictions yield isomorphic effects on trade volumes. However, even in environments where Lerner symmetry holds, the relative price of total expenditure remains sensitive to the directionality of trade distortions. We leverage this property, as noted in recent work by Itskhoki et al. 2025b, to achieve separate identification of export and import costs. We illustrate the intuition behind this identification in the following example.

Identification Example. To illustrate the identification mechanism and the necessity of relative prices, consider an episode where country d imposes unilateral tariffs, which are fully pass-through to border prices. This policy change triggers two distinct effects. First, a direct effect: the tariff increases the price of foreign goods, $p^{R,f,d}$, reducing the import share $\lambda^{f,d}$. Second, a general equilibrium effect: the price index of total expenditure in country d rises relative to the rest of the world ($\frac{P^d}{P^f}$ increases). This GE shift simultaneously affects the import share $\lambda^{f,d}$ and the export share $\lambda^{d,f}$. Consequently, an estimator based solely on trade shares would erroneously attribute these GE price movements to changes in export costs, even if the underlying shock was purely import-driven.

Our proposed statistics in Proposition 1 successfully isolate these direct cost changes from the confounding general equilibrium forces. The second term in equations (23) and (24)—the relative price of consumption baskets—serves to cancel out the endogenous price response. Specifically, the term $(\lambda_t^{j,i}/\lambda_t^{j,j})^{\frac{1}{1-\theta}}$ is proportional to (P_t^j/P_t^i); they co-move one-for-one under standard assumptions. By incorporating relative prices, our measure ensures that country d's tariffs do not pollute the estimated export costs, despite the tariff's significant impact on the domestic price level P^d.

Interpretation and Limitations. The previous example also clarifies the scope of our identification. Our trade cost measures are "sufficient statistics" in the sense that they capture the wedge required to rationalize the observed divergence between international and domestic flows under the assumption of equal preferences across countries. Consequently, our estimates do not isolate trade policy alone; rather, they encompass any potential model-miss specification and any friction that induces a differential adjustment of cross-border trade relative to domestic expenditure.[5] While this prevents us from decomposing the wedge into specific sub-components, it ensures that our measure provides a complete accounting of the total distortionary burden affecting the trade balance.

This broad interpretation implies that $\mathcal{X}_t$ and $\mathcal{M}_t$ may reflect a variety of mechanisms discussed in the literature, such as the gradual accumulation of customer capital, new exporters' efficiency gains, sunk costs of market entry or financial frictions (Fitzgerald et al. 2024; Ruhl et al. 2017; Alessandria et al. 2021; Merga 2024; Merga 2023; Kohn et al. 2016) that disproportionately affect international trade credit relative to domestic flows.

Average Trade Costs and the HR index. Our measures provide a natural generalization of standard trade cost metrics, such as the Head-Ries (HR) index (Head et al. 2001). By taking the geometric average of our export and import cost statistics, we recover the symmetric HR index, which expresses average trade costs in tariff-equivalent terms:

$$\mathcal{T}_t^{HR} = (\mathcal{M}_{dt}\mathcal{X}_{dt})^{\frac{1}{2}} = \left(\frac{\lambda_t^{f,d}\lambda_t^{d,f}}{\lambda_t^{f,f}\lambda_t^{d,d}}\right)^{\frac{1}{2(1-\theta)}} \tag{9}$$

While the HR index is structurally consistent with our framework under the restriction of symmetry, it is inherently limited by its construction: it lacks the dimensionality required to separate directional shocks to export and import costs. By collapsing these costs into a geometric mean, any fluctuation in the index is interpreted as a shift in average costs, effectively conflating two distinct economic forces. Indeed, in what follows we show that

[5] For example, to the extent that trade flows exhibit a different elasticity to real exchange rate movements than to explicit cost changes, our measures will reflect these dynamic rigidities as implicit trade costs.

the HR index captures only the "common" component of trade frictions, making it an insufficient statistic for analyzing the macroeconomic consequences of asymmetric trade shocks—the primary focus of this study.

2.3 Decomposition: Common and Asymmetric Components

Having established separate estimators for aggregate export and import costs, we now decompose these measures into latent common and asymmetric components. We define the common component, $\tau_{d,t}^{C}$, as the source of symmetric fluctuations in trade costs, and the asymmetric component, $\tau_{d,t}^{A}$, as the source of directional divergence. To formalize this decomposition, let $\varepsilon_{z,\tau^j} \equiv \frac{\partial \ln z_{d,t}}{\partial \ln \tau_{d,t}^{j}}$ denote the elasticity of trade cost measure $z \in \{\mathcal{X}, \mathcal{M}\}$ with respect to latent shock τ^j for $j \in \{A, C\}$.

Definition 1 (Common Trade Costs). A shock $\tau_{d,t}^{C} \in \mathbb{R}_+$ is defined as common if it satisfies:

$$\varepsilon_{\mathcal{X}_{d,t},\tau_{d,t}^{C}} = \varepsilon_{\mathcal{M}_{d,t},\tau_{d,t}^{C}} = \varepsilon^{C} \quad \forall \{d, t\}$$

where $\varepsilon^{C} \in \mathbb{R}_+$ is a constant scaling parameter.

Definition 2 (Asymmetric Trade Costs). A shock $\tau_{d,t}^{A} \in \mathbb{R}_+$ is defined as asymmetric if it satisfies:

$$\varepsilon_{\mathcal{X}_{d,t},\tau_{d,t}^{A}} - \varepsilon_{\mathcal{M}_{d,t},\tau_{d,t}^{A}} = \varepsilon^{A} \quad \forall \{d, t\}$$

where $\varepsilon^{A} \in \mathbb{R}_+$ represents the differential impact of the shock on export versus import costs.

Proposition 2 establishes that observable export and import costs can be uniquely represented as functions of these two latent components.

Proposition 2. *Let $\mathcal{X}_{d,t}$ and $\mathcal{M}_{d,t}$ be positive observable trade cost measures. There exist latent components $\tau_{d,t}^{C}, \tau_{d,t}^{A} \in \mathbb{R}_+$ and mapping functions $f, g : \mathbb{R}_+^2 \to \mathbb{R}_+$ such that:*

$$\mathcal{X}_{d,t} = f(\tau_{d,t}^{C}, \tau_{d,t}^{A}) \quad \textit{and} \quad \mathcal{M}_{d,t} = g(\tau_{d,t}^{C}, \tau_{d,t}^{A})$$

subject to the elasticity constraints in Definitions 1 and 2, if and only if:

(i) ***Smoothness:*** $f, g \in \mathcal{C}^2(\mathbb{R}^2_+)$ *are twice continuously differentiable.*

(ii) ***Non-collinearity:*** $\mathcal{X}_{d,t}$ *and* $\mathcal{M}_{d,t}$ *are not perfectly collinear across the sample.*

Proof. See Appendix A.1. □

Corollary 2.1. The mapping between latent components and observable trade costs is identified up to a scaling constant. S

Proof. See Appendix A.1. □

Implications for Identification. The existence of multiple mappings has two primary implications for our empirical strategy. First, common and asymmetric trade costs are identified up to a scale. Given that our analysis focuses on the within-country time variation of these components, this lack of absolute scale identification does not pose a challenge to our estimates.

Second, the corollary underscores a limitation in the conventional trade toolkit for our purpose. The HR index identifies only the common component of trade frictions. Specifically, the HR index—the geometric mean of export and import costs—represents a particular case of common trade costs, recovered when the elasticities are constrained to $\varepsilon_{\mathcal{X},\tau^C} = \varepsilon_{\mathcal{M},\tau^C} = 1$. By construction, it is orthogonal to the asymmetric component, effectively filtering out the very distortions that Lemma 1 identifies as potentially important drivers of external imbalances and real exchange rate fluctuations. Consequently, relying on symmetric measures like the HR index yields a blind spot regarding the directional shocks that are central to the analysis of trade balance dynamics.

3 Data and Empirical Measurement

This section describes the construction of our export and import cost statistics and details the data sources utilized in our empirical analysis. Our primary measurement challenge lies in the general unavailability of cross-sectional price levels ($P_t^{j,C}$) that are consistent across countries and over time.

3.1 Construction of Trade Cost Indices

To circumvent the data limitations regarding price levels, we focus on the temporal evolution of trade costs within countries. We construct a time-series index for country d relative to the rest of the world f, normalizing all measures to a base year b, which in practice we set to the initial year in our sample (1996) with full coverage of countries. Our empirical counterparts for aggregate export and import costs are defined as follows:

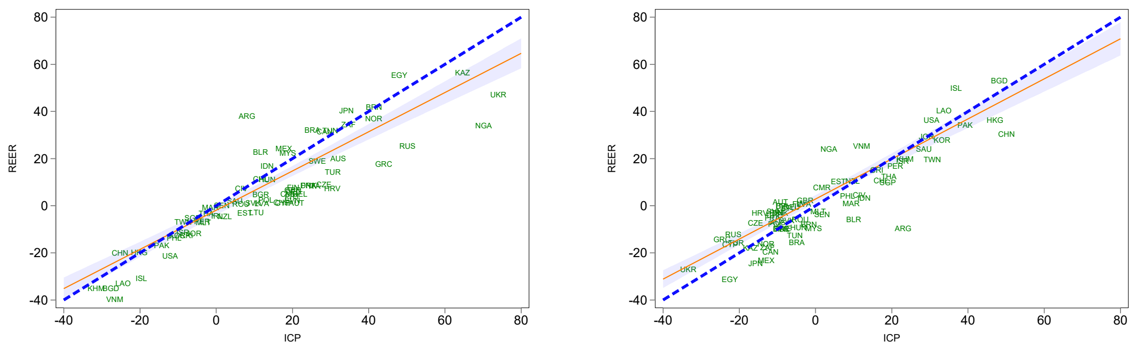
$$\mathcal{X}_t^d = \left[\frac{\left(\frac{\lambda_t^{d,f}}{\lambda_t^{d,d}}\right)^{\frac{1}{1-\theta}} \left(\frac{P_t^f}{P_t^d}\right)}{\left(\frac{\lambda_b^{d,f}}{\lambda_b^{d,d}}\right)^{\frac{1}{1-\theta}} \left(\frac{P_b^f}{P_b^d}\right)} \right] \times 100 \tag{10}$$

$$\mathcal{M}_t^d = \left[\frac{\left(\frac{\lambda_t^{f,d}}{\lambda_t^{f,f}}\right)^{\frac{1}{1-\theta}} \left(\frac{P_t^d}{P_t^f}\right)}{\left(\frac{\lambda_b^{f,d}}{\lambda_b^{f,f}}\right)^{\frac{1}{1-\theta}} \left(\frac{P_b^d}{P_b^f}\right)} \right] \times 100 \tag{11}$$

The terms in (10) and (11) are observable. We utilize REER data to proxy for relative price movements between country d and its trading partners.

We acknowledge that it may diverge from pure consumption price ratios. Hence, to validate our approach, we compare our REER-based measures against estimates derived from the International Comparison Program (ICP) database provided by the World Bank. The ICP offers the most rigorous cross-country price comparability available, making it an ideal benchmark (Waugh 2010). However, its low frequency and scattered availability preclude its use in our primary time-series analysis. As shown in Figure A.3, the export and import cost indices constructed from both REER and ICP data exhibit strong co-movement, suggesting that the REER is a robust proxy for capturing the time-varying components of trade distortions.

Figure 1: Trade cost differences: REER vs ICP



(a) Export costs (b) Import costs

Note: This figure illustrates the change in estimated export and import costs between 2011 and 2017 using two alternative price proxies. The vertical axis depicts trade costs derived from the REER, while the horizontal axis utilizes prices from the ICP database.

Common and Asymmetric trade costs computation. Proposition 2 established that several empirical specifications can identify the common and asymmetric components of trade costs. We prioritize a decomposition that ensures structural interpretability by focusing on a parameterization where $\varepsilon^C = 1$ and $\varepsilon^A = 1$, which allows for a direct mapping between the estimated cost components and the log-linearized trade equations.

To operationalize this, we extract the common component by estimating a country-specific common factor between the normalized log-export and log-import costs. This factor analysis isolates the shared variance in trade frictions that impacts both directions of trade equally. Conversely, we identify the asymmetric component by calculating the log ratio of these aggregate costs, normalized to a 1996 baseline:

$$\tau^A_{d,t} = \left[\ln\left(\frac{\mathcal{X}_{d,t}}{\mathcal{M}_{d,t}} \right) - \ln\left(\frac{\mathcal{X}_{d,1996}}{\mathcal{M}_{d,1996}} \right) \right] \times 100 \tag{12}$$

Using the normalized measures ensures that both common and asymmetric trade represents the percentage-point relative to the start of the sample.

3.2 Data and Variable Construction

Expenditure Shares. We utilize the OECD Inter-Country Input-Output (ICIO) Tables (1995–2020) to construct the directional expenditure shares.

Following Waugh 2010, we define total nominal expenditure for country d as gross production adjusted for the trade balance. Let Y_t^d, EX_t^d, and IM_t^d denote nominal gross production, total exports, and total imports, respectively. The share of expenditure in country d on goods from the rest of the world (f) is:

$$\lambda_t^{d,f} = \frac{IM_t^d}{Y_t^d - EX_t^d + IM_t^d} \tag{13}$$

The corresponding domestic expenditure share is given by:

$$\lambda_t^{d,d} = \frac{Y_t^d - EX_t^d}{Y_t^d - EX_t^d + IM_t^d} \tag{14}$$

Price Indices and Macroeconomic Aggregates. To proxy relative price movements, we use the REER measures from Darvas 2021, which extend the methodology of Bayoumi et al. 2006.[6] For the rest of aggregate variables we use data from the IMF World Economic Outlook (WEO) database. This provides consistent measures for GDP, consumption, the trade balance, and the terms of trade. Our final balanced panel includes 72 countries, with the sample size primarily determined by the intersection of ICIO and WEO coverage.

Trade Policy and Tariffs. To identify policy-driven shocks, we rely on two primary sources. We use the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER) to construct an index of asymmetric trade restrictions. This approach allows us to capture non-tariff barriers and regulatory shifts that tariff data typically omit. We provide a detailed discussion of the index construction in Section 5. To proxy for aggregate tariffs across countries, we obtain data on import-related tax revenues from the OECD

[6] Bayoumi et al. 2006 construct trade shares that explicitly account for the degree of product differentiation; for differentiated goods, their framework incorporates both direct and indirect competition to ensure the weights reflect the full spectrum of multilateral trade linkages. This procedure alleviates potential discrepancies between theoretical ideals and empirical price measurements.

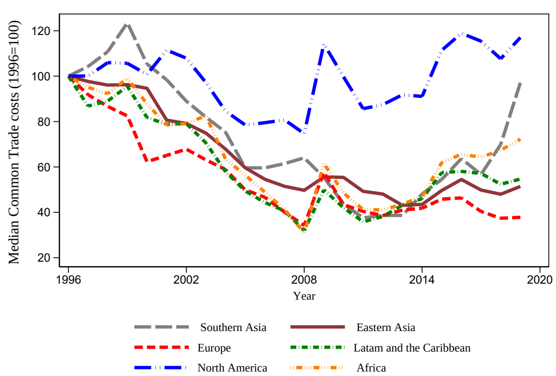
Global Revenue Statistics Database. We calculate the *effective tariff rate* as the ratio of total import tax revenue to total imports, providing an aggregate measure of the direct costs associated with trade policy.

4 The Evolution of Trade Costs

Before proceeding to our formal test for the validation of our measures, we present the temporal evolution of the common and asymmetric components of trade costs. This provides a baseline for understanding the global trade environment and validates our measures against well-documented historical events.

The Global Dynamics of Common Trade Costs. Figure 2 displays the regional averages of the common component of trade costs. Two distinct patterns emerge. First, the period between 1996 and 2008 was marked by a decline in common trade costs globally. For regions such as North America, Latin America, and Africa, this downward trend accelerated significantly following China's accession to the WTO in 2001.

Figure 2: Evolution of Common Trade Costs by Region

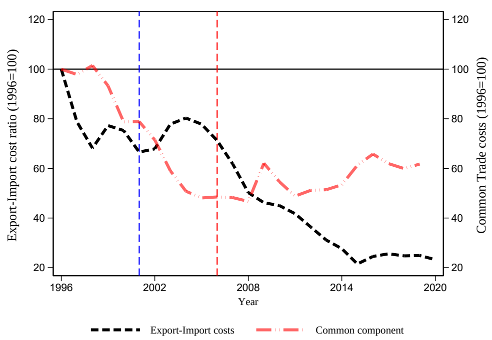


Note: The figure shows the median common trade cost measure for different regions. The elasticity is assumed to be equal to 4 for computation.

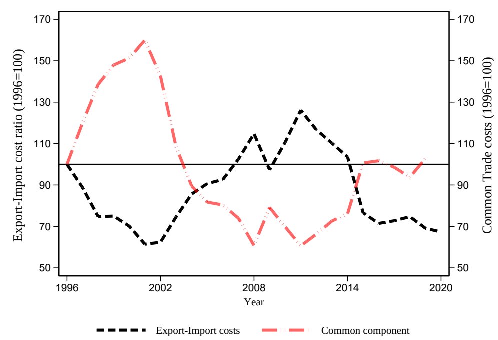
Second, the secular decline in trade costs stalled abruptly following the Global Financial Crisis (GFC). This spike and subsequent "stall" is consistent with the literature on the "Great Trade Collapse" (Bems et al. 2013). Indeed, since 2015, we observe a reversal in the trend, with common trade costs increasing across most regions. This uptick likely reflects the rising tide of protectionism and the restructuring of global value chains that characterized the late 2010s and seems to be acelerated since then (Fajgelbaum et al. 2020; Gopinath et al. 2025).

Asymmetric Trade Costs and Policy Divergence. Figure A.4 contrasts the evolution of the common trade cost component with the export-to-import cost ratio for China and the United States. In the Chinese case, common trade costs (dashed-dotted line) exhibit a sharp decline around the 2001 WTO accession, followed by a spike during the 2009 Global Financial Crisis. However, the export-to-import cost ratio—our measure of asymmetry—reveals a distinct narrative. Following a period of relative stability, the ratio experienced a marked decrease beginning in 2006 (vertical dashed line). This shift aligns with the strategic pivot toward domestic import substitution and the rapid real exchange rate appreciation documented by Alessandria et al. 2017.

Figure 3: Asymmetric Trade Costs



China



USA

Note: The figure shows the asymmetric trade measure (dashed line) and the common trade cost (dot-dash line, shown on the right-hand side) for China and the United States.. The elasticity is assumed to be equal to 4 for computation.

The US experience provides a striking counterpoint. Between 2001 and 2010, while common trade costs were declining, the asymmetric trade cost trended upward, indicating that export frictions were rising relative to import costs. Crucially, this trend reversed in 2010, exactly coinciding with the implementation of the National Export Initiative (NEI), which aimed to double US exports by 2014 through the removal of trade barriers and increased export financing.[7] These episodes highlight the necessity of our decomposition: while the common component tends to track global shocks, the asymmetric ratio captures the idiosyncratic policy orientations and structural shifts that define can affect country's external position.

5 Trade Policy and Trade Cost Validation

We now examine the empirical mapping between our estimated trade cost components and observed macroeconomic trade policies. While the literature often highlights that cross-sectional trade costs are driven by geography and institutional quality rather than explicit policy (Jacks et al. 2008; Waugh 2010), our identification strategy relies exclusively on *within-country* temporal variation.

This validation serves two primary purposes. First, by exploiting narrative trade policy shifts, we provide a "sanity check" for our structural identification. Second, determining the degree to which specific policy instruments manifest as common or asymmetric shocks allows us to characterize the effective reach of trade interventions. We begin by analyzing the relationship between significant tariff adjustments and import costs, before turning to broader trade policy events that influence asymmetric trade costs.

5.1 Validation 1: Tariffs and Import Costs

We first evaluate the sensitivity of our import cost measure to changes in effective tariffs. Figure 4 plots the relationship between five-year changes in effective tariffs and our estimated import costs across the full sample.

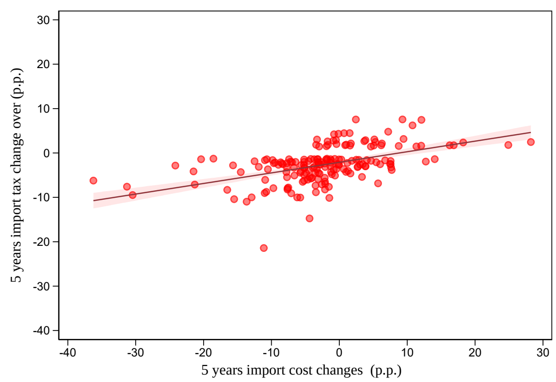
Two salient patterns emerge from this validation exercise. First, we find a robust and statistically significant positive correlation between tariff movements and our recovered import cost statistic, confirming that the measure captures the intended policy signal. Second, the estimated elasticity appears to be greater than unity: the observed changes in our ag-

[7] See the executive order here.

gregate trade cost measure are systematically larger than the corresponding changes in effective tariffs.

This response suggests a strong co-movement between explicit tariffs and non-tariff barriers (NTBs). Under this interpretation, reductions in tariffs do not occur in isolation but are typically accompanied by the endogenous relaxation of NTBs or other discretionary policies affecting international trade that are positively correlated with tariff movements. Consequently, the effective impact of trade policy on the economy, as captured by our statistic, is more potent than what would be suggested by examining tariff schedules alone.

Figure 4: Import costs vs tariffs changes during large tariff changes

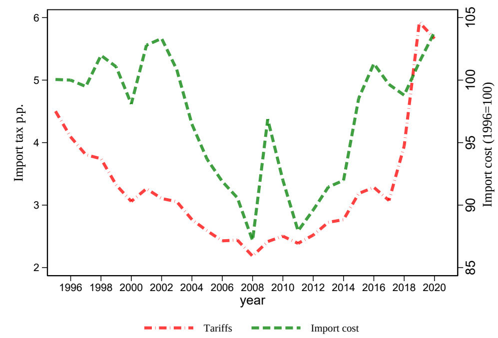


Note: The figure shows the five year cumulative percentage point change for each country in import tariffs (Y-axis) vs the changes in import costs for the same window. Confidence intervals are constructed at the 90% level.

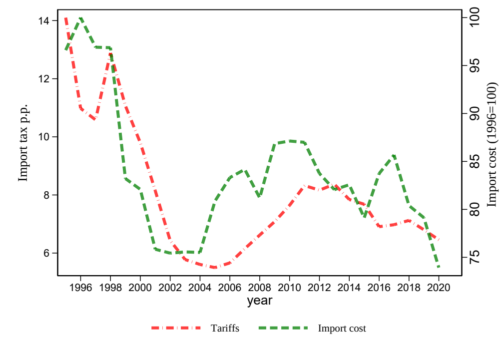
Our import cost measure also captures the specific event-window and year-on-year dynamics with high precision during periods of substantial tariff adjustments. Figure 5 illustrates this alignment for a selection of significant trade liberalization and protectionist episodes. The rest of these large-scale tariff events are detailed in Figure A.3 of the Appendix.

Across these diverse institutional contexts, the import cost statistic tracks the evolution of effective tariffs with surprising fidelity. This dynamic alignment suggests that our statistic is a sensible measure capable of internalizing idiosyncratic policy shifts and their impact on the relative price of foreign goods. The fact that the wedge co-moves so closely with yearly tariffs data reinforces our confidence in using it to recover latent common and asymmetric costs.

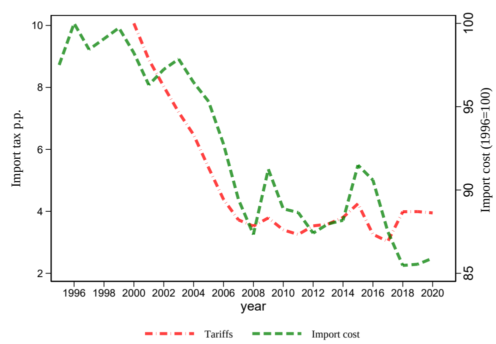
Figure 5: Effective tariffs vs import costs



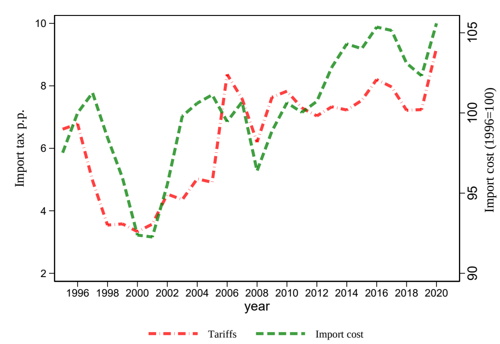
USA



Brazil



Tunisia



New Zealand

Note: The figure shows the evolution of effective tariffs (red dot-dashed) versus the evolution of import costs (green-dashed) for a subset of those countries that went over a cumulative effective tariffs increase of at least two p.p. in five years. Effective tariffs are defined as government revenues from imports over total merchandise imports. Import costs are defined by equation 24.

5.2 Validation 2: Large Asymmetric Trade Policy Events (LATPE) and Asymmetric Trade costs

Having established that our import cost measure closely tracks explicit tariff adjustments, we now evaluate the sensitivity of our asymmetric trade cost component to non-tariff policy shifts. We identify these episodes as Large Asymmetric Trade Policy Events (LATPE). Our objective is to utilize these narrative-driven episodes as a natural test for the structural soundness of our asymmetric cost measures.

To identify these events, we draw on the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database (1999–2022). The AREAER provides a granular, qualitative census of regulatory frameworks, including exchange rate restrictions, capital controls, and specific procedures for international payments and receipts. We utilize the binary indicators documented in these reports to isolate periods of significant regulatory tightening or liberalization that are a priori expected to exert a differential impact on export versus import costs. By mapping our estimated asymmetric trade costs to these events, we can test if our methodology successfully recovers the directional distortions inherent in these policy changes.

Quantifying Asymmetric Policy Shocks. To map the AREAER narrative to our structural wedges, we focus on the regulatory categories specifically governing *Exports and Export Proceeds* (Section VIII) and *Imports and Import Payments* (Section VII). For exports, we aggregate five binary variables capturing distortions due to the existence of: (1) repatriation requirements; (2) financing requirements; (3) documentation requirements; (4) export licenses; and (5) export taxes. For imports, we aggregate six categories: (1) foreign exchange budgeting; (2) financing requirements; (3) documentation requirements; (4) import licenses and other non-tariff measures; (5) import taxes and/or tariffs; and (6) state import monopolies.[8]

For each country-year pair, these categories define the total number of policies distorting exports ($N_{i,t}^{exp}$) and imports ($N_{i,t}^{imp}$). To measure the directional orientation of a country's trade policy changes, we construct the *Policy Asymmetry Index*:

$$\text{Policy Asymmetry}_{i,t} = \frac{1 + N_{i,t}^{exp}}{1 + N_{i,t}^{imp}} \tag{15}$$

A Large Asymmetric Trade Policy Event (LATPE) is identified as an episode where the increase in our index, $\Delta\text{Policy Asymmetry}_{i,t}$, exceeds the 25th percentile of the distribution

[8]This aggregation follows the taxonomic approach of Estefania-Flores et al. 2024 but is restricted specifically to trade-distorting measures.

of all positive index changes. We formalize these episodes via a treatment dummy, $I_{i,t}^{LATPE}$, which equals one at the inception of a large asymmetric shock (T) and remains active for $h > 0$ as long as the policy shift is not reversed—specifically, as long as $\Delta\text{Policy Asymmetry}_{i,T+h} \geq 0$ for all $h > 0$.

This empirical design facilitates a clean identification of the propagation of directional policy shocks by maintaining a clean control group. This latter group consists of "stable-regime" countries that exhibit no changes in the Policy Asymmetry Index throughout the entire sample period ($\Delta\text{Policy Asymmetry}_{i,t} = 0$ for all t).

Estimation. Having defined the policy shocks, we quantify their dynamic impact using the Local Projections Difference-in-Differences (LP-DiD) framework proposed by Dube et al. (2023). This methodology is particularly suited to our setting as it accommodates the staggered timing of policy events and avoids the potential biases—such as negative weighting of earlier treated units—that often plague standard event-study specifications in panels with heterogeneous treatment timing.

We estimate the following specification for each horizon $h \in \{-5, \ldots, 5\}$:

$$Y_{i,t+h} - Y_{i,t-1} = \beta^h \Delta I_{i,t}^{LATPE} + \sum_{k=1}^{4} \Phi_{h,k} \mathbf{X}_{i,t-k} + \gamma_t + \epsilon_{i,t+h} \tag{16}$$

where $\Delta I_{i,t}^{LATPE}$ is the treatment indicator for a large asymmetric trade policy event at time t. The vector of controls, $\mathbf{X}_{i,t-k}$, includes four lags of the dependent variable, the log of domestic-to-foreign expenditure shares, the REER, and the terms of trade. We include year fixed effects, γ_t, to account for global shocks and common trends. The coefficients $\{\beta^h\}$ map out the impulse response function (IRF) of the outcome variable relative to the pre-treatment period ($t-1$).

We focus our empirical analysis on four primary variables of interest. First, we examine the response of the log trade ratio ($\ln(EX_{i,t}/IM_{i,t})$), which serves as the direct macroeconomic observable to verify whether LATPEs indeed induce asymmetric shifts in trade flows.

Second, we perform a comparative analysis of three distinct measures of asymmetric trade costs to evaluate their sensitivity to documented policy events. This ”horse race” includes:

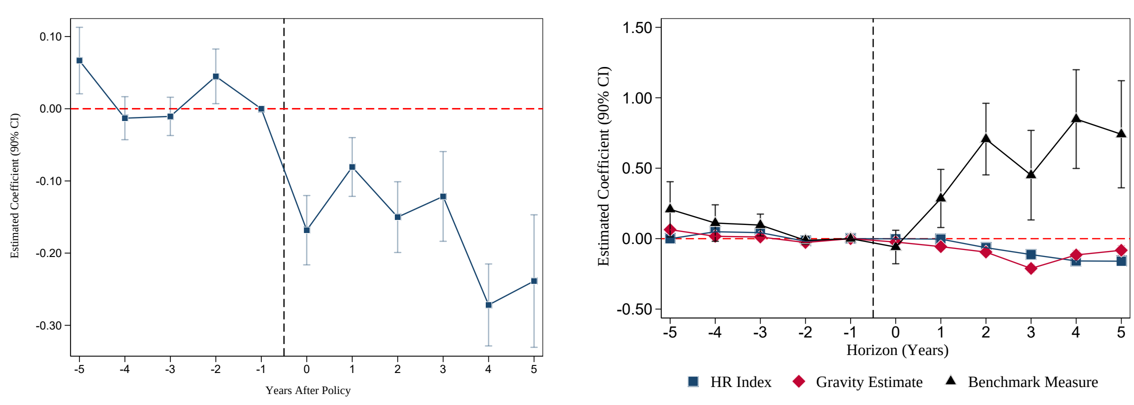
1. **Aggregated Head-Ries (HR) Index**: A measure constructed by aggregating bilateral trade costs based on the HR index, representing one of the standard measures in the literature.

2. **Gravity-Based Estimates**: Directional export and import costs recovered from a standard gravity specification using bilateral trade data.

3. **Benchmark Aggregate Costs**: Our proposed measure derived from the structural decomposition of aggregate prices and expenditure shares.

Detailed derivations and aggregation procedures for the latter two measures are provided in Appendix A.2. By evaluating these competing metrics against the policy changes, we can assess the relevance of the proposed framework to measure directional trade distortions.

Figure 6: Event study results



(a) Log trade ratio

(b) Asymmetric trade costs

Note: The figure shows the results of estimation of local projection diff-in-diff detailed in equation (16). Events are defined as Large Asymmetric Trade Policy (LATPE) as detailed in section 5.2. Controls include the log of domestic to foreign expenditure, REER, terms of trade, and their four-year lags. Standard errors are clustered at the origin country level.

Results. Figure 6 presents the impulse response functions for the trade ratio and the competing trade cost metrics following a Large Asymmetric Trade Policy Event (LATPE). Across all specifications, we find no evidence of significant pre-trends, alleviating concerns that these policy shifts are endogenous responses to prior macroeconomic volatility.

Panel (a) illustrates the substantial real-world impact of these events: a LATPE shock induces a persistent and statistically significant decline in the trade ratio, which falls by approximately 30% over a five-year horizon. This confirms that our identification strategy captures policy changes with major macroeconomic consequences in the expected direction.

Panel (b) provides an important result of this paper. The asymmetric trade cost measures derived from bilateral HR-indices (blue squares) and gravity estimates (red diamonds) fail to track the policy shock, even showing a paradoxical *reduction* in asymmetric trade costs. In contrast, our proposed aggregate measure (black diamonds) exhibits a robust increase of nearly 70 log points. This response is not only internally consistent with the observed collapse in the trade ratio and the policy change, but also demonstrates that our method captures the cumulative impact of regulatory frictions that traditional bilateral aggregations might omit or miss.

6 Trade Costs and the Macroeconomy

Having validated the structural soundness of our measures against trade policy shocks, we now quantify the impact of trade cost dynamics on the aggregate trade balance and the current account across our full sample. This analysis characterizes the transmission mechanism of directional trade shocks to the external position of the economy. We begin by detailing our empirical strategy before presenting the central results.

6.1 Empirical Strategy: Local Projections

To assess the dynamic response of macroeconomic indicators to trade cost shocks, we employ a local projection framework (Jordà et al. 2025). We estimate the following specification for each horizon h:

$$\Delta_h \ln Y_{i,t+h} = \beta^h \ln\left(\tau_{i,t}^J\right) + \Gamma_h' \mathbf{X}_{i,t} + \gamma_t + \gamma_i^{GFC} + \epsilon_{i,t+h} \tag{17}$$

where $\Delta_h \ln Y_{i,t+h} = \ln Y_{i,t+h} - \ln Y_{i,t-1}$ represents the cumulative change in the dependent variable Y from year $t-1$ to $t+h$. The coefficients of interest, $\{\beta^h\}_{h=1}^{10}$, capture the cumulative elasticity (or semi-elasticity) of Y with respect to changes in our trade cost measures ($\tau_{i,t}^J$), which can include common trade cost component and the asymmetric cost ratio.

Motivated by our theoretical framework in Section 2, the control vector $\mathbf{X}_{i,t}$ includes the terms of trade, the REER, and relative domestic-to-foreign expenditure shares. To account for persistent dynamics and potential endogeneity, we include up to four lags of these controls and the independent variable. Year fixed effects, γ_t, are included to absorb global shocks. Furthermore, we incorporate a country-specific Global Financial Crisis (GFC) dummy, γ_i^{GFC}, defined as an indicator for the year 2009 interacted with country-specific intercepts. This interaction term controls for the idiosyncratic intensity with which the GFC impacted individual nations, preventing the "Great Trade Collapse" from biasing our broader estimates of trade cost elasticities.

Identification: Bartik Instruments. To address potential endogeneity concerns and isolate exogenous shifts in trade costs, we construct a Bartik (shift-share) instrument, denoted as $z_{i,t}$. While our structural measures are theoretically independent of contemporaneous domestic shocks—such as productivity or exchange rate movements—under the assumptions of Section 2, the instrument provides a necessary layer of empirical robustness. Specifically, while the trade costs themselves are structurally recovered—and thus theoretically invariant to shifts in relative productivity, domestic demand, or foreign demand—the *policy decisions* reflected in those costs remain potentially endogenous. For instance, a government might implement restrictive trade measures in response to declining domestic productivity or adverse shifts in foreign demand, both of which independently influence external imbalances.

The instrument is constructed using a "leave-one-out" strategy at the sectoral level to purge these idiosyncratic country-policy feedback loops. First, we calculate the average export and import costs for each sector s across the rest of the world, excluding the country of interest i:

$$\widehat{\tau}^{exp}_{i,s,t} = \frac{1}{N-1}\sum_{n\neq i}\tau^{exp}_{n,s,t} \quad \text{and} \quad \widehat{\tau}^{imp}_{i,s,t} = \frac{1}{N-1}\sum_{n\neq i}\tau^{imp}_{n,s,t} \tag{18}$$

$$\widehat{\tau}^{exp}_{i,s,t} = \frac{1}{N-1}\sum_{n\neq i}\tau^{exp}_{n,s,t} \quad \text{and} \quad \widehat{\tau}^{imp}_{i,s,t} = \frac{1}{N-1}\sum_{n\neq i}\tau^{imp}_{n,s,t} \tag{19}$$

Second, we aggregate these international sectoral trade costs using country-specific weights based on the sector's share of total trade five years prior $(t-5)$.[9] Crucially, to satisfy the exclusion restriction, we map the average *import* costs of the rest of the world to country i's *export* costs, reflecting the structural identity that one nation's export friction is its partners' import distortion. The resulting instrument for the asymmetric cost ratio is defined as:

$$z_{i,t} = \frac{\sum_s \omega^{exp}_{i,s,t-5}\cdot\widehat{\tau}^{imp}_{i,s,t}}{\sum_s \omega^{imp}_{i,s,t-5}\cdot\widehat{\tau}^{exp}_{i,s,t}} \tag{20}$$

where ω^{exp} and ω^{imp} denote the lagged sectoral shares of exports and imports, respectively. This construction ensures that $z_{i,t}$ is driven by global sectoral trends rather than idiosyncratic domestic developments, providing a clean source of variation to identify the macroeconomic elasticities of trade costs.

First-Stage Relevance. To isolate the exogenous component of trade cost variation, we estimate the following first-stage specification:

$$\ln\left(\tau^{J}_{i,t}\right) = \alpha + \beta^{IV}\ln(z_{i,t}) + \Gamma'\mathbf{X}_{i,t} + \gamma_t + \gamma^{GFC}_i + \nu_{i,t} \tag{21}$$

where $\tau^{J}_{i,t}$ represents the structurally recovered trade cost (either the common component or the asymmetric ratio). The vector of controls are identical to those employed in the local projection specification in Equation 17.

[9] Sectoral trade costs are constructed using an approach analogous to the aggregate measures but utilizing sectoral expenditure shares.

This first-stage regression tests the predictive power of global sectoral cost shifts—weighted by lagged domestic trade shares—on our country-level trade cost measures. A strong and positive β^{IV} coefficient confirms that domestic trade distortions are significantly shaped by international regulatory and logistical trends.[10]

6.2 Main Empirical Findings

We now present our empirical results based on the local projection specifications detailed above. We first analyze the impact of common (symmetric) trade costs before examining the role of asymmetric trade costs in shaping openness and the trade balance. Our analysis reveals five key findings.

Fact 1: Symmetric trade costs suppress trade openness but are neutral to the trade balance. Panel (a) of Figure 7 illustrates that common trade cost shocks exert a persistent and statistically significant downward pressure on trade openness (exports plus imports). As barriers to both directions of trade, these symmetric frictions act as a permanent drag on trade volumes, consistent with standard gravity-based predictions.

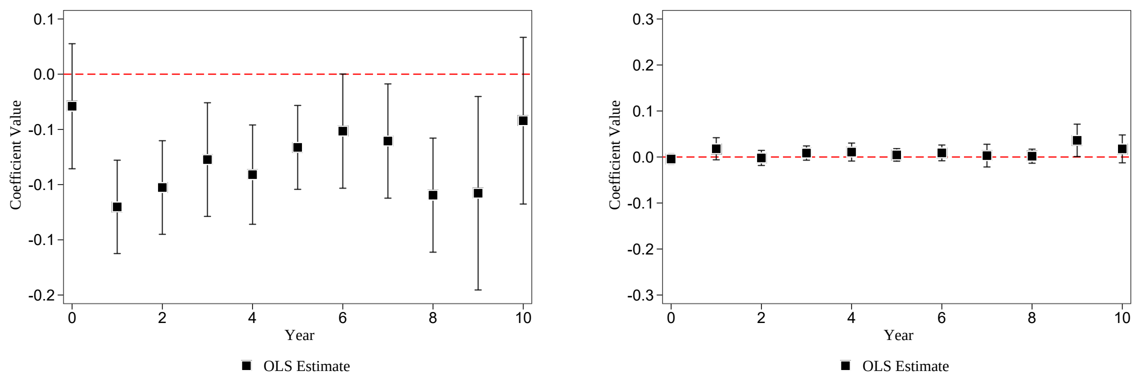
However, as shown in Panel (b), this contraction in openness does not translate into a significant movement in the trade balance. While symmetric costs impede the overall level of international integration, their direct effect on net trade flows is negligible. This finding is consistent with the standard intertemporal view that symmetric trade costs—affecting exports and imports equally—do not fundamentally alter the cross-country saving and investment decisions that determine the current account.[11]

Fact 2: Asymmetric trade costs exhibit significant persistence and mean reversion. Panel (a) of Figure 8 characterizes the dynamic evolution of the asymmetric trade cost ratio following a unit innovation. By construction, the impact effect is normalized to

[10]The instrument strength, based on the Kleibergen-Paap F-statistics range between 50 to 150 depending on the time frame of each regression.

[11]Notably, our results do not directly capture the "tightening effect" of trade costs induced by global interest rate fluctuations as discussed by Reyes-Heroles et al. 2016, since our estimates reflect the aggregate average across both net debtors and creditors.

Figure 7: Common Trade Cost Shocks



(a) Trade openness

(b) Trade balance over GDP

Note: The figure shows the results of the estimation of equation (17) for two dependent variables: trade openness (in log values) and the trade balance (as a share of GDP) in panels (a) and (b), respectively. Controls include - except when used as a dependent variable-: the terms of trade, real effective exchange rates, relative expenditures between country i and the rest of the world, its 4 years lagged, and up to 4 years' lagged values for the dependent and independent variable.

one. We find that asymmetric shocks are not merely transitory; the cost ratio continues to climb for two years following the initial event, suggesting a "phase-in" period for regulatory frictions or a gradual tightening of policy regimes.

After this peak, the effects begin to taper, with costs converging toward their pre-shock baseline by the fifth year. This hump-shaped dynamic implies that a positive shock to the asymmetric index renders exporting temporarily more expensive relative to importing. Crucially, these events represent a temporary increase in the relative price of engaging in international saving and investment. By making net export adjustments more costly for the domestic economy than for the rest of the world, these shocks are likely to act as a time-varying distortion on the intertemporal allocation of resources.

Fact 3: Asymmetric trade costs induce a significant, though temporary, real depreciation. Panel (b) of Figure 8 illustrates the dynamic response of the REER to an asymmetric trade cost innovation. An increase in the export-to-import cost ratio triggers an immediate real depreciation. This occurs because the policy wedge makes domestic tradables relatively cheaper for foreign consumers while inflating the domestic price level relative to the rest of the world.

Crucially, this depreciation persists for approximately three to five years, mirroring the lifecycle of the trade shock identified in Fact 2. This finding directly engages with the classic debate on exchange rate neutrality: while the REER adjusts in a direction that would typically offset trade distortions, the magnitude of this adjustment is insufficient to insulate the trade balance. As shown in the subsequent fact, the "insulation" provided by the REER is incomplete.

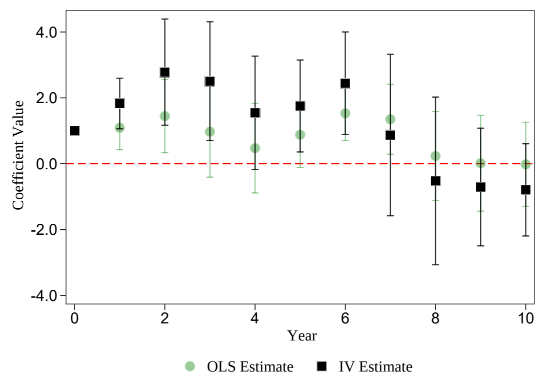
Fact 4: Asymmetric trade costs significantly compress the trade balance and trade ratio. Panels (c) and (d) of Figure 8 depict the consequences for the trade balance-to-GDP ratio and trade ratio . Our estimates indicate that a 1% increase in asymmetric trade costs leads to a 1.3% contraction in the export-to-import ratio and a substantial decline of approximately 4 percentage points in the trade balance.

The economic intuition follows an intertemporal logic: by temporarily raising the relative cost of exporting, these shocks increase the price of engaging in international saving. Faced with a higher price for transferring resources into the future via net exports, domestic agents optimally postpone savings and pull forward expenditures. This intertemporal substitution manifests as a marked deterioration of the trade balance, confirming that asymmetric frictions are a potent driver of external deficits.

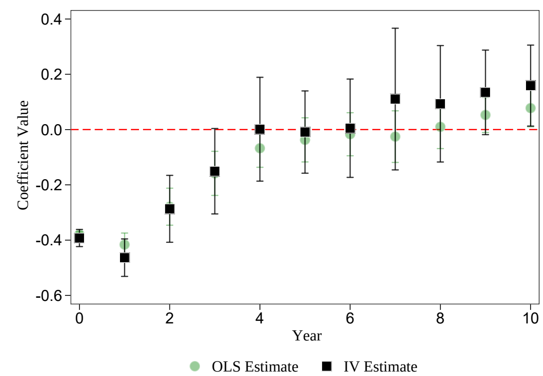
Fact 5: Current account adjustments are driven by shifts in domestic absorption rather than output volatility. Figure 9 decomposes the macroeconomic response to asymmetric trade cost shocks by examining the dynamics of the current account, savings, and investment—all scaled by GDP—alongside the response of real GDP. Consistent with our trade balance results, the current account exhibits a significant and persistent deficit following an change in asymmetric trade costs.

Crucially, real GDP remains largely invariant to these distortions, suggesting that the shock does not operate through a standard supply-side contraction. Instead, the deterioration of the external balance is fueled by a marked rise in both private consumption and

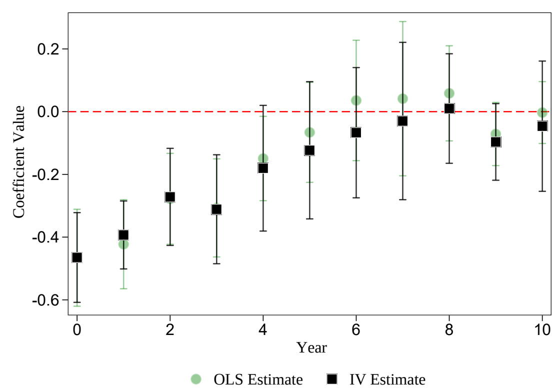
Figure 8: Asymmetric Trade Cost Shocks



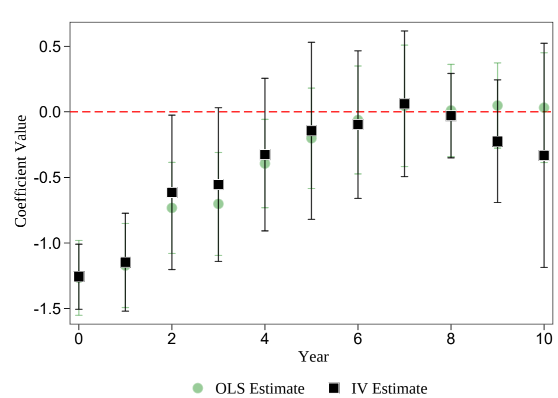
(a) Log Exp-imp trade cost ratio



(b) Log REER



(c) Trade balance over GDP

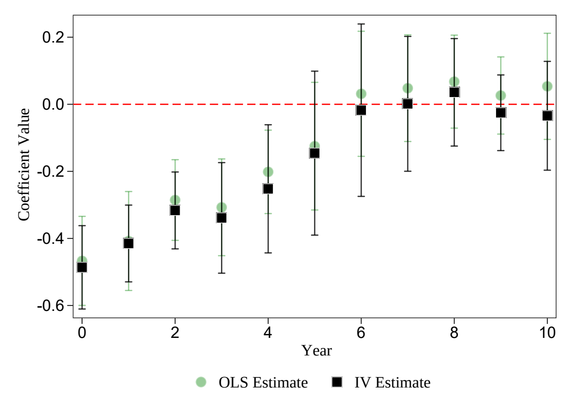


(d) Log export import ratio

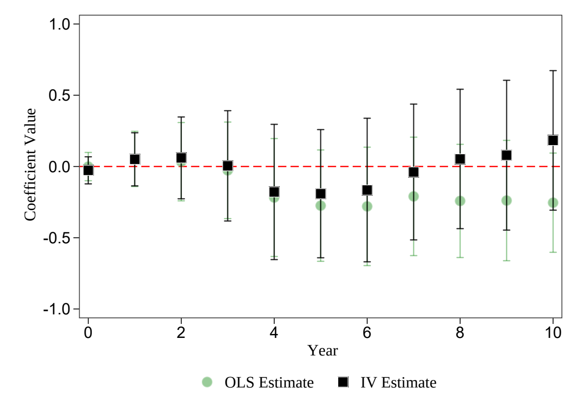
Note: The figure shows the results of estimation of equation (17) . Two estimates are presented for each case: those instrumented in black and those without instrumentation in green. Controls include - except when used as dependent variable-: the terms of trade, real effective exchange rates, relative expenditures between country i and the rest of the world, its 4-year lag, and up to 4 years' lagged values for the dependent and independent variable. Standard errors are clustered at the origin country level.

investment. On impact, the current account deficit is primarily driven by the investment channel. Indeed, as shown in Figure **??** of the Appendix, approximately half of this investment surge is attributable to a net increase in inventories. We infer from this patterns that asymmetric trade costs function as an intertemporal price distortion: by making "saving through net exports" more expensive, these shocks incentivize agents to shift resources toward domestic absorption and inventories accumulation. The resulting current account deficit is therefore a reflection of a change in the optimal timing of expenditure, independent of the economy's total productive capacity.

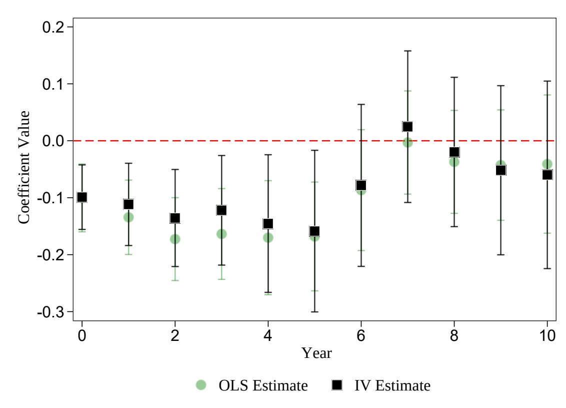
Figure 9: Asymmetric Trade Cost Shocks and Current account



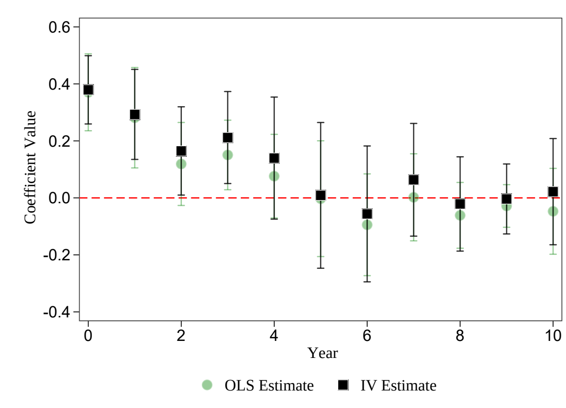
(a) Current account over GDP



(b) Log real GDP



(c) Saving over GDP



(d) Investment over GDP

Note: The figure shows the results of estimation of equation (17) . Two estimates are presented for each case: those instrumented in black and those without instrumentation in green. Controls include - except when used as dependent variable-: the terms of trade, real effective exchange rates, relative expenditures between country i and the rest of the world, its 4-year lag, and up to 4 years' lagged values for the dependent and independent variable. Standard errors are clustered at the origin country level.

7 Discussion: Tariffs, Common, and Asymmetric Trade Costs

Having established the distinct macroeconomic signatures of symmetric and asymmetric trade costs, we now examine the structural pass-through of our measure of tariffs. Abstracting from government revenue effects, tariff changes impact aggregate international allocations primarily by altering the underlying trade costs. A critical question for policy is whether tariffs induce symmetric or asymmetric cost adjustments. The answer is decisive for determining whether tariff policy can effectively influence the trade balance or merely acts as a drag on total trade volumes.

To systematically analyze this relationship, we estimate the following specification in yearly changes:

$$\Delta \ln(\tau_{i,t}) = \beta_1 \Delta T_{i,t} + \beta_2 (I_{\Delta T_{i,t}>0} \times \Delta T_{i,t}) + \beta_3 I_{\Delta T_{i,t}>0} + \Gamma' \Delta \mathbf{X}_{i,t} + \alpha_t + \epsilon_{i,t} \tag{22}$$

where $\Delta T_{i,t}$ denotes the change in effective tariffs. The control vector $\mathbf{X}_{i,t}$ includes the terms of trade, the REER, and relative expenditure shares, alongside four lags of the dependent variable and the tariff level. The coefficient β_1 captures the baseline elasticity of trade costs to tariff movements, while β_2 identifies the differential response specific to tariff increases, allowing us to test for non-linearities in protectionist shocks.

The estimation results reveal a near-unitary pass-through between tariffs and structural import costs. Regardless of the direction of the policy shift, a 1 percentage point change in effective tariffs is associated with an approximately 1.03% change in import costs (as shown in Table 1, Panel 1), once all control and year fixed effects are in place. This finding confirms that our structurally recovered import costs effectively internalizes tariff movements, even after accounting for global shocks and macroeconomic covariates.

A more striking result emerges when examining the response of export costs to domestic protectionism. While tariff reductions appear asymmetric in that they primarily lower import costs, this relationship vanishes during protectionist episodes. When tariffs are increased, the export-to-import cost ratio shows no statistically significant movement (Table 1, Panel 2). This lack of significance implies that export costs rise in tandem with import costs during tariff hikes.

This symmetry in protectionist surges suggests that tariff increases function as a broad tax on international integration rather than a targeted distortion of the trade balance. Consequently, the "common cost" effect identified in Fact 1 dominates during tariff increases,

Table 1: Tariffs and trade costs relationship

Panel 1: Import costs

	Δ Import costs	Δ Import costs	Δ Import costs
Δ Tariffs	2.917***	2.897***	1.034***
	(0.300)	(0.313)	(0.151)
N	1037	1037	649
R^2	0.084	0.111	0.941

Panel 2: Exp-Imp cost ratio

	Δ Exp-Imp cost	Δ Exp-Imp cost	Δ Exp-Imp cost
Δ Tariffs $\times$ $I_{\Delta \text{Tariffs} \leq 0}$	-5.020***	-5.375***	-1.837***
	(0.716)	(0.733)	(0.360)
Δ Tariffs $\times$ $I_{\Delta \text{Tariffs} > 0}$	-1.643	-2.137	0.923
	(1.424)	(1.433)	(0.518)
N	1037	1037	649
R^2	0.052	0.085	0.942
Year FE	-	✓	✓
Controls	-	-	✓

Note: The Table presents the results of estimating equation 22. The first panel uses only yearly import cost changes as dependent variables, the second uses the export-import cost ratio changes. Controls include the terms of trade, real effective exchange rates, relative expenditures between country i and the rest of the world, its 4-year lagged value, and up to 4 years' lagged values for the dependent and independent variables.

providing a structural explanation for why protectionist policies often fail to improve a nation's external position.

8 Conclusion

This paper provides a new method for identifying aggregate export and import costs and decomposing these structural trade costs into common and asymmetric components. By separately identifying inbound and outbound frictions, we move beyond traditional symmetric gravity measures to reveal the distinct macroeconomic effects of trade distortions. Our methodology offers a "sufficient statistic" for aggregate trade barriers that captures the impact of regulatory and non-policy frictions, and demonstrates an improved ability to track asymmetric policy changes.

Our empirical findings document a fundamental dichotomy in how trade costs shape the macroeconomy. We show that common trade costs—which affect exports and imports equally—exert a significant impact on trade openness but remain neutral with respect to the trade balance. In contrast, asymmetric trade costs have first-order effects on external imbalances and real exchange rate fluctuations. These shocks act as a temporary barrier to international saving; by raising the cost of exporting relative to importing, they incentivize domestic absorption—increasing consumption and investment—without significantly altering total output.

Finally, we provide evidence on the limits of protectionism motivated by mercantilist views. While trade policy can influence both cost components, our results suggest that using tariffs to engineer trade balance adjustments is unlikely to be effective. This is because, on average, tariff increases are associated with changes in common trade costs; thus, tariff hikes are accompanied by rising export costs—potentially reflecting retaliation or the increased cost of imported intermediate inputs.

The structural measures developed in this paper open several avenues for future research. They can be utilized to explore the divergent trade cost dynamics between advanced and emerging economies, the role of trade frictions in explaining the "low elasticity" of trade flows to exchange rate movements, and the extent to which trade policy changes hinder international risk-sharing. By providing a more granular view of the barriers to global integration, our framework offers a robust tool for analyzing the evolving landscape of international trade.

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A Appendix

A.1 Appendix: Proofs

Lemma 1: *When export distortions change relative to import ones at least, without affecting domestic price of the goods, at least one of the following variables should adjust: the exports to import ratio, the exchange rate, the terms of trade, or the relative total expenditures. When export and import distortions change symmetrically these variables are unaffected.*

Proof:

Re-writing equation (2) implies that the log ratio of exports to imports is given by:

$$\ln \frac{exp_t^i}{imp_t^i} = -\theta \ln \frac{\overbrace{\zeta_t^{i,j}\tau_t^{i,j}}^{\text{exp. costs}}}{\underbrace{\zeta_t^{j,i}\tau_t^{j,i}}_{\text{imp. costs}}} - \theta \ln \frac{p_t^{i,i}}{p_t^{j,j}} - \theta \ln \frac{P_t^j}{P_t^i} + \ln \frac{C_t^j}{C_t^i}$$

Taking total differences, let $\Delta \frac{p_t^{i,i}}{p_t^{j,j}} = 0$. Note that this implies that:

$$\Delta \ln \frac{\overbrace{\zeta_t^{i,j}\tau_t^{i,j}}^{\text{exp. costs}}}{\underbrace{\zeta_t^{j,i}\tau_t^{j,i}}_{\text{imp. costs}}} = -\Delta \ln \frac{exp_t^i}{imp_t^i} + \Delta \ln \frac{P_t^j}{P_t^i} + \Delta \ln \frac{C_t^j}{C_t^i} = 0$$

Let $\Delta \ln \frac{\zeta_t^{i,j}\tau_t^{i,j}}{\zeta_t^{j,i}\tau_t^{j,i}} \neq 0$ and assume that:

$$\Delta \ln \frac{exp_t^i}{imp_t^i} = 0;\ \Delta \ln \frac{P_t^j}{P_t^i} = 0\ ; \Delta \ln \frac{C_t^j}{C_t^i} = 0$$

By previous condition, we have that:

$$\ln \frac{\zeta_t^{i,j}\tau_t^{i,j}}{\zeta_t^{j,i}\tau_t^{j,i}} = 0$$

which is a contradiction.

Proposition 1. Under CES preferences with price elasticity $\theta > 1$, the aggregate export and import costs for country d relative to the rest of the world f are given by:

$$\mathcal{X}_{dt} = \left(\frac{\lambda_t^{d,f}}{\lambda_t^{d,d}}\right)^{\frac{1}{1-\theta}} \left(\frac{P_t^f}{P_t^d}\right) \tag{23}$$

$$\mathcal{M}_{dt} = \left(\frac{\lambda_t^{f,d}}{\lambda_t^{f,f}}\right)^{\frac{1}{1-\theta}} \left(\frac{P_t^d}{P_t^f}\right) \tag{24}$$

where P_t^j denotes the final consumption price index in country j.

Proof:

By equation 6 we have that:

$$\lambda_t^{i,j} = (1-\omega)\left(\frac{\zeta_t^{i,j} p_t^{i,j}}{P_t^j}\right)^{1-\theta}$$

Using that $p_t^{i,j} = \tau_t^{i,j} p_t^{i,i}$, we obtain that the previous equation is equal to:

$$\lambda_t^{i,j} = (1-\omega)\left(\frac{\zeta_t^{i,j}\tau_t^{i,j} p_t^{i,i}}{P_t^j}\right)^{1-\theta}$$

Hence we get that the ratio of expenditures share is equal to:

$$\frac{\lambda_t^{i,j}}{\lambda_t^{i,i}} = \frac{(1-\omega)}{\omega}\frac{\left(\frac{\zeta_t^{i,j}\tau_t^{i,j} p_t^{i,i}}{P_t^j}\right)^{1-\theta}}{\left(\frac{\zeta_t^{i,i}\tau_t^{i,i} p_t^{i,i}}{P_t^i}\right)^{1-\theta}}$$

After imposing that $\zeta_t^{i,i} = 1; \tau_t^{i,i} = 1$, we get that

$$\frac{\lambda_t^{i,j}}{\lambda_t^{i,i}} = \frac{(1-\omega)}{\omega}\frac{\left(\frac{\zeta_t^{i,j}\tau_t^{i,j}}{P_t^j}\right)^{1-\theta}}{\left(\frac{1}{P_t^i}\right)^{1-\theta}} = \frac{(1-\omega)}{\omega}\left(\zeta_t^{i,j}\tau_t^{i,j}\right)^{1-\theta}\left(\frac{P_t^i}{P_t^j}\right)^{1-\theta}$$

Define *export costs* $\equiv \left(\frac{(1-\omega)}{\omega}\right)^{\frac{1}{1-\theta}} \zeta_t^{i,j}\tau_t^{i,j}$. Then we get that:

$$\text{export costs}_{i,t}^{(1-\theta)} = \frac{\lambda_t^{i,j}}{\lambda_t^{i,i}} \left(\frac{P_t^j}{P_t^i} \right)^{1-\theta}$$

Define import costs as *import costs* $\equiv \left(\frac{\omega}{1-\omega}\right)^{\frac{1}{1-\theta}} \zeta_t^{j,i} \tau_t^{j,i}$. Note that by previous argument we have that:

$$\frac{\lambda_t^{j,i}}{\lambda_t^{j,j}} = \frac{1-\omega}{\omega} \frac{\left(\frac{\zeta_t^{j,i}\tau_t^{j,i}}{P_t^i}\right)^{1-\theta}}{\left(\frac{1}{P_t^j}\right)^{1-\theta}} = \frac{(1-\omega)}{\omega} \left(\zeta_t^{i,j}\tau_t^{i,j}\right)^{1-\theta} \left(\frac{P_t^j}{P_t^i}\right)^{1-\theta}$$

So we get that estimated import costs are:

$$\mathcal{M}_{dt}^{(1-\theta)} = \frac{\lambda_t^{j,i}}{\lambda_t^{j,j}} \left(\frac{P_t^i}{P_t^j} \right)^{1-\theta}$$

Proposition 2 (Decomposition of Trade Costs). Let $\mathcal{X}_{d,t}$ and $\mathcal{M}_{d,t}$ be positive observable trade cost measures. There exist latent components $\tau^C_{d,t}, \tau^A_{d,t} \in \mathbb{R}_+$ and mapping functions $f, g : \mathbb{R}^2_+ \to \mathbb{R}_+$ such that:

$$\mathcal{X}_{d,t} = f(\tau^C_{d,t}, \tau^A_{d,t}) \quad \text{and} \quad \mathcal{M}_{d,t} = g(\tau^C_{d,t}, \tau^A_{d,t})$$

subject to the elasticity constraints in Definitions 1 and 2, if and only if:

(i) **Smoothness**: $f, g \in \mathcal{C}^2(\mathbb{R}^2_+)$ are twice continuously differentiable.

(ii) **Non-collinearity**: $\mathcal{X}_{d,t}$ and $\mathcal{M}_{d,t}$ are not perfectly collinear across the sample.

(⇒) Forward Direction: Conditions (i)-(ii) imply decomposition exists.

Let export costs and import costs be observable variables in country d and time t. There exist decompositions $\tau^C_{d,t}, \tau^A_{d,t} \in \mathbb{R}_+$ and functions $f, g : \mathbb{R}^2_+ \to \mathbb{R}_+$ such that:

$$\mathcal{X}_{dt} = f(\tau^C_{d,t}, \tau^A_{d,t}) \tag{25}$$

$$\mathcal{M}_{dt} = g(\tau^C_{d,t}, \tau^A_{d,t}) \tag{26}$$

with the elasticity constraints:

$$\varepsilon_{f,\tau^C} = \varepsilon_{g,\tau^C} > 0 \quad \text{(equal elasticities w.r.t. } \tau^C) \tag{27}$$

$$\varepsilon_{f,\tau^A} \neq \varepsilon_{g,\tau^A} \ for \ \varepsilon_{f,\tau^A} > 0 \ and \ \varepsilon_{g,\tau^A} > 0 \quad \text{(different elasticities w.r.t. } \tau^A) \tag{28}$$

if and only if:

(i) **Smoothness**: The functions $f, g \in \mathcal{C}^2(\mathbb{R}^2_+)$ are twice continuously differentiable

(ii) **Non-collinearity**: $\nexists$ constants a, b, c such that $a \cdot \mathcal{X}_{dt} + b \cdot \mathcal{M}_{dt} + c = 0$ for all (d, t)

Proof. We prove existence by construction. Let $y_1 = \mathcal{X}_{dt}$ and $y_2 = \mathcal{M}_{dt}$ for notational simplicity.

Step 1: Construct the inverse mapping. Define the transformation $T^{-1} : \mathbb{R}^2_+ \to \mathbb{R}^2_+$ by:

$$\tau^C_{d,t} = \phi(y_1, y_2) = y_1^{1/2} y_2^{1/2} \tag{29}$$

$$\tau^A_{d,t} = \psi(y_1, y_2) = \left(\frac{y_1}{y_2}\right)^{\mu} \tag{30}$$

where $\mu > 0$ is a parameter to be chosen.

Step 2: Verify invertibility using assumption (ii). The Jacobian matrix of T^{-1} is:

$$J^{-1} = \begin{pmatrix} \frac{\partial \phi}{\partial y_1} & \frac{\partial \phi}{\partial y_2} \\ \frac{\partial \psi}{\partial y_1} & \frac{\partial \psi}{\partial y_2} \end{pmatrix} = \begin{pmatrix} \frac{1}{2} y_1^{-1/2} y_2^{1/2} & \frac{1}{2} y_1^{1/2} y_2^{-1/2} \\ \mu y_1^{\mu-1} y_2^{-\mu} & -\mu y_1^{\mu} y_2^{-\mu-1} \end{pmatrix} \tag{31}$$

Computing the determinant:

$$\det\left(J^{-1}\right) = -\frac{\mu}{2} y_1^{\mu-1/2} y_2^{-\mu-1/2} - \frac{\mu}{2} y_1^{\mu-1/2} y_2^{-\mu-1/2} \tag{32}$$

$$= -\mu y_1^{\mu-1/2} y_2^{-\mu-1/2} \neq 0 \tag{33}$$

since $\mu > 0$ this ensures assumption (ii).The non-collinearity of y_1 and y_2 guarantees that both variables provide independent information, preventing the degenerate case where $\det\left(J^{-1}\right) = 0$.

Since:

- $\det\left(J^{-1}\right) \neq 0$ everywhere on $\mathbb{R}^2_+$ (from Step 2)
- The component functions ϕ, ψ are $\mathcal{C}^2$ when $y_1, y_2 > 0$

All partial derivatives exist and are continuous. Then by the Inverse Function Theorem, there exists a local inverse $T : \mathbb{R}^2_+ \to \mathbb{R}^2_+$ such that:

$$y_1 = f(\tau^C, \tau^A) \tag{34}$$

$$y_2 = g(\tau^C, \tau^A) \tag{35}$$

where $f, g \in \mathcal{C}^2(\mathbb{R}^2_+)$ by the theorem.

Step 4: Derive the functional forms. From the inverse relationships in Step 1:

$$\tau^C = y_1^{1/2} y_2^{1/2} \tag{36}$$

$$\tau^A = y_1^{\mu} y_2^{-\mu} \tag{37}$$

Solving this system for y_1 and y_2:

$$y_1 = \tau^C \cdot (\tau^A)^{1/(2\mu)} = f(\tau^C, \tau^A) \tag{38}$$

$$y_2 = \tau^C \cdot (\tau^A)^{-1/(2\mu)} = g(\tau^C, \tau^A) \tag{39}$$

Step 5: Verify the elasticity constraints. The elasticities with respect to τ^C are:

$$\varepsilon_{f,\tau^C} = \frac{\partial \ln f}{\partial \ln \tau^C} = 1 \tag{40}$$

$$\varepsilon_{g,\tau^C} = \frac{\partial \ln g}{\partial \ln \tau^C} = 1 \tag{41}$$

Thus, $\varepsilon_{f,\tau^C} = \varepsilon_{g,\tau^C} = 1$.

The elasticities with respect to τ^A are:

$$\varepsilon_{f,\tau^A} = \frac{\partial \ln f}{\partial \ln \tau^A} = \frac{1}{2\mu} \tag{42}$$

$$\varepsilon_{g,\tau^A} = \frac{\partial \ln g}{\partial \ln \tau^A} = -\frac{1}{2\mu} \tag{43}$$

Since $\mu > 0$, we have $\varepsilon_{f,\tau^A} = \frac{1}{2\mu} \neq -\frac{1}{2\mu} = \varepsilon_{g,\tau^A}$.

Conclusion: Under assumptions (i) and (ii), we have constructed explicit functions f and g with the desired elasticity properties. The decomposition identifies:

- $\tau^C_{d,t}$: Common trade cost component affecting exports and imports symmetrically
- $\tau^A_{d,t}$: Asymmetric component capturing differential trade barriers

Proof. ($\Leftarrow$) **Reverse Direction: If decomposition exists, then conditions (i)-(ii)**

must hold

Suppose there exist functions f, g and decomposition $(\tau^C_{d,t}, \tau^A_{d,t})$ such that:

$$\mathcal{X}_{dt} = f(\tau^C_{d,t}, \tau^A_{d,t}) \tag{44}$$

$$\mathcal{M}_{dt} = g(\tau^C_{d,t}, \tau^A_{d,t}) \tag{45}$$

with $\varepsilon_{f,\tau^C} = \varepsilon_{g,\tau^C}$ and $\varepsilon_{f,\tau^A} \neq \varepsilon_{g,\tau^A}$.

Claim 1: Condition (i) must hold.

The elasticity constraints require:

$$\frac{\partial \ln f}{\partial \ln \tau^C} = \frac{\partial \ln g}{\partial \ln \tau^C} \tag{46}$$

This equality must hold for all values of (τ^C, τ^A) in the domain. For this partial derivative to exist and be well-defined, we need:

- f, g are differentiable (for first-order elasticities to exist)
- The elasticity equality must be verifiable, requiring continuous derivatives
- To ensure the Jacobian analysis is valid, we need second derivatives

Moreover, the inverse mapping from $(y_1, y_2) \mapsto (\tau^C, \tau^A)$ exists by assumption. By the Inverse Function Theorem, this requires $f, g \in \mathcal{C}^1$. However, to ensure the elasticity constraints are preserved under small perturbations and the decomposition is locally stable, we need $f, g \in \mathcal{C}^2(\mathbb{R}^2_+)$.

Claim 2: Condition (ii) must hold.

Suppose, for contradiction, that export and import costs are perfectly collinear:

$$\exists (a, b, c): \quad a \cdot \mathcal{X}_{dt} + b \cdot \mathcal{M}_{dt} + c = 0 \tag{47}$$

Without loss of generality, assume $b \neq 0$. Then:

$$\mathcal{M}_{dt} = -\frac{a}{b} \cdot \mathcal{X}_{dt} - \frac{c}{b} = k \cdot \mathcal{X}_{dt} + c' \tag{48}$$

Substituting into our system:

$$y_1 = f(\tau^C, \tau^A) \tag{49}$$

$$ky_1 + c' = g(\tau^C, \tau^A) \tag{50}$$

Taking elasticities with respect to τ^A:

$$\varepsilon_{f,\tau^A} = \frac{\tau^A}{y_1} \frac{\partial f}{\partial \tau^A} \tag{51}$$

$$\varepsilon_{g,\tau^A} = \frac{\tau^A}{ky_1 + c'} \frac{\partial g}{\partial \tau^A} = \frac{\tau^A}{ky_1 + c'} \cdot k \frac{\partial f}{\partial \tau^A} \tag{52}$$

Since $g(\tau^C, \tau^A) = kf(\tau^C, \tau^A) + c'$, we have $\frac{\partial g}{\partial \tau^A} = k \frac{\partial f}{\partial \tau^A}$.

This gives:

$$\varepsilon_{g,\tau^A} = \frac{ky_1}{ky_1 + c'} \cdot \varepsilon_{f,\tau^A} \tag{53}$$

For $\varepsilon_{f,\tau^A} \neq \varepsilon_{g,\tau^A}$ to hold, we need:

$$\frac{ky_1}{ky_1 + c'} \neq 1 \implies c' \neq 0 \tag{54}$$

But this means the ratio $\varepsilon_{g,\tau^A} / \varepsilon_{f,\tau^A}$ depends on y_1, which varies with (d, t). This contradicts the assumption that a fixed decomposition (τ^C, τ^A) exists with consistently and constant different elasticities.

Therefore, perfect collinearity is impossible, and condition (ii) must hold.

□

Corollary 1 (Non-uniqueness and Scale Identification of Decomposition). Let (f, g, τ^C, τ^A) be a valid decomposition satisfying Proposition 2. Then:

(a) **Multiple decompositions exist**: For any monotonic functions $h_1, h_2 : \mathbb{R}_+ \to \mathbb{R}_+$ with $h_1, h_2 \in \mathcal{C}^2$, the transformation

$$\tilde{\tau}^C_{d,t} = h_1(\tau^C_{d,t}) \tag{55}$$

$$\tilde{\tau}^A_{d,t} = h_2(\tau^A_{d,t}) \tag{56}$$

yields another valid decomposition $(\tilde{f}, \tilde{g}, \tilde{\tau}^C, \tilde{\tau}^A)$.

(b) **Scale identification**: All valid decompositions satisfy the ordinal property:

$$\frac{\tau^C_{d,t}}{\tau^C_{d',t'}} > 1 \iff \frac{\tilde{\tau}^C_{d,t}}{\tilde{\tau}^C_{d',t'}} > 1 \tag{57}$$

and similarly for τ^A.

(c) **Elasticity structure preservation**: For any two valid decompositions, the signs of elasticity differences are preserved:

$$\text{sgn}(\varepsilon_{f,\tau^A} - \varepsilon_{g,\tau^A}) = \text{sgn}(\varepsilon_{\tilde{f},\tilde{\tau}^A} - \varepsilon_{\tilde{g},\tilde{\tau}^A}) \tag{58}$$

Proof. **Part (a): Existence of multiple decompositions**

Given a valid decomposition with:

$$\mathcal{X}_{dt} = f(\tau^C_{d,t}, \tau^A_{d,t}) \tag{59}$$

$$\mathcal{M}_{dt} = g(\tau^C_{d,t}, \tau^A_{d,t}) \tag{60}$$

Define new variables $\tilde{\tau}^C = h_1(\tau^C)$ and $\tilde{\tau}^A = h_2(\tau^A)$ where h_1, h_2 are strictly monotonic.

Then:

$$\mathcal{X}_{dt} = f(h_1^{-1}(\tilde{\tau}^C), h_2^{-1}(\tilde{\tau}^A)) \equiv \tilde{f}(\tilde{\tau}^C, \tilde{\tau}^A) \tag{61}$$

$$\mathcal{M}_{dt} = g(h_1^{-1}(\tilde{\tau}^C), h_2^{-1}(\tilde{\tau}^A)) \equiv \tilde{g}(\tilde{\tau}^C, \tilde{\tau}^A) \tag{62}$$

The new elasticities are:

$$\varepsilon_{\tilde{f},\tilde{\tau}^C} = \varepsilon_{f,\tau^C} \cdot \frac{d\ln\tau^C}{d\ln\tilde{\tau}^C} = \varepsilon_{f,\tau^C} \cdot \frac{h_1'(\tau^C)\cdot\tau^C}{h_1(\tau^C)} \tag{63}$$

$$\varepsilon_{\tilde{g},\tilde{\tau}^C} = \varepsilon_{g,\tau^C} \cdot \frac{h_1'(\tau^C)\cdot\tau^C}{h_1(\tau^C)} \tag{64}$$

Since $\varepsilon_{f,\tau^C} = \varepsilon_{g,\tau^C}$ and both are multiplied by the same factor, we have $\varepsilon_{\tilde{f},\tilde{\tau}^C} = \varepsilon_{\tilde{g},\tilde{\tau}^C}$.

Part (b): Scale identification

Since h_1 and h_2 are strictly monotonic:

$$\tau^C_{d,t} > \tau^C_{d',t'} \iff h_1(\tau^C_{d,t}) > h_1(\tau^C_{d',t'}) \iff \tilde{\tau}^C_{d,t} > \tilde{\tau}^C_{d',t'} \tag{65}$$

This shows that while the cardinal values change, the ordinal rankings are preserved.

Part (c): Elasticity structure preservation

For the asymmetric component:

$$\varepsilon_{\tilde{f},\tilde{\tau}^A} - \varepsilon_{\tilde{g},\tilde{\tau}^A} = \left(\varepsilon_{f,\tau^A} - \varepsilon_{g,\tau^A}\right) \cdot \frac{h_2'(\tau^A)\cdot\tau^A}{h_2(\tau^A)} \tag{66}$$

Since h_2 is monotonic, $h_2' > 0$, and thus:

$$\operatorname{sgn}(\varepsilon_{\tilde{f},\tilde{\tau}^A} - \varepsilon_{\tilde{g},\tilde{\tau}^A}) = \operatorname{sgn}(\varepsilon_{f,\tau^A} - \varepsilon_{g,\tau^A}) \tag{67}$$

Therefore, if one decomposition identifies τ^A as having different effects on exports vs. imports, all valid decompositions preserve this qualitative relationship. □

Proof. (⇐) **Necessity: All valid decompositions are related by monotonic transformations**

We prove by contradiction. Suppose $(f_1, g_1, \tau_1^C, \tau_1^A)$ and $(f_2, g_2, \tau_2^C, \tau_2^A)$ are two valid decompositions of the same observable costs, but they are **not** related by monotonic transformations.

Step 1: Set up the contradiction hypothesis. Since both are valid decompositions:

$$y_1 = f_1(\tau_1^C, \tau_1^A) = f_2(\tau_2^C, \tau_2^A) \tag{68}$$

$$y_2 = g_1(\tau_1^C, \tau_1^A) = g_2(\tau_2^C, \tau_2^A) \tag{69}$$

By our contradiction hypothesis, at least one of the following must be true:

(a) $\nexists$ monotonic h_1 such that $\tau_2^C = h_1(\tau_1^C)$ for all observations

(b) $\nexists$ monotonic h_2 such that $\tau_2^A = h_2(\tau_1^A)$ for all observations

Step 2: Analyze the equal elasticity constraint. Both decompositions satisfy:

$$\left.\frac{\partial \ln y_1}{\partial \ln \tau_1^C}\right|_{\tau_1^A} = \left.\frac{\partial \ln y_2}{\partial \ln \tau_1^C}\right|_{\tau_1^A} \tag{70}$$

$$\left.\frac{\partial \ln y_1}{\partial \ln \tau_2^C}\right|_{\tau_2^A} = \left.\frac{\partial \ln y_2}{\partial \ln \tau_2^C}\right|_{\tau_2^A} \tag{71}$$

These constraints imply that for fixed τ_i^A:

$$\ln(y_1/y_2) = \Phi_i(\tau_i^A) \quad \text{for } i = 1, 2 \tag{72}$$

Since both expressions equal the same observable $\ln(y_1/y_2)$:

$$\Phi_1(\tau_1^A) = \Phi_2(\tau_2^A) = \ln(y_1/y_2) \tag{73}$$

Step 3: Derive the contradiction for case (b). Suppose τ_2^A is not a monotonic function of τ_1^A. Then there exist observations (d, t) and (d', t') such that:

$$\tau_1^A(d,t) < \tau_1^A(d',t') \tag{74}$$

$$\tau_2^A(d,t) > \tau_2^A(d',t') \tag{75}$$

From the different elasticity constraint for decomposition 1:

$$\varepsilon_{f_1,\tau_1^A} \neq \varepsilon_{g_1,\tau_1^A} \implies \Phi_1 \text{ is strictly monotonic} \tag{76}$$

Similarly for decomposition 2:

$$\varepsilon_{f_2,\tau_2^A} \neq \varepsilon_{g_2,\tau_2^A} \implies \Phi_2 \text{ is strictly monotonic} \tag{77}$$

But then:

$$\Phi_1(\tau_1^A(d,t)) < \Phi_1(\tau_1^A(d',t')) \quad \text{(by monotonicity of } \Phi_1\text{)} \tag{78}$$

$$\Phi_2(\tau_2^A(d,t)) > \Phi_2(\tau_2^A(d',t')) \quad \text{(by monotonicity of } \Phi_2\text{)} \tag{79}$$

This contradicts $\Phi_1(\tau_1^A) = \Phi_2(\tau_2^A) = \ln(y_1/y_2)$ for both observations. Therefore, τ_2^A must be a monotonic function of τ_1^A.

Step 4: Derive the contradiction for case (a). Given that $\tau_2^A = h_2(\tau_1^A)$ for some monotonic h_2, fix any value $\tau_1^A = a$. Then:

$$y_1 = f_1(\tau_1^C, a) = f_2(\tau_2^C, h_2(a)) \tag{80}$$

$$y_2 = g_1(\tau_1^C, a) = g_2(\tau_2^C, h_2(a)) \tag{81}$$

The equal elasticity constraints imply:

$$y_1 = B_1(a) \cdot M_1(\tau_1^C) \tag{82}$$

$$y_2 = B_1(a) \cdot M_2(\tau_1^C) \tag{83}$$

$$y_1 = B_2(h_2(a)) \cdot N_1(\tau_2^C) \tag{84}$$

$$y_2 = B_2(h_2(a)) \cdot N_2(\tau_2^C) \tag{85}$$

where M_1/M_2 and N_1/N_2 are constants (independent of τ_i^C).

Suppose τ_2^C is not a monotonic function of τ_1^C. Then for some fixed a, there exist two values $\tau_1^{C\prime}, \tau_1^{C\prime\prime}$ with $\tau_1^{C\prime} < \tau_1^{C\prime\prime}$ but corresponding values satisfy $\tau_2^{C\prime} > \tau_2^{C\prime\prime}$.

Since (y_1, y_2) uniquely determine trade costs through the inverse mapping (by Proposition 2), and both decompositions must yield the same (y_1, y_2):

$$M_1(\tau_1^{C\prime}) < M_1(\tau_1^{C\prime\prime}) \quad (M_1 \text{ increasing}) \tag{86}$$

$$N_1(\tau_2^{C\prime}) > N_1(\tau_2^{C\prime\prime}) \quad (N_1 \text{ increasing}) \tag{87}$$

But this would imply different values of y_1 from the two decompositions, a contradiction.

□

A.2 Appendix: Construction of other measures

Here we explain the procedure we use to contruct the other trade measures.

A.2.1 Gravity measure

First step: Estimation Bilateral trade barriers are estimated using a gravity approach extending Eaton and Kortum (2002, Ecta) to panel data. The gravity equation relates bilateral expenditure shares to trade barriers:

$$\frac{\lambda_{id}}{\lambda_{dd}} = \exp\{-\theta(\ln p_i - \ln p_d + \ln \tau_{id})\} \tag{88}$$

where λ_{id} denotes country j's expenditure share on country i output, p_i represents output prices, τ_{id} captures bilateral trade barriers, and θ is the trade elasticity parameter. The shares are computed using both merchandise and services expenditure.

The estimation assumes common importer effects in trade barriers. The panel specification becomes:

$$\frac{\lambda_{idt}}{\lambda_{jdt}} = \exp\{\pi_{it} + \pi_{dt} + \delta_{dt} + \delta_{id} + \epsilon_{idt}\} \tag{89}$$

where π_{it} and δ_{dt} are time-varying importer and exporter fixed effects, δ_{id} captures time-invariant bilateral factors. The model is estimated using Poisson maximum likelihood estimation.

Second step: Bilateral trade barriers. From the estimate compute the bilateral trade barriers:

$$-\theta \ln \hat{\tau}_{idt}^{EK} = \pi_{it} - \pi_{dt} + \delta_{dt} + \delta_{id} + \epsilon_{idt}$$

Third step: aggregation Second, bilateral barriers are aggregated to country-level import and export barrier indices.

Second, bilateral barriers are aggregated to country-level import and export barrier indices. Import barriers for country d are constructed as:

$$\ln \hat{\tau}_{dt}^{M,EK} = \sum_{i \neq d} \mu_{idt-1} \ln \hat{\tau}_{idt}^{EK} \tag{90}$$

where $\mu_{idt} = M_{idt} / \sum_{i \neq d} M_{idt}$ represents lagged import weights.

Export barriers for country i are analogously constructed as:

$$\ln \hat{\tau}_{it}^{X,EK} = \sum_{d \neq i} \xi_{idt-1} \ln \hat{\tau}_{idt}^{EK} \tag{91}$$

where $\xi_{idt} = M_{idt} / \sum_{j \neq i} M_{idt}$ represents lagged export weights.

A.2.2 Bilateral H-R Index

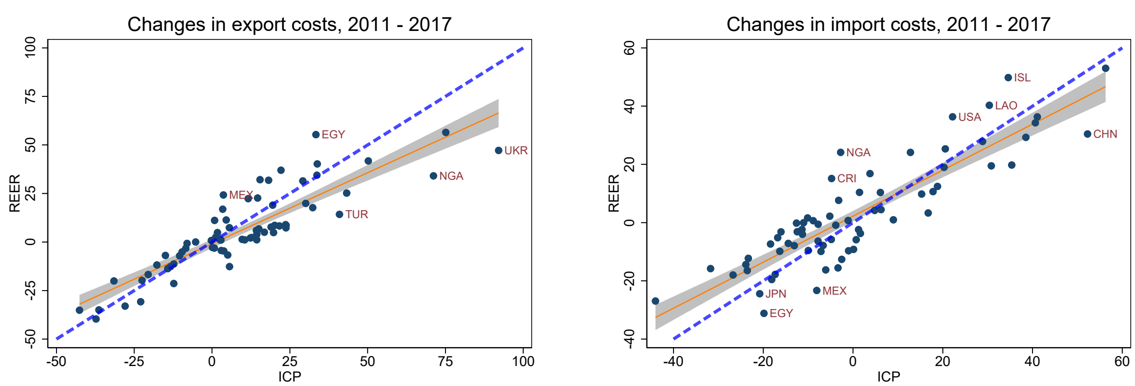
First step: Compute Bilateral trade barriers. Compute the bilateral expenditure share for countries d and origin i for each period as explain in the main text. Then set the value for θ and compute:

$$\hat{\tau}_{idt}^{HR} = \left(\frac{\lambda_t^{i,d} \lambda_t^{d,i}}{\lambda^{i,i} \lambda^{d,d}} \right)^{\frac{1}{2(1-\theta)}}$$

Second step: Aggregation. We follow the same procedure previously described to aggregate trade costs into export and import aggregate trade costs.

A.3 Appendix: Figures

Figure A.1: Trade cost differences: REER vs ICP

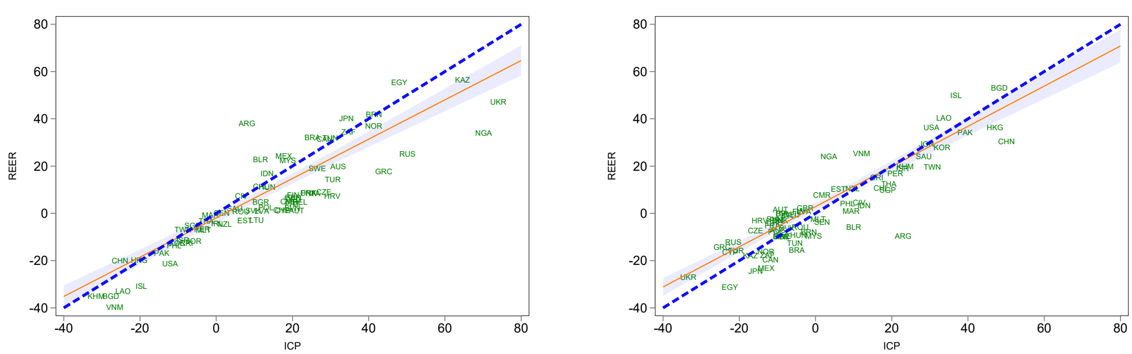


Export costs

Import costs

Note: This figure shows the change in exports and import costs estimated using two different prices. Y-axis uses trade costs using REER as proxy for prices, while X-axis uses the proxy based on only tradable goods for the ICP database.

Figure A.2: Trade cost differences: REER vs ICP

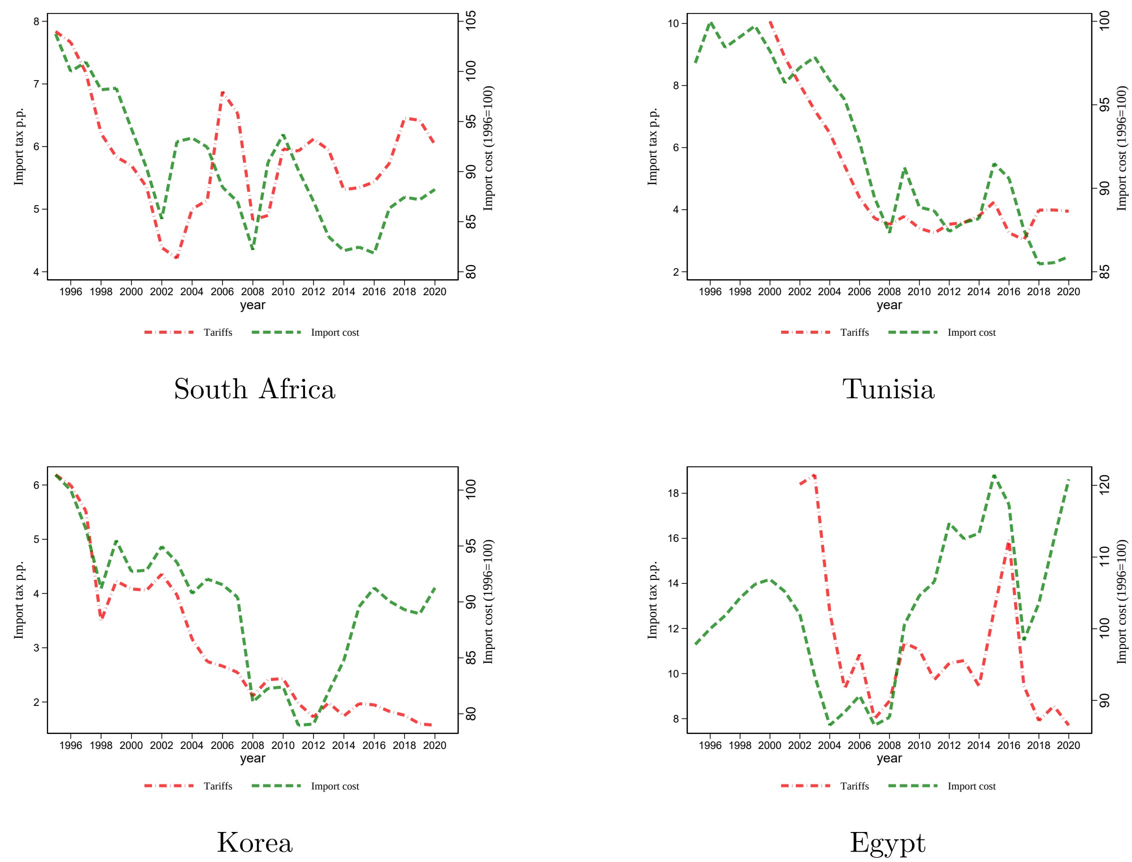


(a) Export costs

(b) Import costs

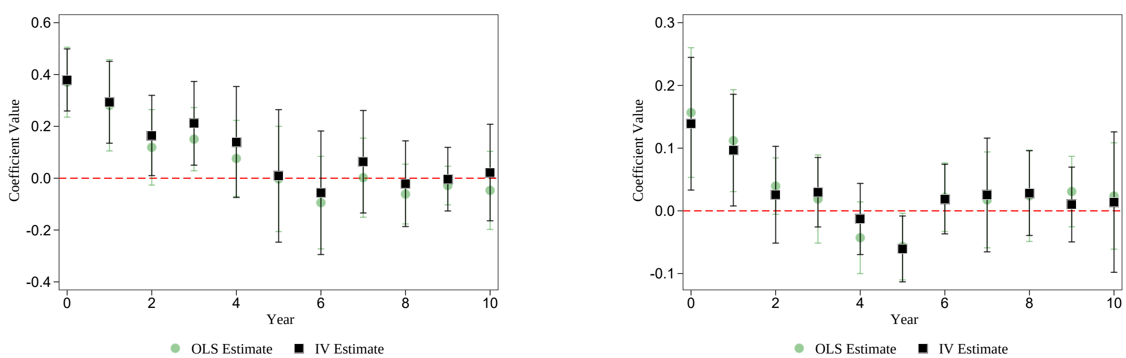
Note: This figures shows the the change in exports and import costs estimated using two different prices. Y-axis uses trade costs using REER as proxy for prices, while X-axis uses the proxy based on ICP database.

Figure A.3: Effective tariffs vs import costs



Note: We show the evolution of effective tariffs versus the evolution of import costs for a subset of those countries that went over an cumulative effective tariffs increase of at least 2 p.p. in four years. Effective tariffs are defined as government revenues from imports over total imports. Import costs are defined by equation 24.

Figure A.4: Asymmetric Trade Costs and Investment Adjustment



Investment over GDP

Net Inventories over GDP

Note: The figure shows the results of estimation of equation (17) . Two estimates are presented for each case: those instrumented in black and those without instrumentation in green. Controls include - except when used as dependent variable-: the terms of trade, real effective exchange rates, relative expenditures between country i and the rest of the world, its 4-year lag, and up to 4 years' lagged values for the dependent and independent variable. Standard errors are clustered at the origin country level. Inventories changes are calculated as total aggregate investment minus gross capital formation.