Tariff-Related U.S. Shocks and Macro-Financial Transmission to Brazil: Evidence from a Small Open-Economy BVAR

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Resumo

Como choques de política comercial dos EUA afetam uma economia emergente cuja exposição direta ao mercado norte-americano é limitada, mas cujo ciclo macroeconômico é fortemente ligado a preços globais, apetite por risco e condições cambiais? Este artigo estuda essa questão para o Brasil, usando o episódio tarifário EUA–Brasil de 2025 como motivação. Desenvolvemos um BVAR de economia pequena e aberta com bloco externo exógeno e bloco brasileiro que responde contemporânea e dinamicamente. Choques nos preços de importação dos EUA deterioram a posição comercial do Brasil e geram respostas persistentes na taxa de câmbio real efetiva (apreciação), preços domésticos, taxa básica e produto. A pressão cambial responde fracamente. A decomposição de variância atribui mais de 90% da variância de produto, preços e câmbio real ao bloco de política comercial dos EUA, e indica que a transmissão ocorre via mecanismo macro-financeiro mediado por termos de troca, não via restrição comercial bilateral.

Palavras-chave: tarifas; incerteza de política comercial; Brasil; BVAR de economia pequena e aberta; transmissão macro-financeira; pressão cambial.

Área temática: 5 – Comércio Internacional, Taxa de Câmbio e Desenvolvimento Econômico.

Abstract

How do U.S. trade-policy shocks affect an emerging economy whose direct exposure to the U.S. market is limited but whose macroeconomic cycle is closely tied to global prices, risk appetite and exchange-rate conditions? This paper studies this question for Brazil, using the 2025 U.S.–Brazil tariff episode as a motivation. We develop a small open-economy Bayesian VAR with an exogenous U.S./global block and a Brazilian block that responds contemporaneously and dynamically. U.S. import-price shocks deteriorate Brazil's trade position and generate persistent responses in the real effective exchange rate (appreciation), domestic prices, the policy rate and output, while exchange-market pressure responds weakly. The forecast-error variance decomposition attributes more than 90% of the variance of output, prices and the real exchange rate to the U.S. trade-policy block, indicating that transmission operates through a macro-financial mechanism mediated by the terms of trade rather than through a narrow bilateral trade channel.

Keywords: tariffs; trade-policy uncertainty; Brazil; small open-economy BVAR; macro-financial transmission; exchange-market pressure.

1 Introduction

The renewed use of tariffs by the United States has revived a central question in international macroeconomics: when trade-policy shocks originate in the core of the global system, do they affect emerging economies mainly through direct bilateral trade exposure, or through broader macro-financial channels? Tariffs are levied on goods, but rarely act only as changes in product-level trade costs. They can signal a more uncertain policy environment, alter import-price dynamics, affect expectations about global demand, shift risk appetite, and interact with exchange rates, commodity prices and domestic monetary conditions (CALDARA *et al.*, 2020; GOPINATH *et al.*, 2020; MIRANDA-AGRIPPINO; REY, 2020). For emerging economies, these channels can be operationally relevant even when direct exposure to the tariff-imposing country is limited.

On 30 July 2025 the United States issued Executive Order 14323, imposing a 40% *ad valorem* tariff on a broad set of Brazilian goods, effective 6 August 2025. Combined with the 10% universal tariff established by Executive Order 14257 of 2 April 2025, the aggregate rate applied to Brazilian exports reached 50% – the highest bilateral incidence between the two countries in decades (ABREU, 2025).[1] Two features make the episode particularly informative. First, the measure was imposed independently of trade-balance considerations: in 2025 the United States ran a bilateral goods surplus of roughly US$14.4 billion with Brazil, a configuration in place since 2008 (U.S. Census Bureau, 2026). This is unusual relative to the 2018–2019 trade war and the broader 2025 cross-country pattern, in which bilateral tariffs correlate strongly with U.S. bilateral deficits rather than with geopolitical alignment, distance or income (FAJGELBAUM; KHANDELWAL, 2026). Because the shock responds neither to Brazilian macroeconomic conditions nor to bilateral imbalances, it provides an unusually informative source of variation for tracing the transmission of an external trade-price disturbance to a large emerging economy. Second, as Section 2 documents (see Table 1), Brazil's export basket displays a structural bifurcation between a commodity core largely outside the 2025 tariff scope and tariff-exposed manufacturing segments that are individually small in the aggregate basket (Ministério do Desenvolvimento, Indústria, Comércio e Serviços – MDIC, 2026). This composition bounds the direct-trade margin of transmission *ex ante*.

Brazil also provides a useful setting on more general grounds. It is a large emerging economy and a systemically important country in Latin America, yet remains small relative to U.S. trade-policy, financial and monetary conditions. Its export structure is commodity-intensive, its domestic cycle is sensitive to global prices and risk appetite, and its macro-financial adjustment historically operates through exchange rates, inflation expectations, interest rates and external liquidity conditions (GOLDFAJN; MINELLA, 2005; GARCIA *et al.*, 2024). Recent evidence on U.S. tariff episodes concentrates on the issuing economy: the 2018 measures produced substantial border pass-through and limited absorption by foreign exporters (AMITI; REDDING; WEINSTEIN, 2019; AMITI; REDDING; WEINSTEIN, 2020; FAJGELBAUM *et al.*, 2020; CAVALLO *et al.*, 2021), and Boer e Rieth (2024) show that tariff-level shocks explain roughly 10% of unanticipated variation in U.S. GDP, with

[1] Both orders were issued under the International Emergency Economic Powers Act (IEEPA), an instrument whose application to international trade was subsequently revised by the U.S. Supreme Court in February 2026. For the empirical exercise, that decision functions only as an upper bound on the estimation sample.

realized trade flows responsible for only a modest share. For the 2025 measures, border pass-through is high and rapid while retail pass-through is gradual (FAJGELBAUM; KHANDELWAL, 2026; CAVALLO; LLAMAS; VAZQUEZ, 2025). Theoretical work has refined the conditions under which a temporary tariff is contractionary in an open economy (AUCLERT; ROGNLIE; STRAUB, 2025; BIANCHI; COULIBALY, 2025; WERNING; COSTINOT, 2025), but transmission to receiving emerging economies remains comparatively under-studied.

In parallel, the global financial cycle and dominant-currency literatures have shown that U.S. shocks transmit to emerging economies with velocity and amplitude that bilateral trade shares would not predict (REY, 2015; MIRANDA-AGRIPPINO; REY, 2020; GOPINATH *et al.*, 2020). The risk channel operates with larger elasticities in emerging markets than in advanced economies (KALEMLI-ÖZCAN, 2019), the pass-through from policy rates to short-term market rates is incomplete (LEO; GOPINATH; KALEMLI-ÖZCAN, 2022), and dollar appreciation correlates with contractions in global bank leverage and cross-border credit (BRUNO; SHIN, 2015). For commodity-exposed economies, world-price shocks add a further propagation channel (FERNáNDEZ; SCHMITT-GROHé; URIBE, 2017). Whether these macro-financial mechanisms operate when the originating disturbance is itself an explicitly real, sectorally concentrated trade-policy measure is an empirical question.

This paper investigates it using a small open-economy Bayesian VAR (SOE-BVAR) with an exogenous U.S./global block and a Brazilian block that responds contemporaneously and dynamically to external disturbances. The external block includes U.S. trade-policy uncertainty, U.S. import prices, global financial risk (the VIX), commodity prices, U.S. activity and the U.S. policy rate. The Brazilian block includes exchange-market pressure, the real effective exchange rate, the Brazilian policy rate, domestic prices, output and a trade-ratio measure defined as log exports minus log imports. The design treats the U.S./global block as predetermined with respect to Brazil at the monthly frequency, while allowing Brazilian variables to react immediately and over time to external shocks. External innovations are identified recursively within the U.S./global block; Brazilian responses are left unrestricted. The signs, magnitudes and persistence of those responses are therefore empirical outcomes rather than imposed assumptions.

The empirical exercise is organized around three open questions formalized in Subsection 2.3: the dominant margin of adjustment between conventional external vulnerability and macro-financial channels; the distinction between realized trade-price shocks and a pure uncertainty channel; and the theoretically ambiguous direction of the domestic activity response. Brazilian responses are left entirely unrestricted in the SOE-BVAR so that signs, magnitudes and persistence are empirical outcomes.

The paper makes contributions in three fronts. It shifts the analytical focus from the tariff-imposing core to a receiving emerging economy and exploits the absence of bilateral trade imbalances in the 2025 episode as a relatively exogenous source of variation. It bridges the trade-policy literature with the global financial cycle and dominant-currency paradigms, documenting macro-financial propagation when exchange-market pressure remains muted. And it provides a parsimonious framework that disentangles tariff-related shocks from global risk, commodity fluctuations and generic U.S. macroeconomic innovations.

Empirically, U.S. import-price shocks deteriorate Brazil's trade position but generate quantitatively

larger and more persistent responses in the real effective exchange rate (appreciation), domestic prices, the policy rate and output. Exchange-market pressure remains weak and largely domestic. Trade-policy uncertainty produces a similar macro-financial profile but a weaker trade-ratio response, while placebo shocks to U.S. output and policy rates do not reproduce the baseline. The joint co-movement of commodity prices, the real exchange rate and the trade ratio points to a terms-of-trade mediation that Section 4 develops; a pre-2025 sample reproduces the pattern.

These results suggest that the macroeconomic relevance of U.S. tariff-related shocks for Brazil should not be evaluated solely through direct bilateral exposure. Even when aggregate exposure to the U.S. market is limited, tariff-related disturbances can matter if they operate through import prices, policy uncertainty, global financial conditions, relative prices and domestic monetary responses. The evidence supports a macro-financial interpretation of tariff transmission to Brazil: tariff-related U.S. shocks are not merely sectoral trade restrictions, but external disturbances that can reshape the macroeconomic environment of a large emerging economy.

The rest of the paper is organized as follows. Section 2 reviews the literature and develops the testable implications, including the bifurcation evidence that bounds the direct-trade channel *ex ante*. Section 3 describes the data and empirical strategy. Section 4 reports the baseline impulse-response results. Section 5 presents the forecast-error variance decomposition. Section 6 discusses robustness, placebo and falsification exercises. Section 7 concludes.

2 Background, tariff exposure and transmission channels

This section reviews the literature that informs the empirical exercise. Subsection 2.1 examines the macroeconomics of tariff shocks and the global financial-cycle and dominant-currency mechanisms that may shape their transmission. Subsection 2.2 documents the structural bifurcation of Brazil's export basket that bounds the direct-trade channel *ex ante* and reviews the financial channels through which external shocks have historically reached the Brazilian macroeconomy. Subsection 2.3 articulates the testable implications.

2.1 Tariffs, uncertainty and macro-financial transmission

Tariffs are trade-policy instruments, but their macroeconomic effects extend well beyond bilateral trade flows. Evidence from the 2018 U.S. tariff episodes shows substantial border pass-through with limited absorption by foreign exporters (AMITI; REDDING; WEINSTEIN, 2019; AMITI; REDDING; WEINSTEIN, 2020; FAJGELBAUM *et al.*, 2020; CAVALLO *et al.*, 2021). Tariffs also operate through an uncertainty channel: when firms face uncertainty about future market access, input costs or retaliation, investment and entry decisions adjust before quantities fully respond (HANDLEY; LIMãO, 2017; CALDARA *et al.*, 2020). The aggregate response therefore combines a relative-price component, a cost-push component when imported inputs enter production, a demand component when exporters face weaker market access, and an expectations component when investors revise their views on future policy. In models with nominal rigidities, imported inputs and incomplete pass-through, these channels need not have the same sign or timing.

The empirical implication is that even in the issuing economy the realized-trade channel accounts for a modest fraction of the variance induced in key macroeconomic variables. Boer e Rieth (2024), using a Bayesian SVAR with sign and narrative restrictions, show that tariff-level shocks explain approximately 10% of unanticipated variation in U.S. GDP and depress imports, exports and investment persistently, with a general-equilibrium import elasticity of about -0.8. Tariff-uncertainty shocks explain a further 5% of U.S. GDP variance, operating preferentially through the exchange rate and expectations. Caldara *et al.* (2020) document that roughly two-thirds of the U.S. macroeconomic contraction in tariff episodes arises from news about future tariffs without realized rate changes. Theoretical work converges on a common implication: a temporary tariff has relative-price content and an ambiguous activity sign that depends on import-substitution elasticities, the role of durable goods and the policy reaction function (AUCLERT; ROGNLIE; STRAUB, 2025; BIANCHI; COULIBALY, 2025; WERNING; COSTINOT, 2025). This convergence motivates our choice not to impose signs on Brazilian responses in the SOE-BVAR.[2] For the 2025 episode itself, three features matter: the shock is historically large but structurally heterogeneous (the average applied U.S. tariff rose from 2.4% to 9.6%, the highest in eighty years, but 57% of imports entered duty-free at the end of 2025 and minerals, energy and most agricultural goods faced near-zero rates); border pass-through is high and rapid; and the net welfare impact for the United States is small in magnitude relative to the substantial movements observed in CPI, PPI and real wages (FAJGELBAUM; KHANDELWAL, 2026; CAVALLO; LLAMAS; VAZQUEZ, 2025).

For emerging economies receiving the shock, transmission likely extends beyond the direct trade margin through the global financial cycle and dominant-currency mechanisms (REY, 2015; MIRANDA-AGRIPPINO; REY, 2020; GOPINATH *et al.*, 2020). Empirical work documents that U.S. shocks affect emerging-market interest rates, exchange rates, inflation and output rapidly (CANOVA, 2005; MAćKOWIAK, 2007; AKıNCı, 2013), that risk-channel elasticities are larger in emerging markets than in advanced economies (KALEMLI-ÖZCAN, 2019), and that dollar appreciation correlates with contractions in global bank leverage and cross-border credit (BRUNO; SHIN, 2015). The IMF's October 2025 *Global Financial Stability Report* (International Monetary Fund. Monetary and Capital Markets Department, 2025) documents accumulated vulnerabilities in emerging markets where these channels can amplify external shocks through simultaneous FX and fixed-income repricing

For commodity-exporting economies, world-price shocks add a further propagation channel (FERNáNDEZ; SCHMITT-GROHé; URIBE, 2017), and the direction of the commodity-price response to a U.S. trade-policy shock is not pinned down theoretically: global-demand compression channels would lower commodity prices, while risk-premium and supply-friction channels would raise them. Iacoviello *et al.* (2024) document, in a historical panel of 44 economies, that geopolitical-risk shocks raise inflation and lower output while commodity prices tend to rise – a configuration of direct relevance given that the 2025 episode sits within a broader geoeconomic environment (AIYAR *et al.*, 2023;

[2] Auclert, Rognlie e Straub (2025) show that in a New Keynesian model with imported inputs, a tariff depresses output whenever the elasticity of substitution between domestic and foreign goods is below a weighted average of intertemporal and export-demand elasticities, a condition satisfied under realistic calibrations that recognize the importance of durable goods. Bianchi e Coulibaly (2025) show that the optimal monetary response of the issuing economy is expansionary because households fail to internalize that higher imports raise tariff revenue. Werning e Costinot (2025) link the trade-balance response to a permanent tariff to the Engel curve for aggregate imports and exports.

MOHR; TREBESCH, 2025). The joint dynamics of risk pricing and capital flows further imply that an originating shock that elevates global risk transmits to emerging markets through reorganization of gross flows, largely independently of the bilateral composition of trade (FORBES; WARNOCK, 2012).

Direct evidence on transmission to receiving economies remains scarce. Dynamic general-equilibrium simulations with sectoral reallocation and nominal wage rigidity assign Brazil a cumulative real-income loss close to zero through 2028, against losses of up to three percentage points for close U.S. partners such as Ireland, Mexico and Canada (RODRíGUEZ-CLARE; ULATE; VASQUEZ, 2025); these models operate strictly through the real channel and exclude financial transmission and policy responses by construction. On the financial front, Benguria e Saffie (2025) show that the unanticipated tariff component of the *Liberation Day* announcement produced an immediate decline in stock prices and a bilateral dollar depreciation in flexible-rate countries – contrary to the standard prediction of appreciation – which they rationalize through dollar invoicing and partial trade reallocation. Neither approach quantifies the macro-financial response of a specific large emerging economy to the 2025 shock.

2.2 Brazil's exposure: bifurcation and emerging-market evidence

Brazil's exposure to U.S. tariff shocks has a direct sectoral layer and an aggregate macro-financial layer; in the Brazilian case the asymmetry between the two is structural, as Table 1 documents in product-level trade data.

Table 1 – Share of Selected Goods in Brazilian Exports and US Demand (Average 2022–2025)

Product Description (SITC Group)	**US Import Weight (%)**	**Share in Total Exports (%)**	**Share / MAX (%)**
Highest Commercial Exposure to the US (Top 5)			
Other bast textile fibres, tow, etc.	100.00	0.03	0.19
Ships and other floating structures for breaking up	99.98	0.13	0.95
Raw silk (not thrown)	99.96	0.01	0.08
Coal briquettes and solid fuels	99.63	0.00	0.01
Copper mattes; cement copper	96.05	0.07	0.48
Core Export Basket (Top 5 in Total Exports)			
Soybeans	0.13	13.68	100.00
Crude petroleum and oils obtained from bituminous minerals	11.60	12.82	93.72
Iron ore and concentrates	1.30	8.69	63.52
Sugars and molasses	2.57	4.37	31.96
Maize (excluding sweet corn), unground	0.01	3.13	22.86

Source: Author's own elaboration based on ComexStat data.

Table 1 documents a bifurcation between the aggregate core of the export basket and the segments on which the 2025 U.S. tariffs directly impinge. The commodity core that historically determines Brazil's terms of trade and macroeconomic cycle – soy, crude oil, iron ore, sugar, corn – jointly accounts for over a third of total export value but exhibits mitigated exposure to the shock through distinct channels: agricultural and mining staples direct marginal fractions of their volume to the United States (e.g., soybeans at 0.13% and iron ore at 1.30%), and crude petroleum, despite a more relevant 11.60% U.S. destination share, remains sheltered by the near-zero tariff incidence applied to energy sectors.

By contrast, the segments most commercially exposed to the U.S. market direct majority shares of their output there – often above 90% – but individually represent sub-unitary fractions of the aggregate basket. Capital goods and intermediate-metallurgy products (aircraft, semi-finished iron and steel, pig iron) sit between the two extremes, with intermediate U.S. shares (30-70%) and individual basket weights of 1-2%. The bifurcation has two implications. First, it bounds the direct trade margin of transmission: tariff exposure falls on segments that are commercially exposed but macroeconomically marginal, while the commodity core that dominates the aggregate basket is sheltered by a combination of low or zero sectoral rates and predominantly extra-U.S. destination. Second, it shifts the burden of quantifying the macroeconomic impact onto financial and terms-of-trade channels.

A direct micro-founded reference point for the 2025 episode is Ribeiro (2025), who simulate the Section 232 steel tariff in a GDyn-GTAP computable general-equilibrium model and obtain sectoral export losses of 11.27% for ferrous metals and 36.2% in U.S. destination volumes alongside essentially nil aggregate effects (-0.01% GDP, -0.03% total exports). The GTAP framework captures only the purely real-commercial channel by construction; the SOE-BVAR proposed here covers a broader set of tariff-related disturbances and accommodates financial, risk-premium and expectations channels. The contrast between the two exercises is suggestive rather than decisive – the two estimands are not directly comparable in scope, horizon or methodology – but it is consistent with a substantial role for non-trade channels in the aggregate response.

The financial mechanism has been articulated previously for Brazil. Agénor, Alper e Silva (2018) study a small open economy with financial frictions, imperfect capital mobility and managed floating calibrated to middle-income emerging markets, showing that external shocks transmit sequentially through capital flows, the exchange rate, inflation, the policy rate, bank funding and credit, with the inflation response structurally delayed and possibly switching sign across horizons.[3] Janot, Garcia e Novaes (2021) complement this picture from the firm side, showing in difference-in-differences around the 2002 Brazilian currency crisis that exporters with currency mismatches reduced investment by 12.5 percentage points more than comparable firms, with the balance-sheet effect dominating the competitiveness effect from real depreciation. The implication is that exchange-rate depreciations in contexts of external stress should not be treated as expansionary *a priori*; Brazilian responses are left entirely unrestricted. [4]

[3] The post-1999 institutional context of this channel is established in Goldfajn e Minella (2005): the regime of floating exchange rate, inflation targeting and fiscal responsibility, in place for over two decades, has preserved the risk-premium $\rightarrow$ policy-rate $\rightarrow$ exchange-rate $\rightarrow$ output chain as the dominant external-shock transmission driver. Capeleti, Garcia e Sanches (2022) further document that Brazilian directed credit functioned effectively as a countercyclical buffer only in 2009, in a concentrated banking market – an element that operates in reduced form through the implicit policy reaction function captured by the BVAR.

[4] The intuition that Brazil's commodity-intensive basket should make commodity-price shocks the dominant external propagation channel deserves empirical caution. Curatola-Melo e Guimaraes (2025) show, using heteroscedasticity-based identification around USDA Grain Stocks Reports, that OLS estimates of commodity-price effects can overstate causal magnitudes substantially, and that effects on sovereign CDS and equity indices are similar across Latin American economies despite different export compositions – suggesting that the transmission mechanism operates primarily through correlated global financial conditions rather than directly through export revenue. The channel-grouped FEVD in Section 5, with separate "commodities" and "U.S. trade-policy" groupings, is designed precisely to distinguish these contributions. The closest existing exercise in scope and structural ambition is Garcia *et al.* (2024), who construct vulnerability indices for 24 economies paired with the United States using time-varying-parameter BVARs with block exogeneity but identify U.S. shocks recursively through U.S. GDP, inflation and the policy rate – without explicit

2.3 Transmission channels and testable implications

The empirical analysis is organized around three implications that emerge from the literature reviewed above and that the SOE-BVAR is positioned to evaluate.

First, if U.S. import-price shocks capture a tariff-related trade-price disturbance, their effects can in principle operate through two distinct margins. A narrow trade-cost interpretation would predict that the response concentrates in Brazil's trade position – measured by the log difference between exports and imports – with limited propagation to other macroeconomic variables. A broader macro-financial interpretation would predict that responses also appear in the real effective exchange rate, domestic prices, the policy rate and output, even when the direct-trade margin is bounded by sectoral composition. The bifurcation documented in Subsection 2.2 bounds the direct-trade margin *ex ante*, but does not by itself pin down the magnitude of the macro-financial response, which the empirical exercise is designed to recover.

Second, U.S. trade-policy uncertainty and U.S. import prices need not transmit through identical channels. Uncertainty primarily affects expectations, investment and risk pricing, while import-price shocks combine a realized trade-price component with the same expectations and risk-pricing channels. The two shocks therefore provide an internal cross-check: similar macro-financial profiles across both, combined with a differentiated trade-ratio response, would support a reading in which the macro-financial channel is distinct from the realized-trade channel; similar profiles across all dimensions would point to a common transmission mechanism; differentiated profiles across all dimensions would point against the macro-financial interpretation.

Third, the margin through which Brazil adjusts to tariff-related shocks is itself an open question. A conventional emerging-market interpretation would predict persistent exchange-market stress in response to adverse external shocks. An alternative reading – in which Brazil absorbs the shock primarily through relative prices, inflation dynamics and monetary-policy responses – would predict a more muted exchange-market-pressure response alongside meaningful adjustment in other macro-financial variables. The channel-grouped variance decomposition is designed to discriminate between these alternatives by quantifying how the variance of each Brazilian variable is allocated across transmission channels.

These implications deliberately avoid imposing a purely contractionary interpretation. For Brazil, the sign of the output response is theoretically ambiguous: a tariff-related shock can worsen the trade ratio and still raise measured aggregate activity in the short run if relative-price effects, commodity-income effects, expenditure switching or domestic-demand responses dominate the direct export contraction within the horizon studied. The empirical strategy therefore leaves Brazilian responses unrestricted in the SOE-BVAR and treats the signs, magnitudes and persistence of the impulse responses as empirical outcomes to be interpreted *ex post* against the theoretical channels reviewed above.

trade-policy content – and aggregate impulse responses without decomposing variance by transmission channel. The present paper isolates a specific class of shocks within a coherent macro-financial environment and quantifies its channel-decomposed footprint on Brazil, complementing the time-variation approach.

3 Data and empirical strategy

3.1 Data

The empirical analysis uses monthly data from January 2010 to December 2025 and is organized around two blocks. The first is an external U.S./global block, designed to capture the dominant international environment faced by Brazil. It includes U.S. trade-policy uncertainty (US.tpu), U.S. import prices (US.pimp), global financial risk measured by the VIX (US.vix), commodity prices (US.pcom), U.S. activity (US.y) and the U.S. policy rate (US.r). The second is the Brazilian block, which includes exchange-market pressure (BR.emp), the real effective exchange rate (BR.reer), the Brazilian policy rate (BR.r), domestic prices (BR.p), output (BR.y) and a trade-ratio measure (BR.trd).

Series, sources and transformations are detailed in the Online Supplement (Section S0)[5]. The benchmark sample covers 192 monthly observations (2010:01–2025:12). All variables are transformed according to the estimation database, adjusted for the Covid-19 volatility episode, and standardized before estimation in the benchmark specification. Standardization allows impulse responses to be interpreted in comparable posterior standard-deviation units across variables measured in different scales, including rates, price indexes, real activity indicators and financial-stress measures. The Covid-19 adjustment follows the logic of treating the pandemic as an exceptional volatility episode rather than as an ordinary realization of the data-generating process, as recommended in recent VAR applications after March 2020 (LENZA; PRIMICERI, 2022).

The exchange-market-pressure index is constructed following Park e Mercado (2014) and Balakrishnan *et al.* (2009) as the difference between the standardized month-on-month depreciation of the BRL/USD nominal exchange rate and the standardized month-on-month change in international reserves, thus capturing the dual manifestation of external financial stress in currency-user economies (depreciation pressure and reserve depletion). The trade ratio is $\log(X_t) - \log(M_t)$ computed from export and import quantum indices from IpeaData. A decline in this variable therefore represents a deterioration in Brazil's relative trade position. This measure is useful because the paper is interested not only in export losses but also in the broader reallocation of trade flows induced by tariff-related external disturbances.

3.2 A small open-economy BVAR with a dominant U.S./global block

The empirical strategy builds on the VAR tradition introduced by Sims (1980), which treats macroeconomic variables as jointly dynamic and uses impulse responses to trace the propagation of shocks over time. Because the model is estimated with monthly data and a relatively rich set of domestic and external variables, we use a Bayesian specification. Bayesian VARs discipline parameter uncertainty through shrinkage priors and are especially useful when the number of coefficients is large relative to the available time-series observations (LITTERMAN, 1986; SIMS; ZHA, 1998; BAńBURA; GIANNONE; REICHLIN, 2010).

The small open-economy structure follows the block-exogeneity logic applied to similar emerging-economy settings by Cushman e Zha (1997), Zha (1999), Canova (2005) and Maćkowiak (2007).

[5] The supplement has been fully anonymized for blind review purposes.

Table 2 – Benchmark SOE-BVAR specification.

Feature	Benchmark specification
Frequency and sample	Monthly, January 2010–December 2025 (192 observations)
External block	US.tpu, US.pimp, US.vix, US.pcom, US.y, US.r
Brazilian block	BR.emp, BR.reer, BR.r, BR.p, BR.y, BR.trd
Small open-economy restriction	U.S./global block exogenous to Brazil
External ordering	US.tpu → US.pimp → US.vix → US.pcom → US.y → US.r
Lag structure	One lag in the external and Brazilian blocks
Prior tightness	$\lambda = 0.20$
Benchmark treatment	Covid-volatility adjustment and standardization before estimation
Main shock	U.S. import-price shock (US.pimp)
Complementary tariff-related shock	U.S. trade-policy uncertainty shock (US.tpu)
Robustness checks	Alternative lag length; tighter and looser priors; pandemic treatment (Covid dummies, no adjustment); standardization; alternative recursive orderings; trade disaggregation; pre-2025 sample; placebo shocks; no contemporaneous external response

Notes: The benchmark SOE-BVAR treats the U.S./global block as exogenous to Brazil, while the Brazilian block responds contemporaneously and dynamically to external shocks. The benchmark uses standardized variables after the transformations and Covid-volatility adjustment described in Table S1. Domestic signs are not imposed.

Let $X_t^{\text{US}} \in \mathbb{R}^{n_{\text{US}}}$ denote the U.S./global block and $X_t^{\text{BR}} \in \mathbb{R}^{n_{\text{BR}}}$ the Brazilian block, with $n_{\text{US}} = n_{\text{BR}} = 6$. The two blocks are defined as $X_t^{\text{US}} = [\text{US.tpu}_t, \text{US.pimp}_t, \text{US.vix}_t, \text{US.pcom}_t, \text{US.y}_t, \text{US.r}_t]'$ and $X_t^{\text{BR}} = [\text{BR.emp}_t, \text{BR.reer}_t, \text{BR.r}_t, \text{BR.p}_t, \text{BR.y}_t, \text{BR.trd}_t]'$.

The external block follows a Bayesian VAR:

$$X_t^{\text{US}} = c^{\text{US}} + \sum_{\ell=1}^{p} A_\ell^{\text{US}} X_{t-\ell}^{\text{US}} + u_t^{\text{US}}, \qquad u_t^{\text{US}} \sim \mathcal{N}(0, \Sigma^{\text{US}}). \tag{1}$$

The Brazilian block follows a Bayesian VARX specification in which contemporaneous and lagged external variables enter as exogenous regressors:

$$X_t^{\text{BR}} = c^{\text{BR}} + \sum_{\ell=1}^{p} A_\ell^{\text{BR}} X_{t-\ell}^{\text{BR}} + B_0 X_t^{\text{US}} + \sum_{\ell=1}^{p} B_\ell X_{t-\ell}^{\text{US}} + u_t^{\text{BR}}, \qquad u_t^{\text{BR}} \sim \mathcal{N}(0, \Sigma^{\text{BR}}). \tag{2}$$

This structure imposes a small open-economy restriction. The U.S./global block evolves independently of Brazilian variables, while Brazil responds contemporaneously (via B_0) and dynamically (via $\{B_\ell\}$ and $\{A_\ell^{\text{BR}}\}$) to external shocks. This assumption is appropriate because the paper studies shocks originating in the center of the global system and their transmission to an emerging economy whose domestic variables are unlikely to affect U.S. trade-policy uncertainty, global risk, U.S. import prices, commodity prices or U.S. monetary conditions at the monthly frequency.

The contemporaneous term $B_0 X_t^{\text{US}}$ in equation (2) is central to the benchmark. Financial and price shocks can affect Brazil within the same month through exchange rates, risk premia, import prices, commodity prices and expectations. However, because contemporaneous external effects may strengthen short-run transmission, we estimate a robustness specification that excludes B_0, allowing Brazil to respond only to lagged external variables. This provides a demanding test of whether the results depend on immediate external adjustment or survive under a more restrictive dynamic specification.

The benchmark uses one lag in each block ($p = 1$), with robustness to two lags. The model is estimated using a conjugate Matrix-Normal Inverse-Wishart posterior with shrinkage priors centered on persistent own dynamics. The benchmark prior tightness is $\lambda = 0.20$, with robustness exercises

using tighter ($\lambda = 0.10$) and looser ($\lambda = 0.40$) priors. This design balances parsimony and flexibility: it keeps the benchmark model interpretable while allowing the robustness exercises to test whether the main results depend on lag length or prior tightness.

3.3 Identification of external shocks

External shocks are identified recursively within the U.S./global block. Let $u_t^{US} = P\varepsilon_t^{US}$, where P is the lower-triangular Cholesky factor of Σ^{US} and ε_t^{US} is the vector of structural innovations. The benchmark ordering is US.tpu $\rightarrow$ US.pimp $\rightarrow$ US.vix $\rightarrow$ US.pcom $\rightarrow$ US.y $\rightarrow$ US.r. This ordering treats trade-policy uncertainty as the upstream policy-information component, followed by U.S. import prices, global financial risk, commodity prices, U.S. activity and the U.S. policy rate. The central shock in the paper is the U.S. import-price shock. It is the preferred empirical proxy for tariff-related trade-price transmission because tariff measures are expected to affect import-price dynamics more directly than broad U.S. output or interest rates. This choice is also consistent with evidence that recent U.S. tariff episodes affected import prices and generated substantial tariff pass-through at the border (AMITI; REDDING; WEINSTEIN, 2019; FAJGELBAUM *et al.*, 2020; CAVALLO *et al.*, 2021).

We also estimate responses to U.S. trade-policy uncertainty as a complementary tariff-related shock. This distinction is important. Import-price shocks capture realized trade-price pressure, while trade-policy uncertainty captures expectations and uncertainty around the future policy environment. Both are related to tariff episodes, but they need not generate the same transmission mechanism. The uncertainty channel is motivated by evidence that trade-policy uncertainty can affect firm entry, investment and real activity before trade flows fully adjust (HANDLEY; LIMãO, 2017; CALDARA *et al.*, 2020).

Additional shocks are used to separate the baseline mechanism from other external disturbances. The VIX shock captures global financial risk. The commodity-price shock captures an alternative external channel that is especially relevant for Brazil's commodity-intensive export structure. U.S. output and U.S. interest-rate shocks are used as placebo or comparison shocks, testing whether the baseline results are specific to tariff-related disturbances or are instead generated by generic U.S. macroeconomic innovations. Brazilian variables are not sign-restricted; the signs, magnitudes and persistence of their responses are empirical outcomes, not imposed assumptions.

3.4 Posterior inference, accumulated effects and channel decomposition

For each shock, we report posterior median impulse responses and 68% and 90% credible intervals. The 68% interval summarizes the central posterior mass, while the 90% interval provides a more conservative assessment of uncertainty. Responses are reported in standardized units in the benchmark specification.

Because individual monthly responses may be noisy even when the overall dynamic effect is economically meaningful, we also compute accumulated and average responses over three windows: 0–3, 0–6 and 0–12 months. For response variable j, shock s, and horizon window $[h_1, h_2]$, the accumulated response is defined as

$$CA^s_{j,h_1:h_2} = \sum_{h=h_1}^{h_2} IRF^s_{j,h}, \tag{3}$$

where $IRF^{s}_{j,h}$ denotes the impulse response of variable j to shock s at horizon h. The average response is

$$AA^{s}_{j,h_1:h_2} = \frac{1}{h_2 - h_1 + 1} \sum_{h=h_1}^{h_2} IRF^{s}_{j,h}. \tag{4}$$

The posterior distribution of these accumulated and average responses is computed across posterior draws. We report posterior medians, credible intervals and posterior sign probabilities, including $\Pr(CA > 0)$ and $\Pr(CA < 0)$. These probabilities are useful because the model is Bayesian and the relevant inferential question is whether posterior mass is concentrated on one side of zero.

To quantify transmission channels, we compute forecast-error variance decompositions by grouping the structural shocks $\varepsilon^{\text{US}}_t$ identified in subsection 3.3, together with the Brazilian innovations u^{BR}_t from (2), into five categories:

$$g \in \{\text{U.S. trade policy},\ \text{global financial risk},\ \text{commodities},\ \text{U.S. macro-policy},\ \text{Brazil domestic}\}. \tag{5}$$

The U.S. trade-policy group includes US.tpu and US.pimp. The global financial group includes US.vix. The commodity group includes US.pcom. The U.S. macro-policy group includes US.y and US.r. The domestic group includes Brazilian shocks.

For each Brazilian response variable j, group g, and forecast horizon H, the grouped variance share is computed as

$$FEVD_{j,g}(H) = \frac{\sum_{s \in g} \sum_{h=0}^{H} \left(IRF^{s}_{j,h} \right)^2}{\sum_{s \in S} \sum_{h=0}^{H} \left(IRF^{s}_{j,h} \right)^2}, \tag{6}$$

where S denotes the full set of external and domestic shocks. This decomposition allows us to evaluate whether fluctuations in Brazilian variables are primarily associated with tariff-related U.S. shocks, global financial risk, commodity shocks, U.S. macro-policy disturbances or domestic Brazilian innovations.

3.5 Robustness design

Robustness, falsification and placebo exercises vary the lag length, prior tightness, Covid-19 treatment, standardization, recursive ordering and trade specification; estimate a pre-2025 sample and a specification with no contemporaneous external response ($B_0 = 0$ in equation (2)); and replace the import-price shock with VIX, commodity-price, U.S. output and U.S. policy-rate shocks to assess whether the baseline transmission pattern is specific to tariff-related disturbances. Results are summarized in Section 6 and reported in full in the Online Supplement.

4 Baseline results: trade-price shocks and macro-financial transmission

4.1 External propagation of a U.S. import-price shock

Figure 1 reports the response of the U.S./global block to a U.S. import-price shock. The shock raises U.S. import prices persistently and is accompanied by increases in trade-policy uncertainty, global financial risk and commodity prices. This joint movement is important for interpretation. The shock should not be read as a mechanical coefficient on a single legal tariff measure. Instead, it captures a broader tariff-related trade-price disturbance in which import-price pressures interact with uncertainty, financial conditions and global relative prices.

This interpretation is consistent with the high border pass-through and limited foreign-exporter absorption documented for the 2018 U.S. tariff episodes (FAJGELBAUM *et al.*, 2020; CAVALLO *et al.*, 2021), which support the use of U.S. import prices as the empirical proxy for realized trade-price pressure.

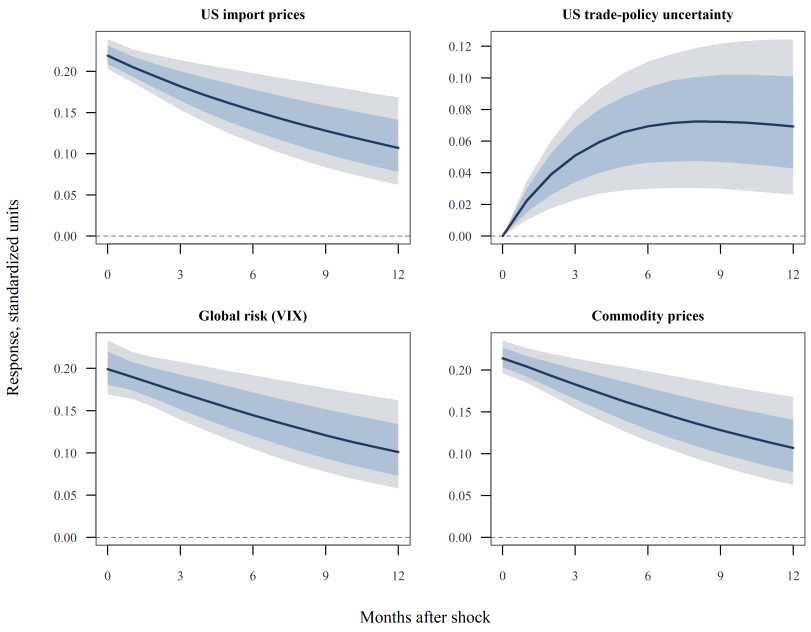


Figure 1 – External block responses to a U.S. import-price shock.

Notes: The figure reports posterior median responses from the benchmark SOE-BVAR model. Shaded areas denote 68% and 90% credible intervals. Responses are expressed in standardized units. The horizontal axis measures months after the shock. Source: authors' estimates.

4.2 Brazilian transmission of a U.S. import-price shock

Figure 2 reports the Brazilian responses to the U.S. import-price shock. The trade ratio falls, indicating a deterioration in Brazil's relative trade position. At the same time, the real effective exchange rate appreciates persistently – an increase in the IMF REER index corresponds to a loss of trade competitiveness through a stronger Brazilian real relative to a basket of trading partners – while domestic prices, the policy rate and output rise persistently. Exchange-market pressure reacts weakly and remains close to zero over most of the horizon.

Table 3 confirms the magnitude and precision of these responses. Over the 0–12 month window, the cumulative response of the trade ratio is negative (-0.944), with a 90% credible interval of $[-1.455, -0.440]$ and posterior probability $\Pr(CA < 0) = 1.00$. The corresponding cumulative responses of the real effective exchange rate, domestic prices, the policy rate and output are positive and precisely estimated: 1.997 for REER, 1.829 for prices, 1.002 for the policy rate and 1.982 for output, all with posterior sign probabilities equal to one. By contrast, the exchange-market-pressure response is small and statistically weak, with a 0–12 cumulative response of 0.040 and $\Pr(CA > 0) = 0.58$.

The joint pattern admits a coherent interpretation. The trade ratio deteriorates, confirming that the direct trade channel is present: tariff-related U.S. import-price shocks worsen Brazil's relative trade position, as the bifurcation documented in Subsection 2.2 would predict for the directly exposed manufacturing and intermediate-metallurgy segments. The remaining responses, however, are consistent with the terms-of-trade interpretation outlined in Subsection 2.3. The U.S. import-price shock is accompanied by an increase in global commodity prices (Figure 1); for a commodity-intensive export economy, this raises export revenue per unit and improves the terms of trade, which translates into real appreciation of the domestic currency – the standard mechanism whereby world commodity shocks transmit to commodity-exporting economies (FERNáNDEZ; SCHMITT-GROHé; URIBE, 2017). The conjunction of commodity-price increases and dollar appreciation around adverse external shocks is documented in historical panels by Iacoviello *et al.* (2024), a pattern consistent with risk-premium and supply-friction channels dominating global-demand compression in the determination of commodity prices over the horizons studied. The result is that, on the activity side, commodity-income and expenditure-switching effects appear to dominate the direct export contraction within the horizon studied, generating the positive short-run output response. On the price side, the increase in domestic inflation is consistent with the dominant-currency mechanism of Gopinath *et al.* (2020): dollar-invoiced commodity and tradable-goods prices feed through to local prices even when the bilateral exchange rate appreciates. The policy rate rises in response, consistent with the Brazilian inflation-targeting regime in place since 1999 (GOLDFAJN; MINELLA, 2005).

This reading is consistent with the literature on protectionism in open economies, with one important qualification. Barattieri, Cacciatore e Ghironi (2018) show that protectionism tends to be inflationary and recessionary in the small open economy that imposes the tariff, while Furceri *et al.* (2022) find that tariff increases are associated with real exchange-rate appreciation, output losses and limited effects on the trade balance in the imposing country. The Brazilian response in this paper shares the inflationary and trade-balance components of that literature, but the sign of the activity response differs because Brazil is not the country imposing the tariff: the shock here is an external U.S. trade-price disturbance hitting a commodity-exporting emerging economy whose terms of trade improve as a side effect of higher U.S. import prices and the joint commodity-price response. The positive short-run output response should therefore not be interpreted as evidence that tariffs are welfare-improving for Brazil, that directly affected sectors benefit, or that this configuration is desirable. It indicates that, within the 0–12 month horizon, the commodity-income channel dominates the direct export contraction. Whether this dominance survives at longer horizons or under different commodity-price configurations is a substantive open question that the present specification cannot

resolve.

The weakness of the exchange-market-pressure response is the other distinctive feature of the transmission. Under a conventional emerging-market external-stress narrative, an adverse U.S. shock would be expected to depreciate the currency and deplete reserves, manifested as a positive EMP response. The data show neither: the BRL appreciates (REER rises) and EMP remains close to zero. This is consistent with the terms-of-trade resolution above: when the shock raises commodity prices, the income effect dominates and conventional external-stress signatures do not materialize. The forecast-error variance decomposition in Section 5 quantifies how concentrated this conclusion is across transmission channels.

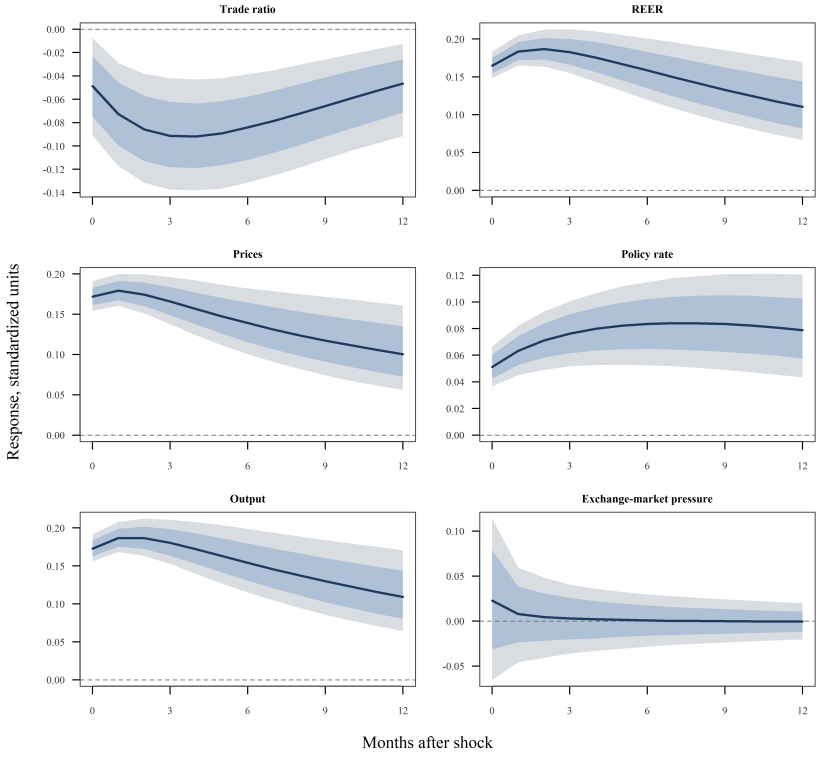


Figure 2 – Brazilian transmission of a U.S. import-price shock.

Notes: The figure reports posterior median responses from the benchmark SOE-BVAR model. Shaded areas denote 68% and 90% credible intervals. Responses are expressed in standardized units. An increase in REER corresponds to an appreciation of the Brazilian real against the basket of trading partners (IMF EER index convention). The horizontal axis measures months after the shock. Source: authors' estimates.

4.3 Trade-policy uncertainty as a complementary transmission channel

Figure 3 reports the Brazilian response to a U.S. trade-policy uncertainty shock. The pattern is similar to the import-price shock for several macro-financial variables, but the trade-ratio response is markedly weaker and statistically imprecise. Table 3 shows that the cumulative 0–12 response of the trade ratio is -0.021, with a wide credible interval $[-0.585, 0.533]$ and $\Pr(CA < 0) = 0.53$. In contrast, REER, prices, the policy rate and output respond positively and persistently, with posterior sign probabilities equal to one. Exchange-market pressure again remains weaker than the other macro-financial responses.

The contrast between the two tariff-related shocks is the second testable implication of Subsection 2.3, and the data support its substantive content. U.S. import-price shocks capture realized

trade-price pressure and produce a robust, statistically tight trade-ratio response; U.S. trade-policy uncertainty captures expectations and information about the future policy environment and does not produce an immediate, statistically meaningful deterioration of the trade ratio. Yet both shocks generate similar macro-financial responses – real appreciation, higher domestic prices, higher policy rates, higher activity – which indicates that the macro-financial transmission profile is shared across the two tariff-related disturbances. This is consistent with Caldara *et al.* (2020), who show that trade-policy uncertainty affects investment and aggregate activity, and with Handley e Limão (2017), who emphasize that uncertainty about trade policy can alter firm decisions before trade quantities fully adjust.

The VIX shock provides an additional contrast and helps separate the tariff-related mechanism from a generic global-risk channel. As reported in Figure S3, a pure global-risk shock generates more modest Brazilian responses and does not reproduce the full pattern observed after import-price and trade-policy uncertainty shocks. This matters because it indicates that the baseline result is not simply a generic response to external financial stress. Akıncı (2013) shows that global financial shocks explain an important share of macroeconomic fluctuations in emerging economies; the evidence here suggests that tariff-related shocks have a more specific transmission profile, combining a realized trade-price component (for import-price shocks), an expectations component (for trade-policy uncertainty) and a terms-of-trade transmission mediated by commodity prices.

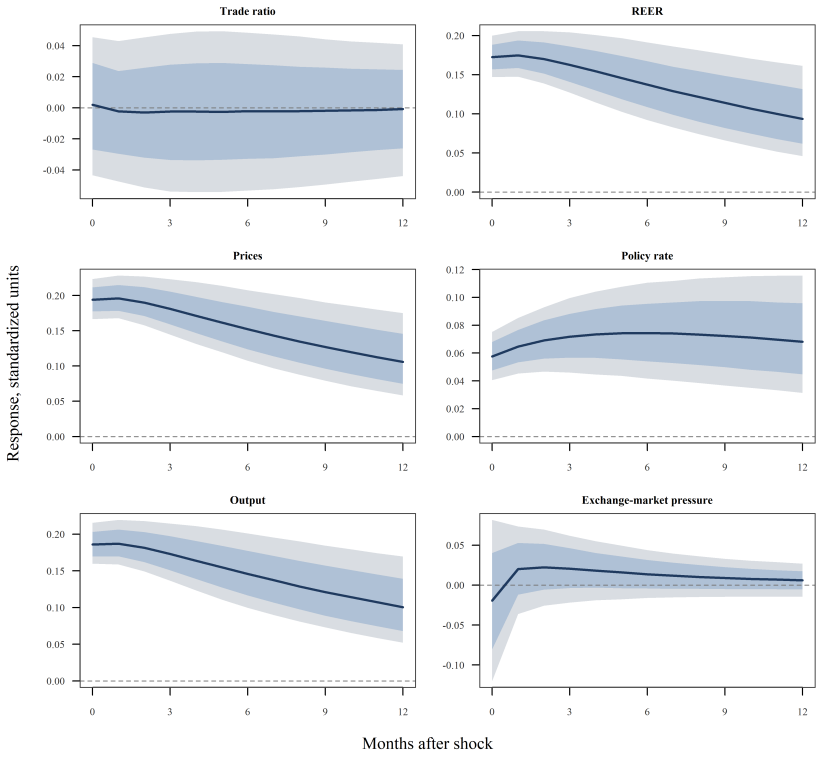


Figure 3 – Brazilian transmission of a U.S. trade-policy uncertainty shock.

Notes: Posterior median responses to a one-standard-deviation U.S. trade-policy uncertainty shock. Shaded areas report 68% and 90% credible intervals. Responses are in standardized units; horizon in months. An increase in REER corresponds to an appreciation of the Brazilian real against the basket of trading partners (IMF EER index convention). Dashed line denotes zero. Source: authors' estimates.

4.4 Cumulative effects and interpretation

Table 3 reports cumulative Brazilian responses over the 0–3, 0–6 and 0–12 month windows for both tariff-related shocks. Three patterns emerge. The trade ratio deteriorates robustly under US.pimp ($\Pr(CA < 0) = 1.00$ at 0–12 months) but not under US.tpu ($\Pr(CA < 0) = 0.53$). REER, prices, the policy rate and output respond positively and persistently to both shocks ($\Pr(CA > 0) = 1.00$ in every 0–12 cell). Exchange-market pressure is small and imprecise in both columns. The asymmetry across response variables and the contrast between US.pimp and US.tpu on the trade ratio support the second testable implication of Subsection 2.3: the macro-financial transmission profile is shared across the two shocks even when the realized-trade component is not.

Table 3 – Cumulative Brazilian responses to tariff-related U.S. shocks.

Shock	Brazilian response	0–3 months	0–6 months	0–12 months	Pr(sign), 0–12
U.S. import-price shock					
	Trade ratio	−0.299 [−0.470, −0.127]	−0.568 [−0.852, −0.265]	−0.944 [−1.455, −0.440]	$\Pr(<0) = 1.00$
	REER	0.718 [0.639, 0.806]	1.219 [1.043, 1.413]	1.997 [1.571, 2.500]	$\Pr(>0) = 1.00$
	Prices	0.691 [0.612, 0.779]	1.135 [0.956, 1.332]	1.829 [1.399, 2.341]	$\Pr(>0) = 1.00$
	Policy rate	0.261 [0.185, 0.339]	0.507 [0.350, 0.664]	1.002 [0.648, 1.370]	$\Pr(>0) = 1.00$
	Output	0.727 [0.648, 0.816]	1.217 [1.036, 1.417]	1.982 [1.545, 2.501]	$\Pr(>0) = 1.00$
	Exchange-market pressure	0.040 [−0.147, 0.224]	0.044 [−0.218, 0.303]	0.040 [−0.329, 0.408]	$\Pr(>0) = 0.58$
U.S. trade-policy uncertainty shock					
	Trade ratio	−0.008 [−0.180, 0.170]	−0.015 [−0.330, 0.296]	−0.021 [−0.585, 0.533]	$\Pr(<0) = 0.53$
	REER	0.679 [0.569, 0.806]	1.118 [0.886, 1.386]	1.786 [1.278, 2.409]	$\Pr(>0) = 1.00$
	Prices	0.761 [0.646, 0.895]	1.244 [1.011, 1.525]	1.988 [1.496, 2.641]	$\Pr(>0) = 1.00$
	Policy rate	0.264 [0.182, 0.349]	0.484 [0.319, 0.666]	0.916 [0.548, 1.327]	$\Pr(>0) = 1.00$
	Output	0.727 [0.612, 0.860]	1.190 [0.957, 1.463]	1.904 [1.389, 2.547]	$\Pr(>0) = 1.00$
	Exchange-market pressure	0.046 [−0.161, 0.234]	0.091 [−0.197, 0.372]	0.138 [−0.259, 0.540]	$\Pr(>0) = 0.74$

Notes: Entries are cumulative posterior medians, with 90% credible intervals in brackets. Responses are in standardized units. The last column reports the posterior probability of the 0–12 month cumulative response having the indicated sign. An increase in REER corresponds to an appreciation of the Brazilian real against the basket of trading partners (IMF EER index convention). Source: authors' estimates.

4.5 Positioning relative to the literature

The results complement the tariff literature in two ways. First, they confirm that tariff-related shocks are closely linked to price and trade adjustments, as documented in studies of U.S. tariff pass-through and protectionism (AMITI; REDDING; WEINSTEIN, 2019; AMITI; REDDING; WEINSTEIN, 2020; FAJGELBAUM *et al.*, 2020; CAVALLO *et al.*, 2021; BOER; RIETH, 2024; FAJGELBAUM; KHANDELWAL, 2026). Second, they shift the focus from the tariff-imposing country to an emerging economy receiving the external shock. Most existing evidence emphasizes the effects of tariffs on the country imposing them; the results here show that tariff-related U.S. disturbances also propagate to a large emerging economy, with a transmission profile mediated by the commodity-intensive composition of the export basket.

The findings also qualify the global financial-cycle interpretation. Global risk matters for emerging economies (REY, 2015; MIRANDA-AGRIPPINO; REY, 2020; AKıNCı, 2013), but the Brazilian responses to tariff-related shocks documented here are not reducible to a VIX shock. The evidence points to a hybrid mechanism in which trade-price shocks originating in the United States interact with uncertainty, commodity prices and domestic monetary responses – consistent with the dominant-currency

view that international prices transmit external shocks beyond bilateral trade shares (GOPINATH *et al.*, 2020) and with the world-price channel for commodity-exporting economies (FERNáNDEZ; SCHMITT-GROHé; URIBE, 2017). For the class of trade-policy shocks studied here, the terms-of-trade channel appears to dominate the conventional risk-pricing and balance-sheet channels of the global financial cycle in the short run, which we read as evidence in favor of the macro-financial interpretation outlined in Subsection 2.3.

5 Channel decomposition

Impulse responses describe the dynamic profile of the shock, but they do not quantify the relative importance of each transmission channel. To assess whether Brazilian fluctuations are mainly associated with tariff-related U.S. shocks, global financial risk, commodity prices, U.S. macro-policy shocks or domestic disturbances, we compute forecast-error variance decompositions by channel as defined in equation (6). This exercise follows a long tradition in open-economy VAR analysis, where variance decompositions are used to evaluate the contribution of external shocks to domestic macroeconomic fluctuations. In closely related settings, Canova (2005) studies the transmission of U.S. shocks to Latin America, and Akıncı (2013) shows that global financial-risk shocks explain an important share of macroeconomic fluctuations in emerging economies.

Figure 4 reports the posterior median forecast-error variance shares at horizons of 3, 6 and 12 months. The corresponding numerical estimates are reported in Table S1. The decomposition reveals a stark asymmetry across Brazilian variables. The U.S. trade-policy group, which combines U.S. import-price and trade-policy uncertainty shocks, explains the overwhelming majority – above 90% across all horizons – of the forecast-error variance of Brazilian output, domestic prices and the real effective exchange rate. The policy rate is more mixed: the U.S. trade-policy group rises from approximately 32% at the three-month horizon to about 50% at twelve months, while the remainder is largely accounted for by domestic disturbances, with a small contribution from global financial shocks. By contrast, exchange-market pressure is almost entirely explained by domestic disturbances (above 98% at all horizons), and the trade ratio retains a substantial domestic component – between 85% and 93%, with the U.S. trade-policy share rising modestly from around 6% at three months to about 15% at twelve.

Two features of the decomposition deserve emphasis. First, the share attributed to the commodity group is small across all Brazilian variables. This may appear, at first reading, to be in tension with the terms-of-trade interpretation advanced in Subsection 4.2, which emphasized commodity-price dynamics as the mediating channel for the real-appreciation and positive-output response. The tension is, however, only apparent. The recursive ordering exposed in subsection 3.3 places US.pcom after US.tpu, US.pimp and US.vix, so that the commodity group in Figure 4 captures only the variance originating in commodity-price innovations orthogonal to the upstream trade-policy block. The portion of commodity-price variation that responds endogenously to a U.S. import-price shock – which is what mediates transmission to Brazil in the impulse-response analysis – is attributed by construction to the U.S. trade-policy group. The decomposition therefore says that, conditional on the identification scheme, fluctuations in commodity prices that are independent of U.S. trade-policy disturbances are

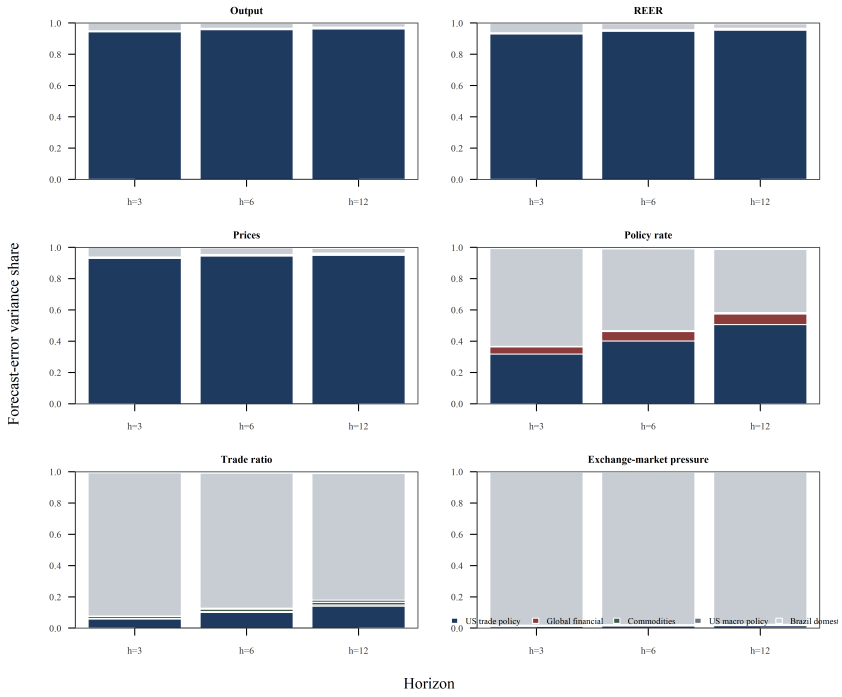


Figure 4 – Forecast-error variance decomposition by transmission channel.

Notes: Bars report posterior median forecast-error variance shares at horizons of 3, 6 and 12 months. Shocks are grouped into U.S. trade policy (US.tpu and US.pimp), global financial risk (US.vix), commodities (US.pcom), U.S. macro-policy (US.y and US.r) and Brazilian domestic shocks, as defined in equation (5). Source: authors' estimates.

not a quantitatively important driver of Brazilian macroeconomic variability. Commodity prices remain a transmission channel for the tariff-related shock; they are not, in this sample, an independent source of macroeconomic variation.

Second, the global financial-risk group (US.vix) contributes a small share to all Brazilian variables. This is consistent with the broader interpretation of the paper. The tariff-related transmission documented in Section 4 is not a manifestation of generic global financial stress: a VIX shock by itself does not reproduce the baseline response pattern, and it does not explain a large share of the forecast-error variance of any Brazilian macro-financial variable. Akıncı (2013) documents an important role for global financial-risk shocks in emerging-market fluctuations; the present results are not in conflict with that finding, but they indicate that the channel through which tariff-related U.S. shocks reach Brazil is distinct from the channel through which generic risk shocks operate.

The decomposition refines the interpretation of the impulse responses. The evidence does not support a narrow view in which tariff-related U.S. shocks affect Brazil mainly through direct bilateral trade exposure: the trade ratio retains a large domestic component, consistent with the bifurcation documented in Subsection 2.2 that bounds the direct-trade margin. Nor does it support a classic emerging-market stress narrative in which external shocks operate primarily through exchange-market pressure: EMP is almost entirely domestic. Instead, the decomposition points to a broader macro-financial mechanism in which tariff-related U.S. shocks are quantitatively dominant for the macroeconomic core – output, prices and the real exchange rate – while exchange-market pressure and the trade ratio remain largely governed by domestic shocks. The policy rate sits in between, reflecting both the central bank's reaction to external shocks and the persistence of domestic monetary-policy dynamics. This

pattern is consistent with the dominant-currency interpretation that international prices and imported inputs transmit external disturbances beyond bilateral trade shares (GOPINATH *et al.*, 2020) and with the world-price channel of Fernández, Schmitt-Grohé e Uribe (2017) for commodity-exporting economies – both operating, in this case, through the U.S. trade-policy block rather than through standalone commodity or risk shocks.

The finding that exchange-market pressure remains almost entirely domestic has a substantive implication for how external vulnerability is conceptualized. Brazil can experience meaningful macro-financial transmission from U.S. trade-policy shocks – visible in output, prices, the policy rate and the real exchange rate – without a large or persistent exchange-market-pressure episode. External vulnerability, in this case, is not revealed by exchange-market stress but by the adjustment of relative prices, domestic inflation, interest rates and output. This is why the paper interprets the Brazilian response as macro-financial in a broad sense, rather than as a classic sudden-stop or exchange-market-pressure mechanism.

6 Robustness and alternative-shock evidence

This section evaluates whether the baseline interpretation depends on specific modeling choices. We assess the robustness of this interpretation along five families of perturbations, summarized below. The full set of impulse-response figures, model-stability diagnostics and tabulated cumulative responses for every alternative specification is reported in the Online Supplement (Sections S1–S4); we report here only the qualitative outcome of each exercise.

Specification choices. Varying the lag structure from one to two lags, tightening or loosening the prior ($\lambda \in \{0.10, 0.40\}$ instead of the benchmark 0.20), and removing the standardization step before estimation leave the baseline pattern qualitatively unchanged: the trade ratio deteriorates after a U.S. import-price shock, the real effective exchange rate appreciates, domestic prices, the policy rate and output rise persistently, and exchange-market pressure remains weak. Magnitudes shift, but the joint sign pattern and the asymmetry between macro-financial responses and EMP are preserved.

Treatment of the Covid-19 period. The benchmark follows Lenza e Primiceri (2022) and treats the pandemic as an exceptional volatility episode. Alternative treatments – Covid dummies and no pandemic-volatility adjustment – affect magnitudes, especially for prices, interest rates and the real exchange rate, but preserve the qualitative pattern. Tariff-related shocks continue to affect trade, prices, monetary conditions and output more strongly than exchange-market pressure regardless of how the pandemic is handled.

Identification ordering. The benchmark recursive ordering places trade-policy uncertainty first and import prices second. Reordering the external block so that the VIX precedes import prices, or so that import prices come first, leaves the U.S. import-price shock as the clearest and most stable tariff-related disturbance. The trade-policy uncertainty shock is more sensitive to ordering, which is consistent with its interpretation as an expectations and information shock rather than a realized trade-price disturbance.

Trade specification and contemporaneous transmission. Replacing the aggregate trade ratio with disaggregated export and import variables shows that tariff-related shocks affect the relative

composition of trade flows, not only the aggregate ratio. A more demanding check sets $B_0 = 0$ in equation (2), allowing Brazil to respond only to lagged external conditions; some short-run responses are attenuated, as expected, but the main signs and economic interpretation are broadly consistent. Part of the transmission is therefore immediate (consistent with a macro-financial channel operating through prices, risk premia, exchange rates and expectations), but the result is not an artifact of contemporaneous external regressors.

Sample period and alternative shocks. Estimating the model on a pre-2025 sample reproduces the qualitative pattern, supporting the interpretation that the mechanism is a recurring relationship between U.S. trade-price and trade-policy shocks and Brazilian dynamics rather than an artifact of the 2025 episode alone. Placebo shocks to U.S. output and the U.S. policy rate do not reproduce the baseline pattern, suggesting that the results are not a generic response to any U.S. macroeconomic innovation. The VIX shock generates a different transmission profile – consistent with the small contribution of the global financial group to the variance decomposition in Section 5. Commodity-price shocks, treated as an alternative external channel rather than a pure placebo, partially overlap with the import-price transmission but do not reproduce it in full; this is consistent with the terms-of-trade interpretation advanced in Subsection 4.2, in which commodity prices mediate the response to the U.S. trade-policy shock rather than serving as an independent driver of Brazilian variability.

7 Conclusion and policy implications

This paper studies how U.S. trade-policy shocks are transmitted to Brazil, a large emerging economy whose direct exposure to the U.S. market is limited but whose macroeconomic cycle is closely connected to global prices, risk appetite and exchange-rate conditions. Using a small open-economy Bayesian VAR with an exogenous U.S./global block, the paper separates tariff-related U.S. import-price shocks and trade-policy uncertainty from global financial risk, commodity-price movements, U.S. macroeconomic shocks and domestic Brazilian innovations.

The evidence supports a shift away from a narrow tariff narrative. U.S. import-price shocks deteriorate Brazil's trade position, but the aggregate response is not confined to trade flows. The real effective exchange rate appreciates, domestic prices, the policy rate and output respond positively and persistently, while exchange-market pressure remains weak and almost entirely domestic in the variance decomposition. U.S. trade-policy uncertainty generates a similar macro-financial pattern with weaker direct effects on the trade ratio. Placebo and alternative external shocks do not reproduce the full baseline response. The forecast-error variance decomposition quantifies the asymmetry: the U.S. trade-policy block accounts for more than 90% of the variance of output, prices and the real effective exchange rate, while exchange-market pressure and the trade ratio remain governed primarily by domestic shocks. This pattern qualifies the standard emerging-market vulnerability narrative: external trade-policy shocks can be macro-financially relevant even when they do not generate large or persistent exchange-market stress.

The results are consistent with the global financial cycle and dominant-currency literatures, but add a trade-policy dimension to that discussion. In a commodity-exporting economy such as Brazil, external trade-price shocks may interact with commodity prices, domestic inflation and monetary-

policy responses in ways that are not captured by bilateral export exposure alone. This also helps explain why the activity response is theoretically ambiguous. Within the horizon studied, rising commodity prices around the U.S. import-price shock improve Brazil's terms of trade, appreciate the real and support short-run aggregate activity through commodity-income and expenditure-switching effects, even as the bifurcation of the export basket limits the direct trade margin. The positive output response should therefore not be read as evidence that tariffs are welfare-improving for Brazil; it is the empirical manifestation, in this sample, of one particular configuration of commodity-price and terms-of-trade dynamics.

The policy implication is twofold. First, tariff-related external shocks should not be managed only as sectoral export shocks. Targeted support may be necessary for firms and sectors directly exposed to U.S. tariff measures, but macroeconomic stabilization also matters. Inflation expectations, exchange-rate pass-through, monetary-policy responses and commodity-price exposure are central to the aggregate consequences of trade-policy shocks. Second, the muted exchange-market-pressure response observed in this episode – and, more generally, in the class of tariff-related shocks studied here – should not be interpreted as a low-vulnerability signal. It is a feature of the specific terms-of-trade configuration accompanying the shock; a different commodity-price response could trigger a more conventional external-stress profile, in which case the policy toolkit would need to address exchange-rate and capital-flow pressures directly. For emerging economies, the relevant policy question is therefore not only which products are directly affected by a tariff, but how the shock reshapes the broader macro-financial environment and which commodity-price configuration accompanies it.

The paper has three natural limitations. First, the empirical exercise does not estimate the causal effect of a single legal tariff announcement in isolation. It identifies a broader transmission mechanism linking U.S. import-price shocks and U.S. trade-policy uncertainty to Brazilian macro-financial dynamics, with the 2025 episode serving as a policy-relevant application. Second, the results are aggregate and do not measure heterogeneous sectoral or regional effects within Brazil. Future work could combine product-level tariff exposure with regional or firm-level data to assess how aggregate macro-financial transmission interacts with sectoral vulnerability. Third, the SOE-BVAR structure treats the U.S./global block as fully exogenous to Brazil and identifies external shocks recursively; structural identification schemes that allow sign and zero restrictions on the contemporaneous matrix (ARIAS; RUBIO-RAMIREZ; WAGGONER, 2018), or multi-country specifications that model transmission paths through third economies, would provide complementary evidence on the same question.

Overall, the 2025 U.S.–Brazil tariff episode illustrates a more general point: when trade-policy shocks originate in the center of the global system, their effects on emerging economies may extend well beyond the sectors directly exposed to the tariff. For Brazil, the relevant transmission is not only commercial but macro-financial, and its sign and magnitude depend on the commodity-price configuration that accompanies the shock.

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