

U.S. Financial Uncertainty and Emerging-Market Vulnerability: Evidence from SVAR and Two-Country DSGE Models

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This paper examines the transmission of U.S. financial uncertainty to Mexico, modeled as a representative small open emerging economy. First, using U.S.-Mexico data, I estimate a Structural Vector Autoregression (SVAR) to establish the empirical effects of a U.S. financial uncertainty shock. The results show a flight-to-safety episode characterized by declines in Mexican equity prices, currency depreciation, and a persistent contraction in economic activity. Second, I develop a non-linear two-country New Keynesian DSGE model, calibrated to U.S.-Mexico data, to explain the mechanisms underlying these empirical responses. The model incorporates an endogenous sovereign risk premium and nominal rigidities, and is consistent with the main empirical responses observed in the SVAR, while providing a structural interpretation of the mechanisms driving them. Counterfactual exercises identify these features as important transmission mechanisms and show that greater trade dependence amplifies the effects of foreign uncertainty through exchange-rate pass-through and imported inflation. The analysis also reveals a policy trade-off: a more aggressive monetary response better stabilizes inflation and exchange-rate dynamics but at the cost of tighter financial conditions, lower asset valuations, and weaker real activity. Overall, the findings highlight the joint role of financial frictions, trade exposure, and monetary policy in shaping emerging-market vulnerability to external financial shocks.

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1 Introduction

Global financial conditions play a central role in shaping macroeconomic fluctuations in emerging markets. A growing literature documents that changes in U.S. monetary policy, investor risk appetite, and global financial conditions generate synchronized movements in international capital flows, asset prices, and credit conditions across countries (Rey, 2015; Miranda-Agrippino and Rey, 2020). Yet much of this literature focuses on changes in the level of financial conditions rather than uncertainty about their future evolution. This distinction is particularly important for emerging economies, where heightened financial uncertainty can interact with sovereign risk, exchange-rate movements, and external financing conditions to amplify domestic fluctuations. Periods of elevated financial uncertainty can therefore generate sharp adjustments in financial markets and real activity even in the absence of an immediate decline in observed fundamentals (Akinci et al., 2022).

This paper examines the transmission of U.S. financial uncertainty to Mexico, modeled as a representative small open emerging economy. Mexico provides a particularly informative setting because of its close economic integration with the United States through trade, production networks, investment, and financial markets. These linkages create several channels through which shocks originating in the U.S. can affect Mexican asset prices, the exchange rate, borrowing conditions, and economic activity. At the same time, Mexico retains important emerging-market features, including exposure to sovereign risk and external financing conditions. The paper therefore asks two related questions: How does U.S. financial uncertainty propagate to a small open emerging economy, and which structural characteristics amplify or mitigate its effects?

First, I establish the empirical effects of U.S. financial uncertainty using a Structural Vector Autoregression (SVAR) estimated with U.S.-Mexico data. The SVAR evidence reveals a coordinated decline in Mexican financial and real conditions following a rise in U.S. financial uncertainty. The responses of equity prices, the exchange rate, and industrial production provide the empirical targets that motivate and discipline the structural model.

Second, I develop a non-linear two-country New Keynesian Dynamic Stochastic General Equilibrium (DSGE) model, calibrated to U.S.-Mexico data, to identify the mechanisms underlying these empirical responses. The model incorporates nominal rigidities, investment adjustment costs, international trade linkages, and an endogenous debt-elastic sovereign risk premium. Following Basu and Bundick (2017), U.S. financial uncertainty enters as a second-moment disturbance, while the sovereign-risk mechanism builds on the emerging-market literature emphasizing country spreads and external financing conditions (Neumeyer and Perri, 2005; Uribe and Yue, 2006; Schmitt-Grohé and Uribe, 2003). Because uncertainty operates through the second moment of the financial shock, the model is solved using a third-order perturbation approximation. The model is broadly consistent with the main empirical responses observed in the SVAR and provides a structural interpretation of the mechanisms driving them. In particular, higher U.S. financial uncertainty raises the external risk premium faced by the emerging economy, tightens financing conditions, and depresses asset prices, investment, consumption, and output.

I then use counterfactual exercises to examine what makes an emerging economy more or less vulnerable to the same external uncertainty shock. Lower home bias, which increases reliance on imported consumption and investment goods, strengthens exchange-rate pass-through and imported inflation, inducing a stronger monetary response and a deeper contraction in economic activity. A higher debt elasticity of the sovereign risk premium makes external borrowing more costly and shifts a larger share of the adjustment toward domestic absorption. I also vary the direct sensitivity of the sovereign spread to U.S. financial uncertainty, showing how this channel changes the relative importance of financial tightening, exchange-rate adjustment, trade reallocation, and domestic activity. Greater price flexibility substantially attenuates the contractionary response of output, highlighting the importance of nominal rigidities in transmitting external uncertainty. Finally, alternative monetary policy rules reveal an important policy trade-off: a stronger response to inflation improves price stabilization and limits exchange-rate pass-through, but at the cost of tighter financial conditions, lower equity valuations, and a deeper contraction in real activity.

This paper contributes to the literature in three ways. First, it provides empirical evidence on the international transmission of U.S. financial uncertainty as a distinct external shock,

documenting its effects on Mexican financial markets, the exchange rate, and real economic activity. Second, it introduces a second-moment U.S. financial uncertainty shock into a two-country New Keynesian framework with an endogenous sovereign risk premium, linking external uncertainty directly to emerging-market financing conditions. Third, the counterfactual analysis shows how trade exposure, sovereign-risk parameters, nominal rigidities, and monetary policy jointly shape the composition and severity of an emerging economy’s adjustment to external financial uncertainty. Together, the empirical and structural results provide a unified framework for understanding how global financial uncertainty interacts with domestic structural characteristics to determine emerging-market vulnerability.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 presents the empirical analysis using the SVAR framework. Section 4 develops the two-country New Keynesian DSGE model, while Section 5 discusses the parameter calibration and estimation of the stochastic volatility process. Section 6 presents the quantitative results, robustness analyses, and structural counterfactuals. Finally, Section 7 concludes and discusses the policy implications.

2 Review of Related Literature

This paper contributes to four interconnected strands of macroeconomic research: the measurement of uncertainty shocks, the international transmission of global financial conditions, the small open economy New Keynesian (SOE-NK) literature, and the role of sovereign risk and financial frictions in emerging market business cycles.

First, this study builds upon the literature examining the macroeconomic effects of uncertainty shocks. The seminal contribution of Bloom (2009) demonstrates that increases in uncertainty can generate sharp contractions in investment, employment, and output through real-option effects and adjustment frictions. Subsequent research has refined the measurement of uncertainty and distinguished financial uncertainty from broader macroeconomic uncertainty. In particular, Jurado et al. (2015) develop a comprehensive measure of economic uncertainty based on forecast errors

across a large set of macroeconomic and financial variables, while Ludvigson et al. (2021) identify financial uncertainty as a distinct driver of business cycle fluctuations. Similarly, Caldara et al. (2016, 2020) show that uncertainty shocks can exert substantial contractionary effects on economic activity, particularly when transmitted through financial markets. By utilizing the financial uncertainty index of Jurado et al. (2015), this paper aligns with a growing literature that views fluctuations in financial uncertainty as an important source of macroeconomic instability.

Second, this paper relates to the the global financial cycle literature and the international transmission of external shocks. Rey (2015) argues that global financial conditions, largely influenced by U.S. monetary policy and investor risk appetite, generate synchronized movements in capital flows, asset prices, and credit conditions across countries. This has motivated studies documenting the importance of external financial conditions for emerging markets. For instance, Miranda-Agrippino and Rey (2020) document the existence of a dominant global financial cycle that explains a substantial share of the co-movement in international asset prices and capital flows. More directly, Bhattarai et al. (2020) demonstrate that U.S. uncertainty shocks generate significant spillovers to foreign economies, producing contractions in output, declines in asset prices, currency depreciations, and tighter financial conditions. This paper contributes to this literature by quantifying these spillovers for Mexico and evaluating the mechanisms through which they propagate.

Third, the theoretical framework builds on the small open economy New Keynesian literature. The benchmark framework developed by Gali and Monacelli (2005) provides the standard monetary-policy model for small open economies under nominal rigidities and international trade. Subsequent contributions, including De Paoli (2009) and Jin and Li (2018), extend the analysis of open-economy policy trade-offs by emphasizing the role of international trade linkages, terms-of-trade adjustments, and cross-country transmission mechanisms in shaping domestic macroeconomic outcomes. The present study adopts this framework to analyze how external financial uncertainty interacts with domestic stabilization policy in an emerging-market environment.

Finally, this paper draws on the literature emphasizing sovereign risk, country spreads, and financial frictions in emerging markets. Neumeyer and Perri (2005) and Uribe and Yue (2006)

show that fluctuations in country risk premia and international borrowing costs are major drivers of emerging-market business cycles. Similarly, Schmitt-Grohé and Uribe (2003) introduce a debt-elastic interest-rate premium to stationarize net foreign asset positions, a mechanism that has become standard in open-economy DSGE models. Building on these insights, Fernández-Villaverde et al. (2011) demonstrate that volatility shocks alone can generate sizable business cycle fluctuations in emerging economies, highlighting the importance of risk as an independent source of macroeconomic instability. The uncertainty mechanism employed in this paper follows Basu and Bundick (2017), who show that nominal rigidities are essential for transforming second-moment uncertainty shocks into first-moment contractions in output and employment. Combining these insights, the present framework integrates uncertainty shocks, sovereign risk premia, and nominal rigidities within a two-country SOE-NK model to examine how U.S. financial uncertainty propagates to Mexico through trade, financial, and monetary-policy channels.

3 Empirical Evidence

This section quantifies the macroeconomic and financial transmission of U.S. financial uncertainty shock to the Mexican economy using a Structural Vector Autoregression (SVAR) model. By isolating an exogenous U.S. financial uncertainty shock, it documents the immediate tightening of domestic financial conditions and the subsequent real-economy contraction. In essence, these empirical dynamics provide the primary benchmark against which the structural model is evaluated.

3.1 Data and Methodology

To evaluate the spillover effects of U.S. financial volatility on the Mexican economy, this chapter employs a Structural Vector Autoregression (SVAR) framework. The sample operates at a monthly frequency ranging from 1994M1 to 2023M12. The domestic macroeconomic and financial data for Mexico are carefully sourced from CEIC, the IMF, and CEPALSTAT¹. The SVAR(p) model with a Cholesky decomposition is expressed as:

$$Y_t = c + \sum_{p=1}^6 \Phi_p Y_{t-p} + \varepsilon_t \quad (1)$$

¹Detailed description of the data can be found on Table VIII.1.2 from Section 8

Here, Y_t is the $M \times 1$ vector of endogenous variables, with the U.S. financial uncertainty shock ordered first, followed by the set of Mexican domestic variables. The matrices $\Phi_1, \Phi_2, \dots, \Phi_6$ are the $M \times M$ coefficient matrices associated with lags $p = 1, \dots, 6$ in the empirical application². The term ε_t denotes the $M \times 1$ vector of reduced-form residuals, assumed to be serially uncorrelated with covariance matrix Σ .

To capture foreign financial market volatility, this analysis employs the Financial Uncertainty (U_F) index constructed by Jurado et al. (2015), which measures the forecast uncertainty associated with a broad set of U.S. financial variables. This index is used to construct the exogenous structural shock based on the SVAR methodology of Ludvigson et al. (2021), which is then standardized to facilitate the quantitative interpretation of the impulse response functions (u_t).

The structural specification is composed of the U.S. financial uncertainty shock alongside three financial variables, two macroeconomic variables, and four trade variables for Mexico. These include: the log of the stock market index (smi), the short-term interest rate ($stir$), the log of the real exchange rate ($reer$), the log of the consumer price index (cpi), the log of industrial production (ip), the log of exports to the U.S. ($exus$), and the log of imports from the U.S. ($imus$). Letting u_t denote the standardized U.S. financial uncertainty shock, the ordering is as follows:

$$Y_t = \begin{bmatrix} u_t & smi_t & stir_t & reer_t & cpi_t & exus_t & imus_t & ip_t \end{bmatrix}' \quad (2)$$

The recursive identification scheme embedded in the Cholesky ordering is motivated by the theoretical assumptions of the small open economy framework. The U.S. financial uncertainty shock is ordered first to impose block exogeneity. As a small open economy, Mexico acts as a price-taker in global financial markets, implying that domestic macroeconomic and financial conditions cannot contemporaneously influence U.S. financial uncertainty. Consequently, the uncertainty shock is permitted to affect all Mexican variables within the same month, while Mexican variables affect the U.S. uncertainty measure only with a lag. This identification strategy is consistent with

²Six lags are uniformly chosen given the monthly frequency of the data from 1994M1 to 2023M12. This lag length follows the established empirical literature, including the works of Bhattarai et al. (2020), Forni et al. (2025), and Megaritis et al. (2025).

the small open economy SVAR literature and with approaches that treat uncertainty as an exogenous source of macroeconomic fluctuations (Cushman and Zha, 1997; Basu and Bundick, 2017).

The domestic financial block, comprising the stock market index, short-term interest rate, and real exchange rate, is ordered immediately after the external shock. Asset prices, interest rates, and exchange rates are forward-looking variables determined in highly liquid markets and are therefore allowed to respond contemporaneously to changes in global risk conditions. Furthermore, these financial variables are assumed to incorporate new information more rapidly than real economic aggregates within the monthly observation window, consistent with the global financial cycle literature (Rey, 2015).

Finally, the macroeconomic and trade block, consisting of consumer prices, bilateral trade flows, and industrial production, is ordered last. This ordering allows real variables to respond contemporaneously to both the external uncertainty shock and domestic financial conditions, while restricting them from contemporaneously affecting the financial block. The assumption is consistent with the presence of nominal rigidities, investment adjustment costs, and production frictions emphasized in the uncertainty literature, which imply that real economic activity responds less rapidly and more persistently than financial markets following uncertainty shocks (Bloom, 2009; Jurado et al., 2015). Real variables are therefore able to respond contemporaneously to uncertainty and financial shocks, while their influence on financial variables is restricted to occur with a lag under the recursive identification scheme.

3.2 Empirical Motivation: U.S. Financial Uncertainty Spillovers to Mexico

Before developing the theoretical framework, it is necessary to establish the stylized facts regarding how U.S. financial uncertainty transmits to the Mexican economy. Figure 1 reports the structural vector autoregression (SVAR) impulse responses of key Mexican macroeconomic and financial variables following an exogenous U.S. financial uncertainty shock.

U.S. Financial Uncertainty Shock in Mexico

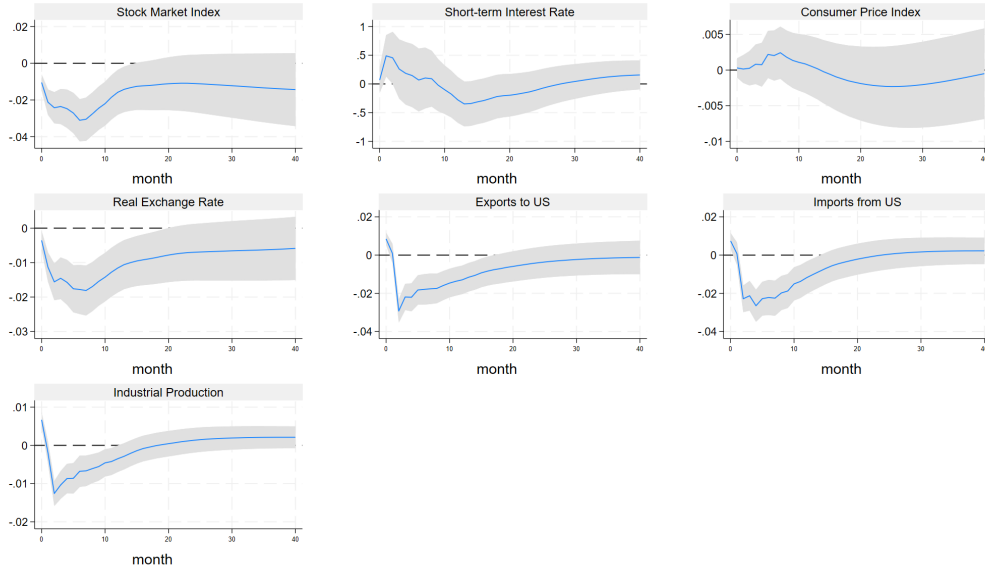


Figure 1: Spillover Effects of a U.S. Financial Uncertainty Shock on Mexico

Notes: The x-axis represents time (in months), while the y-axis shows the magnitude of the response in percentage deviations. The solid blue line represents the estimated SVAR mean response, and the shaded area indicates the 90% confidence interval.

The empirical results demonstrate that U.S. financial uncertainty triggers a severe and persistent tightening of real and financial conditions in Mexico. On impact, a one-standard-deviation financial uncertainty shock generates a sharp 3.10% contraction in the Mexican stock market index and a 1.80% depreciation of the real exchange rate. Furthermore, the short-term interest rate exhibits a statistically significant immediate increase of 0.49 percentage points, reflecting an abrupt spike in domestic borrowing costs. The real economy contracts simultaneously, with aggregate output falling by approximately 1.26%. International trade flows also decline, as exports to the United States fall by 2.92% and imports from the U.S. decrease by 2.65%. Crucially, the adverse effects of this financial uncertainty shock are highly persistent, with real and financial variables remaining significantly depressed for at least ten months following the initial impulse.

These empirical dynamics are particularly striking given the sheer magnitude of the real and financial linkages between the two economies. Mexico is the United States' most highly integrated trading partner, with total bilateral goods trade reaching nearly \$800 billion in 2023. This volume allowed Mexico to surpass China and solidify its position as the top U.S. trade partner,

accounting for over 15% of all U.S. imports³. Beyond goods trade, the financial integration is equally profound through extensive cross-border credit channels and portfolio investments. U.S. institutional investors hold substantial shares of Mexican equities and debt securities, meaning that the continuous flow of U.S. capital directly supports Mexican corporate and sovereign financing. This deep financial interconnectedness intricately ties the valuations of Mexican assets and domestic borrowing costs directly to the risk appetite of U.S. investors.

This economic integration is institutionalized by the U.S.–Mexico–Canada Agreement (USMCA) and is uniquely characterized by the *maquiladora* model of export-oriented manufacturing. Operating primarily under Mexico’s IMMEX program, maquiladoras are foreign-owned assembly plants that import raw materials and intermediate components duty-free, often directly from the U.S., process them using domestic labor, and re-export the finished goods back across the border. As of 2023, the IMMEX program comprised nearly 6,000 active facilities employing approximately 3 million workers, and was responsible for over 80% of Mexico’s total manufacturing exports⁴. Because this cross-border production-sharing model relies heavily on imported intermediate inputs, foreign investment, and access to international financing, Mexican output is acutely exposed to U.S. financial volatility. When U.S. uncertainty rises, the disruption to supply-chain financing and cross-border investment flows triggers immediate contractions in Mexican asset prices and capital accumulation, driving the severe spillover effects observed in the SVAR data.

Within this context of trade and financial integration, the results highlight a critical mechanism. While trade volumes contract, the initial and most aggressive transmission of U.S. uncertainty occurs through financial markets and risk premia. The immediate peso depreciation, the decline in equity prices, and the spike in interest rates are consistent with the asset-price and exchange-rate dynamics typically associated with flight-to-safety episodes, where global investors abruptly shift away from emerging-market assets into U.S. safe havens (Akinci et al., 2022).

³2023 Trade statistics are sourced from the U.S. Census Bureau and the U.S. Bureau of Economic Analysis. In 2023, U.S. imports from Mexico reached approximately \$475 billion, while U.S. exports to Mexico totaled \$323 billion.

⁴Facility counts, employment figures, and export shares for the IMMEX (*Industria Manufacturera, Maquiladora y de Servicio de Exportación*) program are formally reported by Mexico’s National Institute of Statistics and Geography (INEGI) and the Secretariat of Economy.

Consequently, these empirical findings motivate the necessary theoretical structure of the two-country model developed in this chapter. To accurately capture the magnitude and persistence of these spillovers, these findings suggest that a framework based solely on trade linkages may be insufficient to account for the magnitude and persistence of the observed responses. Accordingly, the model incorporates financial frictions. Specifically, an endogenous country risk premium and an exogenous financial uncertainty wedge that allow foreign volatility shocks to directly disrupt domestic capital accumulation, equity pricing, and exchange rate dynamics.

4 Structure of the Model

This is a two-country New Keynesian model featuring a Home economy ($H = \text{Mexico}$), modeled as a small open economy (SOE), and a Foreign economy ($F = \text{USA}$), modeled as a large, open economy. In both countries, households maximize utility, and firms produce differentiated goods with Cobb-Douglas technology subject to nominal rigidities. Following the standard open-economy framework of Galí and Monacelli (2005), international trade is modeled with a nested CES structure. To ensure stationarity in the SOE framework, international borrowing for the Home country features a Schmitt-Grohé and Uribe (2003) debt-elastic premium. The model includes standard first-moment TFP shocks and a U.S. financial uncertainty shock, modeled as a second-moment volatility shock following the work of Basu and Bundick (2017).

4.1 Information Structure

The model assumes rational expectations. At the beginning of each period, households, firms, and monetary authorities in the Home and Foreign economies observe the current realizations of the model's state variables and form expectations using all information available at time t . Based on this information, agents make optimal decisions on consumption, investment, labor supply, pricing, borrowing, and monetary policy. Throughout the model, the expectation operator $E_t[\cdot]$ denotes mathematical expectations conditional on the information available at time t .

4.2 Home Economy: Mexico

The Home economy, Mexico, is a small open economy where representative households

maximize lifetime utility over consumption and labor supply, while firms produce differentiated goods under monopolistic competition and Rotemberg (1982) sticky prices. Consumption and investment are defined by a nested CES Armington structure, where agents first allocate expenditure between domestic and foreign bundles and then across specific varieties within those bundles. To ensure stationarity in international borrowing, the interest rate on foreign bonds includes a debt-elastic risk premium that increases if the country borrows excessively, along with an exogenous financial uncertainty process that increases the volatility of the external risk premium shock.

4.2.1 Households

Preferences. Following the small open economy New Keynesian literature pioneered by Gali and Monacelli (2005), households maximize expected lifetime utility over consumption and labor supply. The framework is augmented with capital accumulation, international bond holdings, and an endogenous sovereign risk premium following Schmitt-Grohé and Uribe (2003), Neumeyer and Perri (2005), and Uribe and Yue (2006), the representative household maximizes the expected present value of its lifetime utility, which features an additively separable functional form:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\phi}}{1+\phi} \right). \quad (3)$$

The utility function consists of consumption (C_t) and labor supply (N_t). The parameter $\sigma > 0$ represents the coefficient of relative risk aversion, and its inverse, $1/\sigma$, is the intertemporal elasticity of substitution, which governs how willing the household is to defer consumption in response to real interest rate changes. The discount factor is $\beta \in (0, 1)$, capturing the household's impatience. Finally, $\phi > 0$ is the inverse of the Frisch elasticity of labor supply, which dictates how responsive labor supply is to changes in the real wage.

Consumption and Investment Aggregators. Following Armington (1969), final consumption (C_t) and investment (I_t) are defined as CES composites of domestic goods ($C_{H,t}, I_{H,t}$) and foreign

goods $(C_{F,t}, I_{F,t})$, with an elasticity of substitution η :

$$C_t = \left[(\omega_C)^{\frac{1}{\eta}} C_{H,t}^{\frac{\eta-1}{\eta}} + (1 - \omega_C)^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}, \quad (4)$$

$$I_t = \left[(\omega_I)^{\frac{1}{\eta}} I_{H,t}^{\frac{\eta-1}{\eta}} + (1 - \omega_I)^{\frac{1}{\eta}} I_{F,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}. \quad (5)$$

These composite goods are, in turn, Dixit and Stiglitz (1977) aggregators of a continuum of individual varieties indexed by $i \in [0, 1]$ from each country, with an elasticity of substitution $\varepsilon > 1$:

$$Z_{j,t} = \left[\int_0^1 Z_{j,t}(i)^{\frac{\varepsilon-1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}}, \quad j \in \{H, F\}, Z \in \{C, I\}. \quad (6)$$

Here, $C_{H,t}(i)$ and $C_{F,t}(i)$ represent the consumption of individual variety i from the Home and Foreign countries, respectively. This nested structure implies a two-stage budgeting process: households first allocate expenditure between Home and Foreign bundles, and then optimally distribute that expenditure across specific varieties within those bundles to minimize costs.

Price Indices and Purchaser Prices. Let S_t be the nominal exchange rate (Home currency per Foreign currency). Assuming the law of one price holds at the dock (no tariffs), the *home-currency* purchaser price of the foreign composite is simply the foreign price converted at the nominal exchange rate:

$$P_{F,t} \equiv S_t P_{F,t}^*. \quad (7)$$

$P_{F,t}^*$ represents the price index of the composite foreign good, measured in the foreign country's own currency. The aggregate price indices for consumption ($P_{C,t}$) and investment ($P_{I,t}$) are the cost-minimizing prices of the Armington bundles:

$$P_{C,t} = \left[\omega_C P_{H,t}^{1-\eta} + (1 - \omega_C) P_{F,t}^{1-\eta} \right]^{\frac{1}{1-\eta}}, \quad (8)$$

$$P_{I,t} = \left[\omega_I P_{H,t}^{1-\eta} + (1 - \omega_I) P_{F,t}^{1-\eta} \right]^{\frac{1}{1-\eta}}. \quad (9)$$

Consistent with the Dixit-Stiglitz aggregator, the price indices for the domestic and foreign bundles are aggregations of individual variety prices:

$$P_{H,t} = \left[\int_0^1 P_{H,t}(i)^{1-\varepsilon} di \right]^{\frac{1}{1-\varepsilon}}, \quad P_{F,t}^* = \left[\int_0^1 P_{F,t}^*(i)^{1-\varepsilon} di \right]^{\frac{1}{1-\varepsilon}}. \quad (10)$$

The parameter $(1 - \omega_C)$ acts as the weight on foreign goods in the consumption basket. In the model's steady state, this weight corresponds directly to the share of consumption expenditure on imported goods, serving as a natural calibration anchor for economic openness.

The optimal allocation of any given expenditure within each category of goods yields the standard downward-sloping demand functions:

$$Z_{j,t}(i) = \left(\frac{P_{j,t}(i)}{P_{j,t}} \right)^{-\varepsilon} Z_{j,t}, \quad j \in \{H, F\}, \quad Z \in \{C, I\}. \quad (11)$$

The optimal allocation of expenditures between Home and Foreign goods thus imply:

$$C_{H,t} = \omega_C \left(\frac{P_{H,t}}{P_{C,t}} \right)^{-\eta} C_t, \quad C_{F,t} = (1 - \omega_C) \left(\frac{P_{F,t}}{P_{C,t}} \right)^{-\eta} C_t. \quad (12)$$

$$I_{H,t} = \omega_I \left(\frac{P_{H,t}}{P_{I,t}} \right)^{-\eta} I_t, \quad I_{F,t} = (1 - \omega_I) \left(\frac{P_{F,t}}{P_{I,t}} \right)^{-\eta} I_t. \quad (13)$$

Budget Constraint and Asset Portfolios. The home-good price is chosen as the numeraire ($P_{H,t} = 1$). For any nominal variable X_t , $\tilde{X}_t \equiv X_t/P_{H,t}$. Because the Home country is a small open economy, households face a portfolio choice: they can save in domestic risk-free bonds ($\tilde{B}_t$) or international dollar-denominated nominal bonds (B_t^*). The household's budget constraint represents a fundamental accounting identity where total uses of funds must equal total sources of funds:

$$\begin{aligned} \tilde{P}_{C,t} C_t + \tilde{P}_{I,t} I_t + \tilde{P}_t^{eq} (s_{t+1} - s_t) + \tilde{B}_t + S_t B_t^{*5} \leq \\ \tilde{W}_t N_t + \tilde{R}_t^k K_{t-1} + \tilde{D}_t s_t + \frac{R_{t-1}^{nom}}{\Pi_{H,t}} \tilde{B}_{t-1} + S_t (R_{t-1}^{ext}) B_{t-1}^*. \end{aligned} \quad (14)$$

The representative household maximizes expected utility subject to this budget constraint, yielding the utility-based stochastic discount factor (SDF), $\Lambda_{t+1} = \beta(C_{t+1}/C_t)^{-\sigma} (\tilde{P}_{C,t}/\tilde{P}_{C,t+1})$.

⁵Here, B_t^* represents the household's net foreign asset position, where a negative value signifies net foreign debt.

The domestic bond Euler equation is:

$$1 = E_t \left[\Lambda_{t+1} \frac{R_t^{nom}}{\Pi_{H,t+1}} \right]. \quad (15)$$

The foreign bond Euler equation adjusts for expected exchange rate depreciation:

$$1 = E_t \left[\Lambda_{t+1} \left(R_t^{ext} \frac{\Pi_{F,t+1}^*}{\Pi_{H,t+1}} \right) \frac{S_{t+1}}{S_t} \right]. \quad (16)$$

By combining these two optimality conditions, the stochastic discount factor cancels out, endogenously generating the Uncovered Interest Parity (UIP) condition, which dictates exchange rate dynamics in response to external rate shocks.

To close the model at the aggregate level, domestic bonds are in zero net supply ($\tilde{B}_t = 0$), and all equity shares are held domestically ($s_t = 1$). Substituting the firm's dividend equation together with the aggregate resource constraint into the household budget constraint yields the aggregate current account accumulation equation presented in Section 4.4.

Equity Pricing. Following the foundational asset pricing model of Lucas Jr (1978), the real price of equity is determined by the expected discounted stream of future dividends. With the utility-based SDF, the asset price must satisfy⁶:

$$\tilde{P}_t^{eq} = E_t \left[\Lambda_{t+1} (\tilde{P}_{t+1}^{eq} + \tilde{D}_{t+1}) \right]. \quad (17)$$

Labor Supply. The intratemporal optimality condition for labor supply equates the marginal rate of substitution between consumption and leisure to the real wage. As households consume more or work more hours, they demand a higher real wage to supply an additional unit of labor:

$$\frac{\tilde{W}_t}{\tilde{P}_{C,t}} = C_t^\sigma N_t^\phi. \quad (18)$$

⁶The inclusion of equity pricing allows the model to directly match the stock-market response observed in the empirical SVAR.

Capital Accumulation and Tobin's Q. Following the theoretical framework introduced by Christiano et al. (2005) and utilizing the specific quadratic functional form by Smets and Wouters (2007), these costs penalize rapid changes in the flow of investment rather than the stock of capital:

$$K_t = (1 - \delta)K_{t-1} + I_t - \frac{\phi_I}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 I_t. \quad (19)$$

These adjustment frictions conceptually break the instantaneous link between the price of investment goods and the value of installed capital, captured by Tobin's Q_t . This represents the shadow price of installed capital. The optimal choice implies the following Euler equations:

$$Q_t = E_t \left[\Lambda_{t+1} \left(\tilde{R}_{t+1}^k + Q_{t+1}(1 - \delta) \right) \right], \quad (20)$$

$$\tilde{P}_{I,t} = Q_t \left[1 - \frac{\phi_I}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 - \phi_I \left(\frac{I_t}{I_{t-1}} - 1 \right) \frac{I_t}{I_{t-1}} \right] + E_t \left[\Lambda_{t+1} Q_{t+1} \phi_I \left(\frac{I_{t+1}}{I_t} - 1 \right) \left(\frac{I_{t+1}}{I_t} \right)^2 \right]. \quad (21)$$

4.2.2 Firms in Home

Each firm produces a unique variety of the good, with output determined by a standard Cobb-Douglas production technology subject to a random TFP shock $A_{H,t}$:

$$Y_{H,t}(i) = A_{H,t} K_{t-1}(i)^\alpha N_t(i)^{1-\alpha}. \quad (22)$$

Firms rent labor and capital in perfectly competitive factor markets. The real marginal cost is derived from the firm's static cost-minimization problem:

$$\text{MC}_{H,t} = \frac{1}{A_{H,t}} \left(\frac{\tilde{R}_t^k}{\alpha} \right)^\alpha \left(\frac{\tilde{W}_t}{1 - \alpha} \right)^{1-\alpha}. \quad (23)$$

Rotemberg Pricing and Dividends. While the broader small open economy architecture follows Gali and Monacelli (2005), this model explicitly departs from their use of Calvo (1983) staggered pricing in favor of quadratic price adjustment costs à la Rotemberg (1982) with steady-state trend inflation indexing. The rationale for this departure is dictated by the non-linear solution method. Because this paper evaluates uncertainty (second-moment) shocks, the model must be

solved using a third-order perturbation. In higher-order approximations, Calvo pricing generates a highly non-linear state variable for cross-sectional price dispersion, which frequently induces explosive macroeconomic dynamics and numerical instability. Conversely, Rotemberg pricing yields symmetric price-setting across all firms, eliminating price dispersion while successfully preserving the necessary New Keynesian nominal rigidities. This modeling choice ensures structural stability and aligns directly with the standard methodology for non-linear uncertainty modeling established by Basu and Bundick (2017). Firm profit maximization balances the marginal benefit of adjusting prices against these quadratic costs, which is scaled relative to the long-run inflation targets ($\bar{\Pi}$ and $\bar{\Pi}^*$), yielding the non-linear New Keynesian Phillips Curves (NKPC):

$$\phi_p \left(\frac{\Pi_{H,t}}{\bar{\Pi}} - 1 \right) \frac{\Pi_{H,t}}{\bar{\Pi}} = (1 - \varepsilon) + \varepsilon \text{MC}_{H,t} + E_t \left[\Lambda_{t+1} \frac{Y_{H,t+1}}{Y_{H,t}} \phi_p \left(\frac{\Pi_{H,t+1}}{\bar{\Pi}} - 1 \right) \frac{\Pi_{H,t+1}}{\bar{\Pi}} \right], \quad (24)$$

Real dividends rebated to households reflect aggregate net cash flows, calculated as total revenues minus factor payments for labor and capital, and the output deadweight losses incurred from structural price adjustments:

$$\tilde{D}_t = Y_{H,t} - \tilde{W}_t N_t - \tilde{R}_t^k K_{t-1} - \frac{\phi_p}{2} \left(\frac{\Pi_{H,t}}{\bar{\Pi}} - 1 \right)^2 Y_{H,t}, \quad (25)$$

4.2.3 Monetary Policy

The central bank in the Home economy sets the nominal interest rate R_t^{nom} following an instrument rule originally proposed by Taylor (1993). However, unlike standard closed-economy formulations, the central bank in this model targets a composite measure of Consumer Price Index (CPI) inflation to account for exchange-rate pass-through, which is a critical concern for emerging market policymakers (Calvo and Reinhart, 2002; Baqueiro et al., 2003).

As argued by Orphanides (2001, 2003), the monetary authority responds to observable output growth rather than the unobservable output gap, providing a more robust representation of real-time central bank behavior during highly volatile periods. The central bank smooths the interest rate via the parameter ρ_r to avoid disruptive financial market volatility, while actively reacting to

deviations in headline CPI inflation and output growth:

$$\log\left(\frac{R_t^{nom}}{\bar{R}}\right) = \rho_r \log\left(\frac{R_{t-1}^{nom}}{\bar{R}}\right) + (1 - \rho_r) \left[\rho_\pi \log\left(\frac{\left(\frac{\tilde{P}_{C,t}}{\tilde{P}_{C,t-1}}\right) \Pi_{H,t}}{\bar{\Pi}}\right) + \rho_y \log\left(\frac{Y_{H,t}}{Y_{H,t-1}}\right) \right] \quad (26)$$

where $\bar{R} = \bar{\Pi}/\beta$ represents the steady-state nominal interest rate, satisfying the Fisher equation under the central bank's non-zero inflation target ($\bar{\Pi}$).⁷ Furthermore, $\tilde{P}_{C,t}/\tilde{P}_{C,t-1}$ captures changes in the consumption bundle's price relative to the domestic price level, while $\Pi_{H,t}$ captures domestic producer-price inflation. Their product therefore gives headline CPI inflation in nominal terms. Because the consumption bundle includes imported goods, this measure incorporates exchange-rate pass-through into consumer prices.

4.3 Foreign Economy: United States

The Foreign economy is modeled as a large open economy that acts as an exogenous driver of global conditions. It is structurally symmetric to the Home economy, with two vital distinctions: U.S. households do not hold emerging market debt, and the financial uncertainty shock enters the model exogenously through the foreign household's intertemporal Euler equation. A positive realization of the uncertainty shock raises precautionary behavior and tightens financial conditions, generating an endogenous contraction in U.S. aggregate demand and output.

4.3.1 Foreign Households and Firms

Preferences and Aggregators. Symmetrical to the Home economy, the representative foreign household maximizes an expected lifetime CRRA utility function. The Foreign economy serves as the source of the external financial shocks in the model. The Foreign utility therefore incorporates

⁷This parameterization aligns with the April 1993 constitutional amendment to Article 28 of the Political Constitution of the United Mexican States, which granted formal autonomy to the Banco de México and legally established price stability as its overriding objective.

a time-varying subjective discount factor driven by the financial risk-premium wedge ($u_{UF,t}$)⁸:

$$E_0 \sum_{t=0}^{\infty} \Theta_t^* \left(\frac{(C_t^*)^{1-\sigma^*}}{1-\sigma^*} - \frac{(N_t^*)^{1+\phi^*}}{1+\phi^*} \right), \quad (27)$$

where the cumulative discount factor evolves according to $\Theta_{t+1}^* = \Theta_t^* \beta^* u_{UF,t}$ with $\Theta_0^* = 1$. It determines the weight assigned to future utility relative to current utility. Because the one-period discount factor depends on the financial wedge, $u_{UF,t}$, fluctuations in this wedge affect the household's intertemporal consumption and saving decisions.

Consumption and Investment Aggregators. Final goods are CES composites of foreign goods ($C_{F,t}^*, I_{F,t}^*$) and goods imported from Home ($C_{H,t}^*, I_{H,t}^*$) with Armington elasticity η^* :

$$C_t^* = \left[(\omega_C^*)^{\frac{1}{\eta^*}} (C_{F,t}^*)^{\frac{\eta^*-1}{\eta^*}} + (1 - \omega_C^*)^{\frac{1}{\eta^*}} (C_{H,t}^*)^{\frac{\eta^*-1}{\eta^*}} \right]^{\frac{\eta^*}{\eta^*-1}}, \quad (28)$$

$$I_t^* = \left[(\omega_I^*)^{\frac{1}{\eta^*}} (I_{F,t}^*)^{\frac{\eta^*-1}{\eta^*}} + (1 - \omega_I^*)^{\frac{1}{\eta^*}} (I_{H,t}^*)^{\frac{\eta^*-1}{\eta^*}} \right]^{\frac{\eta^*}{\eta^*-1}}. \quad (29)$$

These composite goods are Dixit-Stiglitz aggregators with elasticity ε^* :

$$Z_{j,t}^* = \left[\int_0^1 Z_{j,t}^*(i)^{\frac{\varepsilon^*-1}{\varepsilon^*}} di \right]^{\frac{\varepsilon^*}{\varepsilon^*-1}}, \quad j \in \{H, F\}, Z \in \{C, I\}, \varepsilon^* > 1. \quad (30)$$

Price Indices. The foreign CPI, $P_{C,t}^*$, is defined symmetrically. The purchaser price of goods imported from Home, $P_{H,t}^*$, is simply the Home price converted at the exchange rate, implying full pass-through:

$$P_{C,t}^* = \left[\omega_C^* (P_{F,t}^*)^{1-\eta^*} + (1 - \omega_C^*) (P_{H,t}^*)^{1-\eta^*} \right]^{\frac{1}{1-\eta^*}}, \quad (31)$$

$$P_{I,t}^* = \left[\omega_I^* (P_{F,t}^*)^{1-\eta^*} + (1 - \omega_I^*) (P_{H,t}^*)^{1-\eta^*} \right]^{\frac{1}{1-\eta^*}}, \quad (32)$$

$$P_{H,t}^* \equiv \frac{P_{H,t}}{S_t}. \quad (33)$$

⁸The financial wedge $u_{UF,t}$ is the level (first-moment) process that enters households' intertemporal discounting. Its conditional standard deviation, $\sigma_{u,UF,t}$, follows a stochastic-volatility process, so innovations to $\sigma_{u,UF,t}$ represent second-moment (financial uncertainty) shocks. The complete specification is provided in Section 4.5.

The optimal allocation of expenditures between Foreign and Home composite goods implies:

$$C_{F,t}^* = \omega_C^* \left(\frac{P_{F,t}^*}{P_{C,t}^*} \right)^{-\eta^*} C_t^*, \quad C_{H,t}^* = (1 - \omega_C^*) \left(\frac{P_{H,t}^*}{P_{C,t}^*} \right)^{-\eta^*} C_t^*. \quad (34)$$

$$I_{F,t}^* = \omega_I^* \left(\frac{P_{F,t}^*}{P_{I,t}^*} \right)^{-\eta^*} I_t^*, \quad I_{H,t}^* = (1 - \omega_I^*) \left(\frac{P_{H,t}^*}{P_{I,t}^*} \right)^{-\eta^*} I_t^*. \quad (35)$$

Budget Constraint and Optimality. Because the United States acts as the center country, U.S. households are modeled as holding only domestic risk-free nominal assets (B_t^*). Consistent with the small-open-economy assumption, the Home economy takes the world interest rate as given, while the Foreign economy does not internalize developments in Mexican financial markets. Consequently, their budget constraint maps symmetrically to the Home economy, absent the cross-border foreign currency terms, and is denominated entirely in the Foreign numeraire ($P_{F,t}^* = 1$):

$$P_{C,t}^* C_t^* + P_{I,t}^* I_t^* + P_t^{eq,*} (s_{t+1}^* - s_t^*) + \mathcal{B}_t^* \leq W_t^* N_t^* + R_t^{k,*} K_{t-1}^* + D_t^* s_t^* + \frac{R_{nom,t-1}^*}{\Pi_{F,t}^*} \mathcal{B}_{t-1}^*. \quad (36)$$

Optimizing this budget constraint yields a single Euler equation for the U.S. household. Crucially, the financial risk-premium wedge ($u_{UF,t}$) enters directly into this Euler equation as an intertemporal demand shifter:

$$1 = \beta^* u_{UF,t} E_t \left[\left(\frac{C_{t+1}^*}{C_t^*} \right)^{-\sigma^*} \frac{P_{C,t}^*}{P_{C,t+1}^*} \frac{R_{nom,t}^*}{\Pi_{F,t+1}^*} \right]. \quad (37)$$

The U.S. real risk-free rate is explicitly defined as $R_t^* = R_{nom,t}^* / \Pi_{F,t+1}^*$, which serves as the global base rate for emerging market borrowing. Equity pricing, labor supply, Rotemberg production, and the U.S. Federal Reserve Taylor rule map symmetrically to the Home conditions.

$$\tilde{P}_t^{eq,*} = E_t \left[\Lambda_{t+1}^* \left(\tilde{P}_{t+1}^{eq,*} + \tilde{D}_{t+1}^* \right) \right]. \quad (38)$$

$$\frac{\tilde{W}_t^*}{\tilde{P}_{C,t}^*} = (C_t^*)^{\sigma^*} (N_t^*)^{\phi^*}. \quad (39)$$

Foreign Firms and Production. Production follows Cobb-Douglas technology subject to an independent productivity shock $A_{F,t}^*$:

$$Y_{F,t}^* = A_{F,t}^* (K_{F,t-1}^*)^{\alpha^*} (N_{F,t}^*)^{1-\alpha^*}. \quad (40)$$

The remaining firm-side conditions, including marginal cost determination, Rotemberg price adjustment, dividend payments, and the nonlinear Phillips curve, are symmetric to those of the Home economy and are therefore omitted for brevity.

4.3.2 Foreign Monetary Policy

The U.S. Federal Reserve sets the foreign nominal interest rate $R_t^{nom,*}$ according to a symmetric Taylor rule. Consistent with the Home economy's specification, the Federal Reserve responds to fluctuations in U.S. consumer price inflation and output growth:

$$\log(R_t^{nom,*}/\bar{R}^*) = \rho_r^* \log(R_{t-1}^{nom,*}/\bar{R}^*) + (1 - \rho_r^*) \left[\rho_\pi^* \log \left(\frac{\left(\frac{P_{C,t}^*}{P_{C,t-1}^*} \right) \Pi_{F,t}^*}{\bar{\Pi}^*} \right) + \rho_y^* \log(Y_{F,t}^*/Y_{F,t-1}^*) \right] \quad (41)$$

where $\Pi_{F,t}^*$ represents U.S. domestic producer inflation, and the term $P_{C,t}^*/P_{C,t-1}^*$ tracks the change in the relative U.S. consumer price index. This comprehensive target ensures that both central banks monitor their complete domestic consumption baskets, fully accounting for the trade exposures embedded in the global general equilibrium.

4.4 Trade, Market Clearing, and External Accounts

Imports and Exports. Home's imports (M_t) denote Mexico's imports of goods from the Foreign economy, United States⁹, while Home's exports (X_t) denote Mexico's exports to the United States. Bilateral trade is determined by the Armington demand system, with Foreign demand for Home

⁹The model adopts a two-country representation in which the U.S. refers to the Foreign economy. Although Mexico also trades with the Rest of the World, the empirical analysis focuses on bilateral MX–U.S. trade. Given that the U.S. accounted for around 82% of Mexico's exports and 51% of its imports over 1994–2023, this abstraction captures Mexico's primary external trade and financial linkages while maintaining a tractable general equilibrium framework.

goods clearing the export market:

$$M_t \equiv C_{F,t} + I_{F,t} = (1 - \omega_C) \left(\frac{P_{F,t}}{P_{C,t}} \right)^{-\eta} C_t + (1 - \omega_I) \left(\frac{P_{F,t}}{P_{I,t}} \right)^{-\eta} I_t, \quad (42)$$

$$X_t \equiv C_{H,t}^* + I_{H,t}^* = (1 - \omega_C^*) \left(\frac{P_{H,t}^*}{P_{C,t}^*} \right)^{-\eta^*} C_t^* + (1 - \omega_I^*) \left(\frac{P_{H,t}^*}{P_{I,t}^*} \right)^{-\eta^*} I_t^*. \quad (43)$$

Accordingly, all trade variables in the model are interpreted as bilateral Mexico–U.S. trade flows, ensuring consistency between the theoretical framework and the empirical analysis.

Market Clearing and Empirical Measurement. The market for each country’s produced good clears when aggregate supply equals domestic expenditure plus export demand. For direct comparison with empirical SVAR variables, Industrial Production maps directly to aggregate output $Y_{H,t}$, and the Real Exchange Rate is mapped inversely to the nominal rate ($1/S_t$):

$$Y_{H,t} = C_{H,t} + I_{H,t} + X_t, \quad (44)$$

$$Y_{F,t}^* = C_{F,t}^* + I_{F,t}^* + M_t. \quad (45)$$

The quadratic Rotemberg adjustment costs enter the firm’s profit function and therefore reduce dividends distributed to households. Consequently, nominal rigidities affect aggregate demand and firm profitability without altering the accounting form of the goods-market clearing conditions.

Arbitrage and Exchange Rate Determination. The link between the external interest rate and domestic currency dynamics is governed by the household’s optimality conditions regarding domestic and foreign asset holdings. Combining the household’s Euler equations for domestic and foreign bond holdings yields the following SDF-weighted no-arbitrage condition:

$$E_t \left[\Lambda_{t+1} \left(\frac{R_t^{nom}}{\Pi_{H,t+1}} - R_t^{ext} \frac{\Pi_{F,t+1}^*}{\Pi_{H,t+1}} \frac{S_{t+1}}{S_t} \right) \right] = 0, \quad (46)$$

where Λ_{t+1} denotes the intertemporal stochastic discount factor. Equation (48) represents the household’s SDF-weighted no-arbitrage condition rather than the textbook uncovered interest parity (UIP) equation, since the stochastic discount factor remains inside the conditional

expectation. Under a first-order log-linear approximation around the deterministic steady state, however, the condition reduces to a modified UIP relationship. In the resulting linearized system, expected exchange-rate depreciation is determined by the wedge between the domestic real interest rate and the effective external borrowing rate.

Crucially, households borrow internationally at the external rate R_t^{ext} , which incorporates an endogenous sovereign risk premium defined in Equation 48. Consequently, the expected return on foreign assets depends not only on the U.S. risk-free interest rate but also on changes in Mexico's sovereign spread. An increase in uncertainty raises the sovereign spread, thereby increasing Mexico's effective external borrowing cost even if the U.S. policy rate declines. This introduces an additional wedge relative to the textbook UIP condition, requiring adjustments in the exchange rate, the domestic interest rate, or a combination of both to restore arbitrage between domestic and foreign assets. In equilibrium, this mechanism generates capital outflows, exchange-rate depreciation, and tighter domestic financial conditions following a foreign financial uncertainty shock.

Current Account and Sovereign Risk Premium. Net foreign assets are denominated in the foreign numeraire (U.S. dollars) and evolve according to the current account identity:

$$B_t^* = R_{t-1}^{ext} B_{t-1}^* + P_{H,t}^* X_t - M_t. \quad (47)$$

Since the foreign good serves as the model's numeraire ($P_{F,t}^* = 1$), imports enter the equation directly in quantity units. To induce stationarity in the SOE framework, international borrowing features a debt-elastic interest-rate premium. The sovereign risk spread is specified as

$$Spread_t = \exp\left(-\psi(B_t^* - \bar{B}^*)\right) \left(\frac{\sigma_{u,UF,t}}{\bar{\sigma}_{u,UF}}\right)^{\omega_{risk}}. \quad (48)$$

This specification extends the standard debt-elastic interest-rate premium by allowing sovereign borrowing costs to vary with U.S. financial uncertainty. The first component,

$$\exp\left(-\psi(B_t^* - \bar{B}^*)\right),$$

is the debt-elastic premium proposed by Schmitt-Grohé and Uribe (2003), which ensures stationarity of the net foreign asset position in small open economy models. Negative values of B_t^* correspond to net foreign debt; therefore, when the Home economy borrows excessively ($B_t^* < \bar{B}^*$), the term $-\psi(B_t^* - \bar{B}^*)$ becomes positive, increasing the sovereign spread and raising the cost of external borrowing. The second component,

$$\left(\frac{\sigma_{u,UF,t}}{\bar{\sigma}_{u,UF}} \right)^{\omega_{risk}},$$

is motivated by the global financial cycle literature (Rey, 2015) and by evidence that emerging-market sovereign spreads co-move with global financial conditions (Uribe and Yue, 2006; Neumeyer and Perri, 2005). Since the model is driven by stochastic volatility in the U.S. financial uncertainty process, the sovereign spread depends on the conditional volatility, $\sigma_{u,UF,t}$, rather than the level of the financial wedge itself. Economically, an increase in U.S. financial uncertainty raises global risk aversion, increasing the compensation required by international investors to hold emerging-market debt. Consequently, this external uncertainty may directly widen Mexico's sovereign spread and tighten domestic credit conditions even in the absence of changes in domestic macroeconomic fundamentals. Following the sovereign spread literature (Uribe and Yue, 2006), the total external borrowing rate is defined as the U.S. real interest rate multiplied by the sovereign spread:

$$R_t^{ext} = \left(\frac{R_t^{nom,*}}{\Pi_{F,t+1}^*} \right) Spread_t. \quad (49)$$

The U.S. real interest rate serves as the benchmark global funding rate, while the sovereign spread captures country-specific risk. By construction, the external borrowing rate enters directly into the modified UIP condition in Equation (48). Consequently, increases in U.S. financial uncertainty raise Mexico's effective borrowing cost, generating capital outflows, exchange-rate depreciation, and tighter domestic financial conditions.

4.5 Exogenous Shocks

Productivity Shocks. Both countries are subject to standard first-moment TFP shocks which follow AR(1) processes:

$$\log A_{H,t} = (1 - \rho_{A_H}) \log \bar{A}_H + \rho_{A_H} \log A_{H,t-1} + \epsilon_{A_H,t}, \quad (50)$$

$$\log A_{F,t}^* = (1 - \rho_{A_F^*}) \log \bar{A}_F^* + \rho_{A_F^*} \log A_{F,t-1}^* + \epsilon_{A_F^*,t}. \quad (51)$$

Financial Uncertainty (UF) Shock. Specifically, the level component of the financial demand wedge, $u_{UF,t}$, enters the U.S. household's Euler equation as a time-varying intertemporal discount-factor shifter. Following the uncertainty framework of Basu and Bundick (2017), the model introduces a second-moment financial uncertainty shock through stochastic volatility in a risk-premium wedge. Specifically, $u_{UF,t}$, enters the U.S. household's Euler equation as a time-varying intertemporal demand shifter. It does not correspond to innovations in the level of $u_{UF,t}$ itself, but rather to innovations in the stochastic volatility governing its evolution. The level component follows an AR(1) process with time-varying volatility:

$$\log(u_{UF,t}) = (1 - \rho_{u_{UF}}) \log(\bar{u}_{UF}) + \rho_{u_{UF}} \log(u_{UF,t-1}) + \sigma_{u_{UF},t-1} \epsilon_{u_{UF},t}, \quad (52)$$

where $\epsilon_{u_{UF},t} \sim N(0, 1)$. The actual financial uncertainty shock is defined as an innovation to the conditional volatility of the risk-premium process. The stochastic volatility parameter, $\sigma_{u_{UF},t}$, evolves according to an independent AR(1) process:

$$\log(\sigma_{u_{UF},t}) = (1 - \rho_{\sigma_{u_{UF}}}) \log(\bar{\sigma}_{u_{UF}}) + \rho_{\sigma_{u_{UF}}} \log(\sigma_{u_{UF},t-1}) + \sigma_{\sigma_{u_{UF}},t} \epsilon_{\sigma_{u_{UF}},t}, \quad (53)$$

where $\epsilon_{\sigma_{u_{UF}},t} \sim N(0, 1)$. A positive realization of $\epsilon_{\sigma_{u_{UF}},t}$ therefore represents a pure increase in U.S. financial uncertainty, interpreted as a rise in the conditional volatility of future financial conditions. This interpretation is consistent with the financial uncertainty measure of Jurado et al. (2015), which defines uncertainty as the conditional volatility of the unforecastable component of future financial outcomes rather than changes in their conditional mean.

Because uncertainty enters as a second-moment disturbance, the model uses a third-order perturbation approximation. Under first-order linearization, certainty equivalence implies that changes in the variance of future shocks have no effect on equilibrium allocations. Higher-order terms are then necessary to capture precautionary behavior and the macroeconomic consequences of uncertainty. An increase in $\sigma_{u_{UF},t}$ increases the spread of future financial conditions, causing households to increase precautionary savings and reduce current consumption to protect against a wider distribution of future outcomes. Consequently, a positive uncertainty shock induces households to increase precautionary savings and reduce current consumption expenditures. Through nominal rigidities and general equilibrium interactions, this decline in aggregate demand generates a contraction in U.S. economic activity that subsequently propagates internationally through trade, financial, and exchange-rate channels. In addition, the increase in U.S. financial uncertainty raises the sovereign spread faced by Mexican borrowers through Equation (48), generating tighter external financing conditions even when domestic fundamentals remain unchanged.

5 Calibration

Table 1 summarizes the baseline monthly calibration. Deep structural parameters governing household preferences, production technology, nominal rigidities, and substitution elasticities are assumed symmetric across countries to provide a transparent benchmark and isolate the effects of asymmetries in trade exposure, financial frictions, and monetary policy. Parameter values follow standard New Keynesian and small-open-economy calibrations (Gali and Monacelli, 2005; Christiano et al., 2005; Uribe and Yue, 2006). Country-specific differences arise through trade shares, investment adjustment costs, monetary policy rules, and financial frictions, while stationarity is ensured by the debt-elastic risk premium of Schmitt-Grohé and Uribe (2003).

Explicit asymmetries are introduced to capture the interaction between a large foreign economy and a small open emerging economy. First, Armington trade shares (ω) are calibrated using World Bank WITS data, reflecting Mexico’s relatively high reliance on imported capital goods

($\omega_I = 0.41$) compared to the more closed U.S. economy ($\omega_I^* = 0.92$)¹⁰. The use of Armington aggregation follows standard international business cycle and open economy macroeconomic models in which domestic and foreign goods are imperfect substitutes (Backus et al., 1992). Second, investment adjustment costs are set higher for Mexico ($\phi_I = 8.0$ versus $\phi_I^* = 4.0$) to capture stronger emerging-market financial frictions and to help reproduce the persistent, hump-shaped contraction observed in the empirical SVAR. This calibration is consistent with the role of investment adjustment costs in generating gradual investment dynamics and hump-shaped responses to shocks (Christiano et al., 2005; Smets and Wouters, 2007).

In the monetary block, the U.S. Federal Reserve follows a standard Taylor rule responding to inflation and output (Taylor, 1993; Basu and Bundick, 2017). Banxico is calibrated to place greater weight on inflation stabilization, with a muted output response ($\rho_y = 0.10$) and lower interest-rate smoothing ($\rho_r = 0.86$). This reflects Mexico’s institutional emphasis on price stability and the need for rapid policy adjustments in an economy exposed to exchange-rate pass-through and external financial shocks¹¹ (Calvo and Reinhart, 2002; Baqueiro et al., 2003; Capistrán et al., 2011). Finally, the financial uncertainty process is parameterized using MCMC estimation, while the sovereign-risk elasticity (ω_{risk}) is chosen to match the empirical impulse responses. This transmission channel follows the standard emerging-market framework in which external financial shocks propagate through sovereign spreads and foreign borrowing costs (Neumeyer and Perri, 2005; Uribe and Yue, 2006; Fernández-Villaverde et al., 2011).

5.0.1 Calibration of Uncertainty Shocks

To anchor the quantitative impact of uncertainty within the theoretical model, the stochastic volatility process is estimated directly from empirical data. The calibration employs the monthly financial uncertainty (U_F) index developed by (Ludvigson et al., 2021) over the period 1994M1 to 2023M12. This time frame is selected to maintain consistency with the SVAR framework.

¹⁰The WITS-implied domestic share for U.S. capital goods is approximately 0.8. The baseline sets $\omega_I^* = 0.92$ because the model’s investment-goods aggregator is broader than traded capital goods and is intended to preserve the large-economy interpretation of the U.S. block. Thus, ω_I^* is treated as a calibrated home-bias parameter rather than a direct WITS moment.

¹¹The constitutional amendment to Article 28 of the Political Constitution of the United Mexican States in April 1993 granted formal autonomy to Banco de México, establishing the preservation of the currency’s purchasing power as its primary mandate.

Table 1: Baseline Parameter Values

Parameter	Description	Value	Source/Rationale
<i>Panel A: Mexico (Home Economy)</i>			
β	Discount factor	0.9967	Matches annual real rate of $\approx 4\%$ (Uribe and Yue, 2006)
σ	Inv. elasticity of intertemporal substitution	2.0000	Uribe and Yue (2006)
ϕ	Inv. Frisch elasticity of labor supply	2.0000	Chetty et al. (2011)
α	Capital share of output	0.3200	Uribe and Yue (2006)
δ	Depreciation rate	0.0083	Monthly equivalent of $\delta_q = 0.025$ (quarterly)
ϕ_I	Investment adjustment cost	8.0000	High MEX rigidities
ε	Elasticity of substitution (varieties)	6.0000	(Gali and Monacelli, 2005; Christiano et al., 2005)
η	Armington elasticity (trade)	1.5000	Backus et al. (1992)
ω_C	Domestic share in consumption	0.8800	Calibrated via WITS data
ω_I	Domestic share in investment	0.4100	Calibrated via WITS data
ψ	Debt-elastic risk premium	0.0004	Schmitt-Grohé and Uribe (2003)
<i>Panel B: USA (Foreign Economy)</i>			
β^*	Foreign discount factor	0.9967	Symmetry with Home economy
σ^*	Foreign risk aversion	2.0000	Symmetry with Home economy
ϕ^*	Foreign inv. Frisch elasticity	2.0000	Symmetry with Home economy
α^*	Foreign capital share	0.3200	Symmetry with Home economy
δ^*	Foreign depreciation rate	0.0083	Symmetry with Home economy
ϕ_I^*	Foreign investment adjustment cost	4.0000	Christiano et al. (2005); lower than Mexico
ε^*	Foreign elasticity of substitution	6.0000	Symmetry with Home economy
η^*	Foreign Armington elasticity	1.5000	Symmetry with Home economy
ω_C^*	Foreign domestic share (Consum.)	0.9000	WITS; Large economy constraint
ω_I^*	Foreign domestic share (Invest.)	0.9200	WITS; Large economy constraint
<i>Panel C: New Keynesian Parameters</i>			
ϕ_p	Home Rotemberg price adjustment cost	750.00	Equivalence mapping for monthly duration
ϕ_p^*	Foreign Rotemberg price adjustment cost	750.00	Equivalence mapping for monthly duration
ρ_r	Home Taylor rule: Interest rate smoothing	0.8600	Lower policy inertia
ρ_r^*	Foreign Taylor rule: Interest rate smoothing	0.9500	High-inertia calibration
ρ_π	Home Taylor rule: Inflation reaction	1.6000	Hawkish EM stance
ρ_π^*	Foreign Taylor rule: Inflation reaction	1.5000	Taylor (1993); Basu and Bundick (2017)
ρ_y	Home Taylor rule: Output reaction	0.1000	Muted reaction to output
ρ_y^*	Foreign Taylor rule: Output reaction	0.2000	Basu and Bundick (2017)
$\bar{\Pi}, \bar{\Pi}^*$	Steady-state inflation target	1.0025	$\approx 3\%$ annual net steady-state inflation
<i>Panel D: Steady-State Anchors and Shock Processes</i>			
$\bar{A}_H, \bar{A}_F$	Steady-state TFP (Home/Foreign)	1.0000	Normalization
$\bar{u}_{UF}$	Steady-state financial risk premium	1.0000	Normalization
$\bar{\sigma}_{u,UF}$	Steady-state uncertainty volatility	0.0234	Calibrated via MCMC estimation
$\bar{B}^*$	Steady-state net foreign assets	0.0000	(Schmitt-Grohé and Uribe, 2003)
$\bar{R}^*$	Steady-state foreign interest rate	1.0058	Consistent with $\bar{\Pi}^*/\beta^*$
ρ_{AH}	Home TFP shock persistence	0.9500	Neumeyer and Perri (2005)
ρ_{AF}	Foreign TFP shock persistence	0.9500	Smets and Wouters (2007)
$\rho_{u,UF}$	Risk premium level persistence	0.9500	Structural stability constraint
$\rho_{\sigma_{u,UF}}$	Uncertainty shock persistence	0.8587	Calibrated via MCMC estimation
$\sigma_{\sigma_{u,UF}}$	Volatility of uncertainty shock	0.2739	Calibrated via MCMC estimation
ω_{risk}	Financial uncertainty elasticity	0.0015	Matches endogenous spike in empirical short-term rate

Table 2: Posterior Estimates of the Stochastic Volatility Process for U.S. Financial Uncertainty (U_F)

Parameter	5th Percentile	Median (50th)	95th Percentile
Level Persistence ($\rho_{u_{UF}}$)	0.9910	0.9989	0.9997
Volatility Persistence ($\rho_{\sigma_{u_{UF}}}$)	0.7784	0.8587	0.9292
Volatility-of-Volatility Std. Dev. ($\sigma_{\sigma_{u_{UF}}}$)	0.2094	0.2739	0.3394
Steady-State Log-Volatility ($\log(\bar{\sigma}_{u_{UF}})$)	-3.9564	-3.7534	-3.5781

Notes: The table reports the 5th, 50th (median), and 95th percentiles of the posterior distribution for the AR(1) stochastic volatility process parameters. The posterior distributions are estimated using the particle filter algorithm of Born and Pfeifer (2014) on the log-transformed Ludvigson et al. (2021) financial uncertainty index. The Markov Chain Monte Carlo (MCMC) procedure relies on 5,000 Metropolis-Hastings draws, discarding the initial 500 draws as a burn-in period. These entries are as described in equations 52 and 53.

Instead of calibrating the shock parameters to match the decay of the empirical impulse response functions, an AR(1) stochastic volatility model is estimated on the log-transformed U_F index. Because the variance of the shock is unobserved and time-varying, standard linear filtering techniques, such as the Kalman filter, cannot be applied. Consequently, the estimation relies on a particle filter embedded within a Markov Chain Monte Carlo (MCMC) algorithm to evaluate the likelihood of the non-linear state-space representation¹².

Table 2 summarizes the posterior distribution of the estimated parameters. The procedure identifies the underlying level of financial uncertainty as highly persistent, while the autoregressive persistence of the volatility state ($\rho_{\sigma_{u_{UF}}}$) is estimated at 0.8587, and the standard deviation of the volatility-of-volatility shock ($\sigma_{\sigma_{u_{UF}}}$) at 0.2739. To ensure structural stability and prevent explosive unconditional variance during the third-order simulation, the theoretical persistence of the uncertainty level ($\rho_{u_{UF}}$) is formally constrained to 0.95.¹³ The estimated second-moment parameters, however, are mapped directly into the theoretical model, ensuring the uncertainty shock accurately reflects the statistical volatility of the empirical U.S. financial index.

¹²The estimation employs the particle filter algorithm developed by Born and Pfeifer (2014) to evaluate the likelihood of the stochastic volatility process. The Markov Chain Monte Carlo (MCMC) procedure computes 5,000 Metropolis-Hastings draws from the posterior distribution, discarding the initial 500 draws as a burn-in period.

¹³In finite samples, the unconstrained MCMC posterior median approaches the boundary of the unit circle, rendering the empirical process observationally equivalent to a random walk. Constraining this persistence parameter below unity is a standard numerical discipline required to maintain a stationary steady state when solving non-linear DSGE models via higher-order perturbation methods.

6 Results

This section presents the baseline non-linear model against the SVAR estimates. Furthermore, it analyzes the model's sensitivity to varying degrees of international trade exposure (high versus low home bias), alternative monetary policy stances (output stabilizer against an inflation hawk¹⁴ under different smoothing parameters), alternative financial transmission channel specifications for the Schmitt-Grohé and Uribe (2003) debt-elastic premium alongside the uncertainty elasticity (ω_{risk}), and the role of nominal rigidities (flexible versus sticky price-setting).

6.1 Empirical vs DSGE model

Figure 2 presents the theoretical impulse response functions generated by the baseline non-linear DSGE model (dashed line) against the SVAR estimates (solid line), with shaded 90% confidence intervals following the external shock. This is to validate whether the structural frictions and transmission channels embedded within the theoretical framework can accurately replicate the magnitude, direction, and persistence of the empirical spillovers to the Mexican economy.

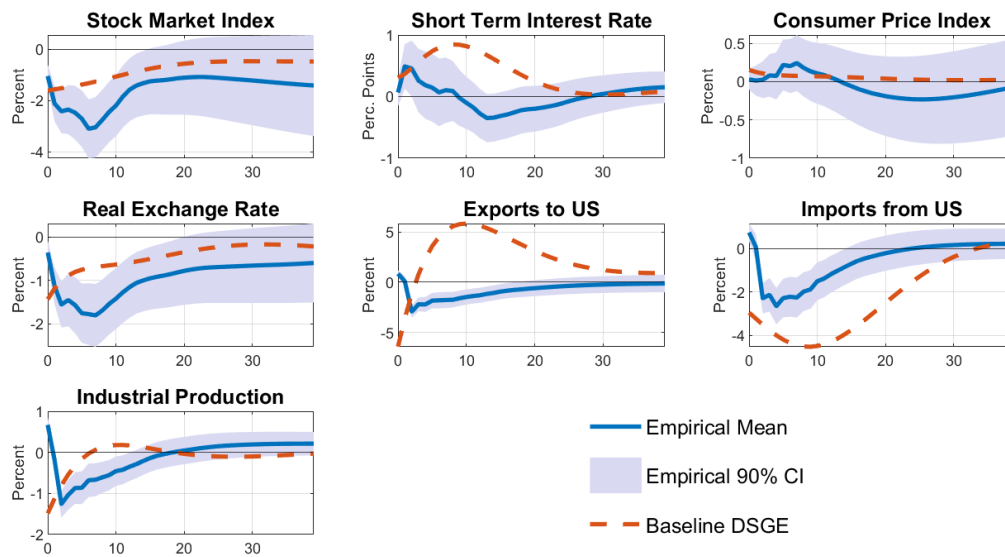


Figure 2: Empirical and model-implied responses to U.S. financial uncertainty

¹⁴An “inflation hawk” regime implies a strong preference for price stability, operationalized via an elevated Taylor rule coefficient for inflation (e.g., $\phi_\pi \geq 2.0$) relative to the weight placed on output stabilization (ϕ_y). For foundational discussions on inflation targeting trade-offs, see Clarida et al. (1999).

The DSGE model performs reasonably well in capturing the real-economy contraction following the external shock. Most notably, it reproduces the persistent, hump-shaped decline in domestic industrial production observed in the empirical analysis. The simulated depth and persistence of the recession are broadly consistent with the SVAR responses, reflecting the role of investment adjustment costs ($\phi_I = 8.0$) in propagating the effects of the uncertainty shock. Similarly, it captures the pronounced decline in imports from the U.S., consistent with the implications of the Armington aggregation framework as lower domestic consumption and investment reduce demand for imported goods. Although several parameters were calibrated to reproduce key features of the empirical responses, the comparison demonstrates that the model jointly generates a coherent set of macroeconomic dynamics that broadly resemble those observed in the data.

On the other hand, the financial and monetary transmission mechanisms operate fundamentally as predicted by the empirical data. The domestic stock market index experiences an immediate contraction in both frameworks, reflecting the flight-to-safety capital outflows and the resulting drop in domestic equity valuations. The model reproduces the direction and timing of the monetary policy response observed in the SVAR estimates with a sharp, immediate increase in the short-term interest rate. This is consistent with the parameterization of the central bank’s Taylor rule. By heavily weighting the inflation response ($\rho_\pi = 1.6$) and muting the output response, the model shows the central bank’s “fear of floating” behavior, aggressively tightening monetary policy to defend the currency despite the onset of a domestic recession (Calvo and Reinhart, 2002)

While the model predicts the initial currency depreciation and the mild upward pressure on the consumer price index (CPI), a clear divergence emerges in the bilateral trade block, particularly for exports to the United States. The DSGE model predicts a stronger export expansion than observed in the empirical evidence, where exports initially decline before gradually recovering. This difference arises because the model captures the interaction of external demand, nominal rigidities, and general equilibrium adjustment within a standard Armington framework. Although the real exchange-rate depreciation improves Mexico’s international competitiveness through the expenditure-switching effect, this positive force is simultaneously offset by the contraction in U.S. aggregate demand induced by the financial uncertainty shock. Consequently, the timing and mag-

nitude of the export response reflect the interaction between improved price competitiveness and weaker foreign demand, resulting in a more gradual adjustment than would be implied by the exchange-rate channel alone. The DSGE framework therefore captures one plausible demand-driven mechanism underlying the observed export dynamics while deliberately abstracting from other real-world frictions, such as foreign-currency invoicing and firm-level pricing behavior, that lie beyond the scope of the baseline Armington structure.

While the baseline model underestimates the severity of this foreign demand collapse, the overall quantitative exercise confirms that the DSGE framework fundamentally captures the core spillover mechanisms of capital flight, domestic monetary tightening, and severe industrial contraction which define the emerging market response to external financial uncertainty shocks.

6.2 Trade: high vs low home bias

To assess the robustness of the model to alternative degrees of trade integration, Figure 3 contrasts the baseline model against two extreme structural counterfactuals by modifying the domestic Armington aggregation shares from their baseline calibration ($\omega_C = 0.88, \omega_I = 0.41$). Specifically, the analysis evaluates a *high home bias* scenario (Panel a), where the domestic economy is heavily insulated from foreign goods ($\omega_C = 0.98, \omega_I = 0.51$), and a *low home bias* scenario (Panel b), representing a highly integrated economy structurally dependent on foreign imports ($\omega_C = 0.78, \omega_I = 0.31$). This exercise isolates how the economy's structural reliance on imported consumption and investment goods affects the transmission of the external shock.

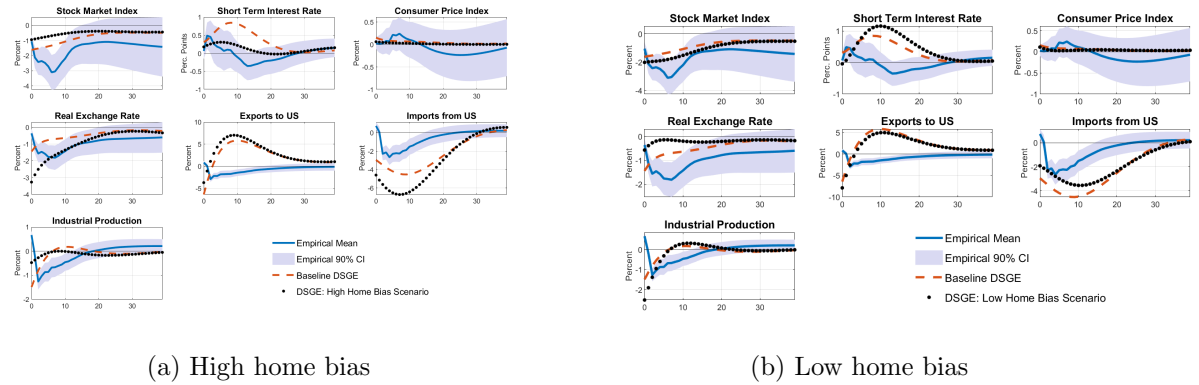


Figure 3: Structural spillovers of U.S. financial uncertainty to Mexico: trade characteristics

In the high home bias scenario (Figure 3a, dotted line), the Home economy produces the majority of its own consumption and investment baskets. Consequently, the real macroeconomic effects of the U.S. uncertainty shock are significantly muted, though not completely eliminated. Industrial production experiences a much more reduced contraction compared to the baseline, and the contraction in imports from the U.S. is significantly reduced. Crucially, because imported goods constitute a negligible fraction of the domestic consumer price index in this scenario, the economy is inherently shielded from exchange-rate pass-through. Without the threat of severe imported inflation, the central bank is not forced to aggressively defend the currency; therefore, the spike in the interest rate is substantially smaller. This result is consistent with the theoretical literature suggesting that lower trade openness physically insulates small open economies from center-country demand fluctuations (Hoek et al., 2022; Llosa et al., 2025).

Conversely, the low home bias scenario (Figure 3b, dotted line) illustrates how deep structural reliance on foreign trade actively amplifies external financial shocks, especially for a Home economy that is heavily dependent on trade with the U.S., where the external shock comes from. Given its high dependence on imported U.S. capital and consumer goods, the initial exchange rate depreciation becomes destabilizing. As the peso depreciates, imported consumption and investment goods become substantially more expensive in domestic-currency terms. Because the economy is structurally reliant on these imports, the central bank faces higher exchange-rate pass-through into consumer prices compared to the high home bias scenario.

To anchor inflation expectations, there is a need to enforce aggressive tightening cycle, evidenced by the steeper and more persistent spike in the short-term interest rate compared to the baseline. This tightened monetary response, combined with the higher cost of imported capital goods, discourages domestic investment and triggers a deeper, sharper contraction in output. The results suggest that greater trade openness increases the sensitivity of domestic inflation to exchange-rate movements, thus inducing a stronger monetary policy response and amplifying the contraction in economic activity (Cavallino and Sandri, 2023; Bianchi and Coulibaly, 2025).

6.3 Taylor Rule: output stabilizer vs inflation hawk

Figure 4 contrasts the baseline model ($\rho_\pi = 1.6, \rho_y = 0.10, \rho_r = 0.86$) against four counterfactual policy regimes. The scenarios are structured along two situations: evaluating an *output stabilizer* ($\rho_y = 1.5$) against an *inflation hawk* ($\rho_\pi = 5.0$), and the degree of policy inertia, reducing the interest rate smoothing parameter ($\rho_r = 0.70$) to analyze the impact of a front-loaded monetary response.

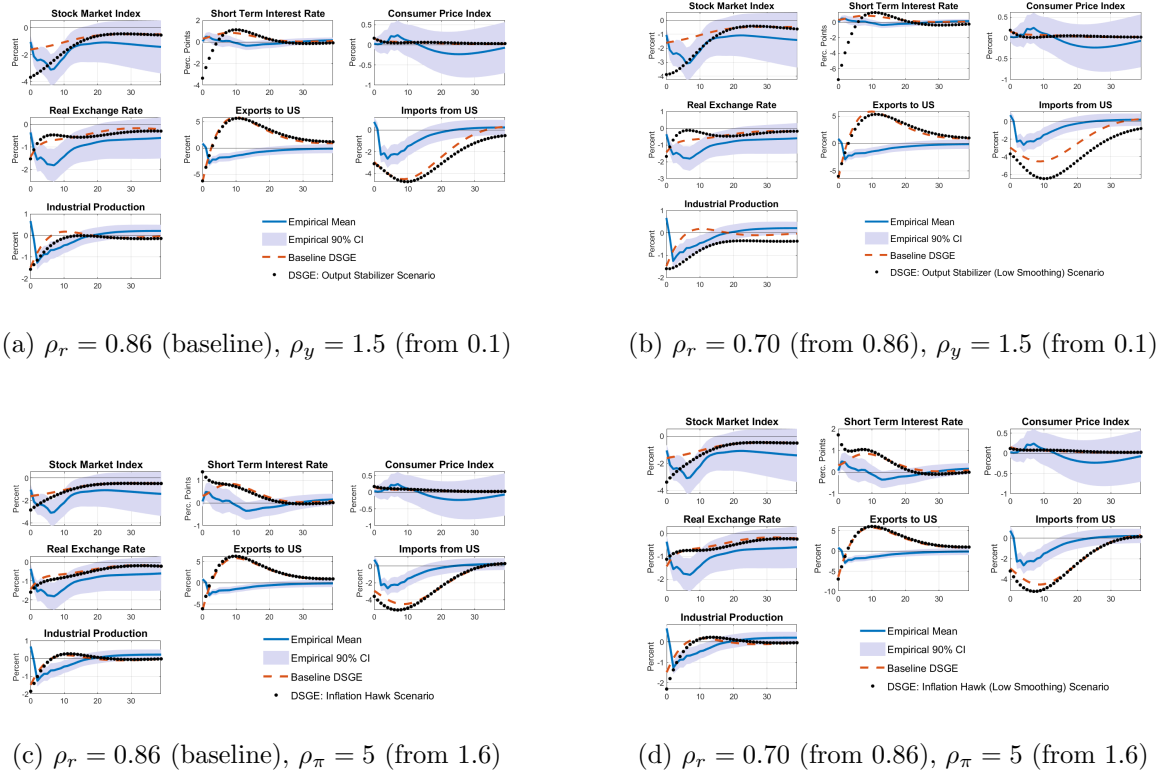


Figure 4: Structural spillovers of U.S. financial uncertainty to Mexico: Taylor rule settings

Panels (a) and (b) evaluate scenarios where the domestic central bank attempts to heavily prioritize output stabilization ($\rho_y = 1.5$) during the external shock. Panel (a) maintains baseline policy inertia ($\rho_r = 0.86$), while Panel (b) eliminates smoothing ($\rho_r = 0.70$) to test a front-loaded policy response. As illustrated by the dotted lines, the output-stabilizing central bank responds to the U.S. shock by abandoning the baseline procyclical tightening and instead aggressively cutting the short-term interest rate. In Panel (a), this accommodative cycle reaches -3.35%, whereas the front-loaded response in Panel (b) forces an immediate, drastic cut of nearly -7.42%.

Despite this massive monetary stimulus, the trajectory of output remains similar from the baseline scenario. This yields a critical structural insight where the domestic recession is driven heavily by the exogenous collapse in U.S. demand and the higher external risk premium. Consequently, attempting to counter-cyclically stimulate the domestic economy is fundamentally ineffective; domestic monetary easing is not as effective against an externally driven real contraction.

Furthermore, it also introduces distinct distortions into domestic financial markets. As seen in Panels (a) and (b), the extreme interest rate cut actually created greater decline and prolonged recovery of the stock prices compared to the baseline. While standard closed-economy models suggest that aggressive monetary easing boosts equity valuations, this model captures the realities of emerging market capital flows. The front-loaded rate cut in Panel (b) collapses the domestic yield advantage during a global flight-to-safety, accelerating capital outflows and depressing domestic equity markets. Interestingly, because the real economy's contraction is anchored by external forces, trade volumes and the price index remain mostly unchanged from the baseline. Ultimately, this result shows that for a highly open emerging market facing a global uncertainty shock, pivoting to an output-stabilization mandate fails to stimulate real production and merely injects unnecessary volatility into domestic financial markets.

Panels (c) and (d) analyzes scenarios where the domestic central bank operates as a stronger inflation response ($\rho_\pi = 5.0$), extremely prioritizing price stability during the external U.S. uncertainty shock. Panel (c) maintains baseline policy inertia ($\rho_r = 0.86$), while Panel (d) reduces smoothing ($\rho_r = 0.70$) to test the effects of a severe, front-loaded monetary tightening cycle.

The extreme hawkish mandate forces a significantly more aggressive procyclical response than the baseline model. In Panel (d), the front-loaded Taylor rule triggers a sharp, immediate increase in the short-term interest rate of 1.72% compared to 1.37% in Panel (c). Given this, this aggressive tightening generates a slightly lower initial spike in the consumer price index on impact, 0.12% compared to the 0.16% baseline. This outcome is consistent with the conventional New Keynesian transmission mechanism. The more aggressive monetary tightening suppresses aggre-

gate demand more rapidly, reducing domestic expenditure and dampening inflationary pressures throughout the economy. As a result, consumer prices rise by less than in the baseline specification despite the larger increase in interest rates. The stronger policy response therefore enhances inflation stabilization by anchoring expectations and limiting the pass-through of the exchange-rate depreciation into domestic prices. While the contractionary effects on output are amplified, the inflationary consequences of the external uncertainty shock are contained more effectively under the hawkish policy regime.

This medium-term nominal anchoring comes at a real-economy cost. Exhibiting an uncompromising “fear of floating,” the central bank aggressively chokes off domestic credit amidst the external shock to defend its inflation target. This huge cost of borrowing forces a lower output, a 2.31% drop compared to the 1.49% baseline decline, and causes a significantly deeper decline in imports from the U.S. as domestic demand dampens. This physical trade-off explicitly validates the theoretical models of Bianchi and Coulibaly (2025) regarding the contractionary nature of emerging market monetary defenses.

Despite improving inflation stabilization, the hawkish monetary stance imposes additional costs on domestic financial markets. The sharp increase in interest rates raises the discount rate applied to future cash flows while simultaneously weakening aggregate demand and firms’ expected earnings. As a result, equity valuations experience a substantial decline, with stock prices falling by approximately 3.39%. This outcome highlights the trade-off faced by the central bank during periods of external financial stress: a more aggressive response helps contain inflationary pressures and exchange-rate pass-through, but it amplifies the contraction in asset prices by tightening financial conditions and reducing the present value of future dividends.

6.3.1 The Impact of Policy Inertia (Smoothing)

Comparing Panels a and c to Panels b and d isolates the effect of interest rate smoothing (ρ_r). Under the baseline high-inertia calibration ($\rho_r = 0.86$), the central bank adjusts the nominal rate gradually. This smoothing mitigates immediate policy shocks but delays the peak impact of the monetary response. When inertia is reduced ($\rho_r = 0.70$), the central bank front-loads its Taylor

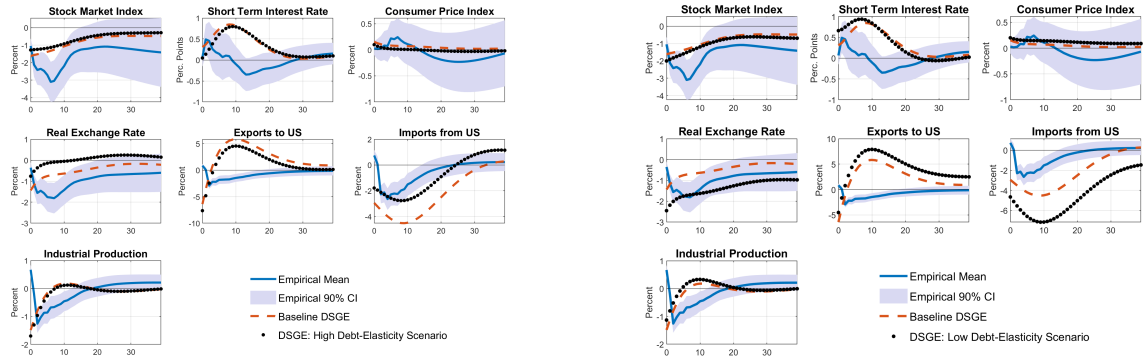
rule, triggering an immediate, aggressive shift in the short-term interest rate.

Crucially, the macroeconomic consequences of reducing policy inertia depend entirely on the central bank's underlying mandate. As observed in Panel (b), when an output-stabilizing central bank front-loads an aggressive rate cut, it signals panic during a flight-to-safety. This abrupt decline in the domestic yield advantage augments capital outflows, unnecessarily prolonging the recovery of the stock prices without providing any measurable additional support to output.

In contrast, Panel (d) shows the effect of a more front-loaded monetary policy response. Reducing policy smoothing produces an immediate 1.72% increase in the policy rate and containing inflationary pressures more rapidly. This abrupt tightening forces a deeper contraction in domestic demand and financial conditions, but it succeeds in containing inflationary pressures more rapidly than the baseline specification. By aggressively anchoring medium-term inflation expectations and limiting exchange-rate pass-through, the front-loaded policy reduces the peak response of consumer prices despite the larger external disturbance. The results suggest that, in a highly open economy exposed to external uncertainty, the timing of monetary policy adjustments is as important as their magnitude. A rapid and credible policy response can substantially improve inflation stabilization, even when the originating shock is entirely external in nature.

6.4 SGU Premium: sensitivity to the debt elasticity

Figure 5 evaluates the alternative calibrations of the Schmitt-Grohé and Uribe (SGU) debt-elastic risk premium parameter, ψ , which governs the sensitivity of external borrowing costs to deviations of net foreign assets from their steady-state level. Relative to the baseline calibration ($\psi = 0.0004$), Panel (a) considers a *higher debt elasticity* economy ($\psi = 0.0008$), while Panel (b) analyzes a *lower debt elasticity* economy ($\psi = 0.0002$). A larger value of ψ implies that international lenders require a stronger increase in the sovereign spread following additional external borrowing, whereas a smaller value weakens this financial amplification mechanism.



(a) Higher debt elasticity ($\psi = 0.0008$)

(b) Lower debt elasticity ($\psi = 0.0002$)

Figure 5: Structural spillovers of U.S. financial uncertainty to Mexico: sensitivity to sovereign risk

Across both scenarios, the qualitative transmission of a U.S. financial uncertainty shock remains robust. Irrespective of the sovereign risk calibration, the shock consistently lowers equity prices, increases domestic interest rates, depreciates the real exchange rate, stimulates exports through improved external competitiveness, compresses imports, and reduces industrial production. These common directional responses indicate that the model's fundamental propagation mechanism is not driven by the calibration of the SGU debt-elastic risk premium, but rather by the interaction between financial uncertainty, international trade, and domestic macroeconomic adjustment.

Quantitatively, however, the transmission channels differ across calibrations. Under the higher debt elasticity specification, external borrowing becomes more costly as foreign indebtedness increases, strengthening the financial transmission mechanism. Because the economy relies less on international borrowing to smooth the shock, a larger share of the adjustment falls on domestic absorption, resulting in a more pronounced contraction in industrial production. At the same time, the real exchange rate depreciates less than in the baseline specification, weakening the expenditure-switching effect. Consequently, exports expand by less, imports contract more moderately, and the smaller exchange-rate depreciation generates weaker imported inflationary pressures, leading to a more subdued increase in domestic policy interest rates.

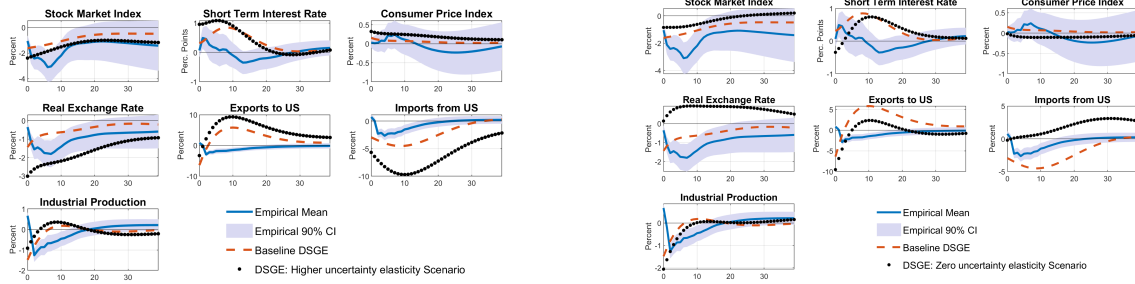
In contrast, under the lower debt elasticity, the sovereign spread responds less aggressively

to changes in external debt, leaving external financing conditions relatively more accommodating. This allows the economy to rely more heavily on foreign borrowing as a buffer against the shock while the exchange rate absorbs a larger share of the adjustment. The stronger depreciation enhances international competitiveness, producing a larger increase in exports and a deeper contraction in imports than in the baseline model. Although the sharper depreciation generates greater short-run inflationary pressures and a stronger initial increase in policy interest rates, improved access to external financing cushions domestic demand, resulting in a smaller decline in output.

Overall, these results indicate that the SGU debt-elastic premium governs the composition of the macroeconomic adjustment rather than its qualitative transmission. A higher debt elasticity strengthens the financial channel by making external borrowing more costly, thereby shifting a larger share of the adjustment toward domestic demand under tighter financing conditions. In contrast, a lower debt elasticity allows external borrowing to absorb a greater portion of the shock, increasing the importance of exchange-rate depreciation and trade reallocation while mitigating the decline in domestic output. Thus, although the relative importance of the financial and trade channels depends on the sovereign risk calibration, the model’s underlying transmission mechanism remains robust across alternative parameterizations.

6.5 Sensitivity to the Uncertainty Elasticity

Figure 6 evaluates the sensitivity of the model to alternative calibrations of the uncertainty elasticity parameter, ω_{risk} , which governs the direct effect of U.S. financial uncertainty on Mexico’s sovereign spread. Specifically, the analysis considers $\omega_{risk} = 0$, which eliminates the direct effect of U.S. financial uncertainty on the sovereign spread and a higher value of $\omega_{risk} = 0.0030$. Comparing these scenarios illustrates the extent to which the sovereign-risk channel amplifies the transmission of U.S. financial uncertainty to the Mexican economy.



(a) Higher uncertainty elasticity ($\omega_{risk} = 0.0030$)

(b) No uncertainty elasticity ($\omega_{risk} = 0$)

Figure 6: Structural spillovers of U.S. financial uncertainty to Mexico: sensitivity to uncertainty elasticity

Panel (a) examines a higher uncertainty elasticity ($\omega_{risk} = 0.0030$), which strengthens the responsiveness of Mexico's sovereign spread to U.S. financial uncertainty. Relative to the benchmark, the larger spread response generates a stronger real exchange-rate depreciation, a more pronounced contraction in imports, and a substantially larger expansion of exports. Despite the tighter financial conditions, industrial production experiences a smaller contraction than under the benchmark calibration, suggesting that the stronger improvement in net exports partially offsets the adverse effects of the uncertainty shock on domestic activity. The policy rate also responds more aggressively as the central bank reacts to the larger exchange-rate depreciation and its associated inflationary pressures. Overall, the timing and qualitative pattern of the impulse responses remain similar to the benchmark specification, with the higher uncertainty elasticity primarily affecting the magnitude of the responses.

Panel (b) considers the opposite case by setting $\omega_{risk} = 0$, thereby eliminating the direct sovereign-risk transmission channel¹⁵. In the absence of this immediate, uncertainty-driven increase in sovereign spreads, the exchange rate no longer depreciates immediately following the uncertainty shock. Instead, it exhibits a brief appreciation, indicating that the initial depreciation observed in the benchmark model is primarily driven by the sovereign-risk channel rather than by

¹⁵Note that setting $\omega_{risk} = 0$ causes the uncertainty multiplier in Equation (48) to evaluate to one, but it does not fix the sovereign spread identically to zero. The endogenous debt-elastic premium, $\exp(-\psi(B_t^* - \bar{B}^*))$, remains active to ensure SOE stationarity. Therefore, the delayed exchange-rate depreciation observed in this scenario is driven by an indirect channel: as weaker U.S. demand worsens Mexico's net foreign asset position, the debt-elastic premium endogenously increases the spread.

conventional trade mechanisms alone. As the effects of weaker U.S. demand and general equilibrium adjustments gradually propagate through the economy, the exchange rate eventually depreciates, although by considerably less than in the benchmark specification. Correspondingly, exports recover more slowly, while imports initially decline but subsequently rise above their steady-state level as the weaker exchange-rate adjustment reduces the expenditure-switching effect. Industrial production experiences a deeper and more persistent contraction than under the benchmark calibration, indicating that the absence of the sovereign-risk channel weakens the external adjustment that partially cushions domestic activity. The policy rate also responds less aggressively, reflecting the reduced transmission of U.S. financial uncertainty through sovereign spreads.

Overall, the sensitivity analysis indicates that the ω_{risk} parameter primarily governs the strength of the sovereign-risk transmission channel. Higher values amplify the depreciation of the real exchange rate, the contraction in imports, and the expansion of exports, while lower values attenuate these responses. Eliminating the channel ($\omega_{risk} = 0$) also alters the short-run exchange-rate dynamics, producing a brief initial appreciation before depreciation resumes. Nevertheless, the broader transmission mechanism remains intact across calibrations, supporting the interpretation of the sovereign-risk channel as an important amplification mechanism rather than the sole driver of the model's dynamics.

6.6 Flexible vs sticky prices

A central principle of the New Keynesian literature on uncertainty is that nominal rigidities constitute a key mechanism through which uncertainty shocks translate into real economic contractions (Basu and Bundick, 2017). To isolate the role of price-setting frictions in cross-border transmission, Figure 7 evaluates the baseline sticky-price model ($\phi_p = 750$) against a theoretical counterfactual where domestic prices are perfectly flexible ($\phi_p \approx 0$). This exercise demonstrates that the severe real-economy spillovers observed in the empirical data are fundamentally dependent on the presence of nominal rigidities in the emerging market.

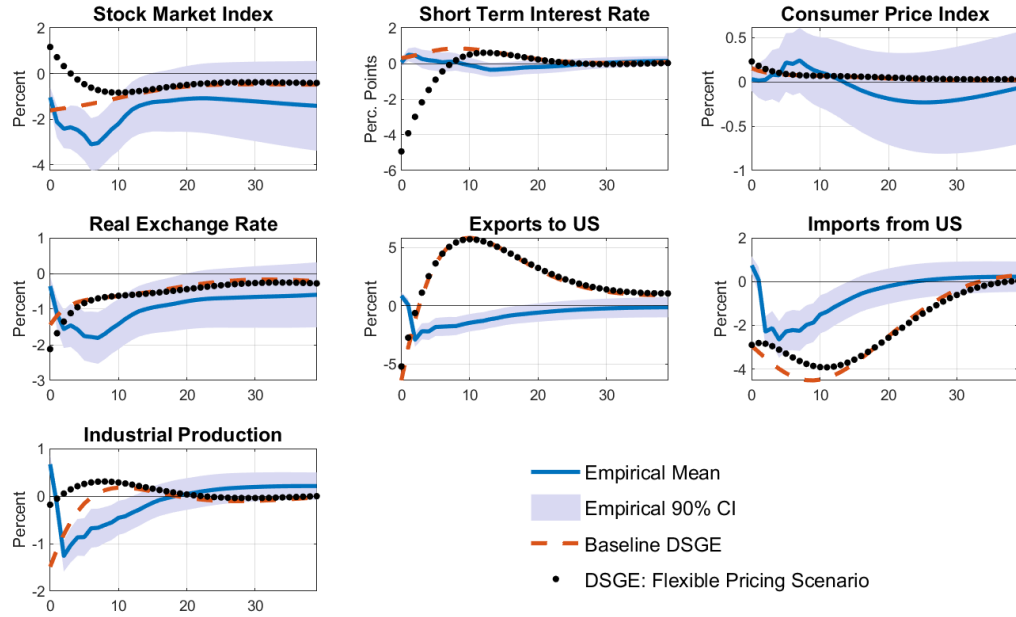


Figure 7: Structural spillovers of U.S. financial uncertainty to Mexico: price-setting characteristics

As illustrated in Figure 7 (dotted black line), completely removing price adjustment costs substantially alters the macroeconomic response to the external shock. Under flexible prices, domestic firms can immediately and costlessly adjust their prices in response to the sudden drop in aggregate demand and the depreciation of the exchange rate. With prices adjusting immediately, the monetary authority can lower the policy rate without generating persistent inflationary pressures, resulting in lower borrowing costs, stimulating domestic consumption and investment. Consequently, output does not collapse; instead, it exhibits a mild, immediate expansion. Furthermore, because inflation dynamics adjust frictionlessly, the central bank is not forced to raise the short-term interest Rate. Instead, the rate drops sharply to accommodate the shock, in stark contrast to the aggressive tightening observed in both the baseline model and the empirical data.

The great divergence between the flexible-price counterfactual and the baseline model confirms the theoretical findings of Basu and Bundick (2017). In a flexible-price environment, precautionary behavior increases desired savings and labor supply (the “precautionary savings” effect). Because prices and wages adjust immediately, markets clear without a substantial contraction in output,

and economic activity may even expand temporarily. However, when prices are sticky, firms cannot immediately lower prices to clear the market. Instead, output and hours worked decline as firms cannot fully offset the demand shortfall through price adjustments.

By successfully replicating the empirical reality, the comparison suggests that nominal rigidities constitute a central transmission mechanism through which external uncertainty shocks affect domestic economic activity. Without sticky prices, the model fundamentally fails to capture the contractionary reality of global financial panics, indicating that price-setting frictions are quantitatively important for modeling uncertainty spillovers to emerging markets.

7 Conclusion

This paper investigates the macroeconomic and financial spillovers of U.S. financial uncertainty to the Mexican economy. Combining empirical Structural Vector Autoregression (SVAR) evidence with a non-linear two-country New Keynesian DSGE framework calibrated to U.S.-Mexico data, the analysis identifies the mechanisms through which external financial uncertainty is transmitted to a representative small open emerging economy. The empirical evidence points to a broad decline in Mexican financial and real conditions following an increase in U.S. financial uncertainty, while the structural model provides an interpretation of how sovereign risk, trade exposure, nominal rigidities, and monetary policy shape these responses.

The quantitative results highlight financial frictions and nominal rigidities as important transmission mechanisms. Higher U.S. financial uncertainty raises the external risk premium faced by the Mexican economy, contributing to tighter financing conditions, exchange-rate depreciation, weaker asset valuations, and a contraction in real activity. The structural counterfactuals further show that the severity and composition of the adjustment depend on the characteristics of the domestic economy. Greater reliance on imported consumption and investment goods strengthens exchange-rate pass-through and imported inflation, inducing a stronger monetary response and a deeper contraction in economic activity. Changes in the debt elasticity of the sovereign risk premium alter the extent to which adjustment occurs through external borrowing, domestic ab-

sorption, the exchange rate, and trade. Similarly, varying the direct sensitivity of the sovereign spread to U.S. financial uncertainty changes the relative importance of financial tightening and external adjustment without overturning the broader transmission mechanism.

Nominal rigidities are also central to the real effects of the shock. When prices are more flexible, the contraction in output is substantially attenuated, indicating that price-setting frictions play an important role in translating foreign financial uncertainty into domestic real activity. Monetary policy introduces an additional trade-off. A stronger response to inflation dampens inflationary pressures and limits exchange-rate pass-through, but it does so at the cost of tighter financial conditions, lower equity valuations, and a deeper contraction in output. Conversely, greater emphasis on output stabilization provides limited support to real activity while weakening the domestic interest-rate advantage and placing additional pressure on financial markets. These findings illustrate the challenge faced by emerging-market central banks when external financial shocks simultaneously threaten nominal stability, financial conditions, and real activity.

Although calibrated to Mexico, the framework provides a useful basis for studying uncertainty spillovers in other small open emerging economies. The results show that vulnerability to a common external financial shock depends not only on the shock itself but also on the structure of the receiving economy, including its trade exposure, sovereign-risk characteristics, nominal rigidities, and monetary policy framework. More broadly, the analysis underscores the importance of jointly accounting for financial and trade channels when evaluating how global financial uncertainty propagates across emerging markets and why otherwise similar economies may experience different macroeconomic adjustments.

8 Appendix

8.1 Data summary

8.1.1 The U.S.

The data used to estimate the U.S. uncertainty shocks is primarily sourced from the St. Louis Federal Reserve’s FRED database. It is also in monthly frequency spanning from 1989M1 to 2023M12.

Table VIII.1.1: U.S. uncertainty variables

Name	Description	Source	Code
uf	Financial uncertainty index including 148 measures of financial indicators	Ludvigson’s website	
um	Macroeconomic uncertainty index based on 134 macroeconomic indicators	Ludvigson’s website	
ip	Industrial Production: Total Index, Index 2017=100, Seasonally Adjusted	FRED	INDPRO
fedfunds	Federal Funds Effective Rate, Percent, Not Seasonally Adjusted	FRED	FEDFUNDS
crsp	CRSP value-weighted stock market index return	WRDS	
vix	CBOE Volatility Index: VIX, Not Seasonally Adjusted	FRED	VIXCLS
sp500	S&P500 closing prices	Stooq	
employment	All Employees, Manufacturing, Thousands of Persons, Seasonally Adjusted	FRED	MANEMP

8.1.2 Mexico

The data for Mexico is carefully sourced from CEIC, Direction of Trade Statistic (DOTS) from IMF, and CEPALSTAT with a monthly frequency ranging from 1994M1 to 2023M12. To account appropriately for the real exchange rate, the data was sourced from Darvas (2021), which is based on 120 trading partners, given that countries with hyperinflation are excluded. Furthermore,

data that are not seasonally adjusted from their source are properly seasonally adjusted using the X-13 ARIMA-SEATS.

Table VIII.1.2: Macroeconomic, Trade, and Financial Variables in Latin America

Name	Description	Source
Mexico		
ip	Industrial production index (Manufacturing), 2018=100	CEIC
cpi	General price level of a representative goods and services basket	CEPALSTAT: Bank of Mexico
reer	Real effective exchange rate	Darvas (2021)
stir	Money market rate	CEIC
exus	Exports to the US in USD	DOTS/IMF
imus	Imports from the US in USD	DOTS/IMF
smi	Mexican Stock Exchange: BMV index	CEIC

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