Productivity Shocks and Monetary Policy in a Two-Country Model

December 7, 2025

Monetary Policy and De-Dollarization Dynamics in a Two-Country DSGE Model: Evidence from the US and China December 7, 2025

1 The Model

We develop a two-country New Keynesian model with nominal rigidities, where the two countries are identified as the United States (US) and China (CN). Each country is populated by households, firms, and a central bank. The model includes standard IS curves, New Keynesian Phillips curves, and Taylor-type monetary policy rules. International linkages arise through trade, terms of trade, and the exchange rate, allowing for monetary and real spillovers across countries.

Home and foreign assignment. The home economy is the United States (US), and the foreign economy is China (CN). The US represents an advanced economy issuing the global reserve currency, while China is modeled as a large emerging economy with partial financial dollarization.

Objective. The objective of this paper is to analyze the transmission mechanisms and international spillovers of two key shocks:

1. a *monetary policy shock in the US economy*, and

2. a *de-dollarization shock in China*, representing a reduction in the degree of dollarization within the Chinese financial system.

1.1 Households

Households consume differentiated goods, supply labor, and trade nominal bonds internationally. The representative household in country H maximizes expected lifetime utility

$$U = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\varphi}}{1+\varphi} \right), \tag{1}$$

The representative household in country F maximizes expected lifetime utility

$$U^* = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{*\,1-\sigma}}{1-\sigma} - \frac{N_t^{*\,1+\varphi}}{1+\varphi} \right), \tag{2}$$

where C_t (resp. C_t^*) is the consumption index in the home (resp. foreign) country, N_t (resp. N_t^*) denotes labor supply, $\beta \in (0,1)$ is the subjective discount factor, $\sigma > 0$ is the coefficient of relative risk aversion, and $\varphi > 0$ is the inverse Frisch elasticity. Foreign households have analogous preferences, as shown by U^*. Consumption is a CES composite of domestic and imported bundles:

$$C_t = \left[(1-\alpha)^{1/\eta} C_{H,t}^{\frac{\eta-1}{\eta}} + \alpha^{1/\eta} C_{F,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}, \tag{3}$$

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

where $\eta > 0$ is the elasticity of substitution between home and foreign goods and $\alpha \in [0,1]$ measures trade openness. Households in both countries maximize the utility function in equation (1) subject to their respective budget constraints.

The budget constraint of the representative household in the home country is given

by

$$\int_0^1 P_t(h)\, C_t(h)\, dh \;+\; \int_0^1 P_t(f)\, C_t(f)\, df \;+\; \mathbb{E}_t\big[Q_{t,t+1}\, D_{t+1}^n\big] \;\leq\; D_t^n \;+\; W_t N_t \;+\; TR_t. \quad (5)$$

The budget constraint of the representative household in the foreign country is analogously given by

$$\int_0^1 P_t^*(h)\, C_t^*(h)\, dh \;+\; \int_0^1 P_t^*(f)\, C_t^*(f)\, df \;+\; \mathbb{E}_t\big[Q_{t,t+1}^*\, D_{t+1}^{n,*}\big] \;\leq\; D_t^{n,*} \;+\; W_t^* N_t^* \;+\; TR_t^*. \quad (6)$$

Definitions:

- $P_t(h), P_t(f)$: prices of domestic (h) and foreign (f) goods in the home country at time t.
- $C_t(h), C_t(f)$: consumption of domestic and foreign goods by home households at time t.
- $P_t^*(h), P_t^*(f), C_t^*(h), C_t^*(f)$: the corresponding variables for the foreign country (denoted with *).
- $\mathbb{E}_t[\cdot]$: conditional expectation operator based on the information set at time t.
- $Q_{t,t+1}$: stochastic discount factor, i.e., the price in period t of a one-period asset paying one unit in period $t+1$. $Q_{t,t+1}^*$ is the foreign counterpart.
- D_{t+1}^n: nominal asset holdings chosen in t and maturing in $t+1$ (D_t^n is the beginning-of-period position). The foreign counterpart is $D_t^{n,*}$.
- $W_t N_t$: nominal labor income, where W_t is the wage rate and N_t denotes labor supply. Analogously, $W_t^* N_t^*$ for the foreign economy.
- TR_t, TR_t^*: lump-sum transfers received by households at time t, which may include dividends or fiscal transfers.

1.2 Firms

A continuum of monopolistically competitive firms produce differentiated goods with linear technology:

$$Y_t(h) = A_t N_t(h), \qquad Y_t^*(f) = A_t^* N_t^*(f), \tag{7}$$

where A_t and A_t^* are productivity processes.

Under Calvo pricing, a fraction $(1-\theta)$ of firms can re-optimize their price each period. The optimal reset price satisfies

$$\tilde{P}_{H,t} = \frac{\varepsilon}{\varepsilon - 1} \frac{\mathbb{E}_t \sum_{k=0}^{\infty} (\beta\theta)^k Q_{t,t+k} Y_{t+k} MC_{H,t+k}}{\mathbb{E}_t \sum_{k=0}^{\infty} (\beta\theta)^k Q_{t,t+k} Y_{t+k}}, \tag{8}$$

where $MC_{H,t}$ is real marginal cost.

Log-linearization yields the New Keynesian Phillips Curves:

$$\pi_{H,t} = \beta \mathbb{E}_t[\pi_{H,t+1}] + \kappa mc_{H,t}, \tag{9}$$

$$\pi_{F,t}^* = \beta \mathbb{E}_t[\pi_{F,t+1}^*] + \kappa mc_{F,t}^*, \tag{10}$$

with slope $\kappa = \frac{(1-\theta)(1-\theta\beta)}{\theta}$.

1.3 Equilibrium and Aggregate Demand

Market clearing requires

$$Y_t(h) = C_t(h) + C_t^*(h), \qquad Y_t^*(f) = C_t(f) + C_t^*(f). \tag{11}$$

Combining the Euler equation with the definition of terms of trade $s_t \equiv p_{F,t} - p_{H,t}$ gives the IS equations:

$$y_t = \mathbb{E}_t[y_{t+1}] - \frac{1}{\sigma}\big(r_t - \mathbb{E}_t[\pi_{H,t+1}]\big) - \frac{\omega_2}{\sigma}\mathbb{E}_t[\Delta s_{t+1}], \tag{12}$$

$$y_t^* = \mathbb{E}_t[y_{t+1}^*] - \frac{1}{\sigma}\big(r_t^* - \mathbb{E}_t[\pi_{F,t+1}^*]\big) + \frac{\omega_2}{\sigma}\mathbb{E}_t[\Delta s_{t+1}], \tag{13}$$

where $\omega_2 = 2\alpha(1-\alpha)(\sigma\eta - 1)$.

1.4 Output Gaps and Natural Output

Natural output $\bar{y}_t$ is defined by $mc_{H,t} = 0$. Solving yields

$$\bar{y}_t = \frac{\varsigma\psi}{\delta} a_t - \frac{\omega_2 \sigma\psi}{\delta} a_t^*, \tag{14}$$

$$\bar{y}_t^* = \frac{\varsigma\psi}{\delta} a_t^* - \frac{\omega_2 \sigma\psi}{\delta} a_t, \tag{15}$$

where a_t, a_t^* are productivity shocks, and ψ, δ are composite parameters.

We define the output gaps as

$$x_t = y_t - \bar{y}_t, \qquad x_t^* = y_t^* - \bar{y}_t^*. \tag{16}$$

1.5 Monetary Policy

Each central bank follows a Taylor-type rule. The US rule follows the standard form:

$$r_t^{US} = \varrho_{US} r_{t-1}^{US} + (1 - \varrho_{US})(\phi_{\pi,US} \pi_{US,t}^{CPI} + \phi_{x,US} x_{US,t}) + m_{US,t}. \tag{17}$$

For China, the monetary policy rule includes both the US spillover and a dollarization channel:

$$r_t^{CN} = \varrho_{CN} r_{t-1}^{CN} + (1-\varrho_{CN})(\phi_{\pi,CN} \pi_{CN,t}^{CPI} + \phi_{x,CN} x_{CN,t}) + \delta_{rUS} r_t^{US} + \gamma_{dol} dol_{CN,t} + m_{CN,t}. \tag{18}$$

Here, δ_{rUS} captures how the People's Bank of China (PBoC) responds to US monetary policy, while γ_{dol} measures the influence of dollarization pressures on domestic policy rates.

The degree of dollarization evolves as:

$$dol_{CN,t} = \rho_{dol} dol_{CN,t-1} + \gamma_\pi \pi_{CN,t}^{CPI} + \epsilon_{dol,t}, \tag{19}$$

where $\epsilon_{dol,t}$ is a de-dollarization shock.

1.6 Transmission Mechanism of De-Dollarization

The degree of dollarization crucially affects the effectiveness of monetary policy in China. When financial assets and contracts are highly dollarized, the PBoC's ability to control inflation and output is weakened. Because domestic financial conditions respond less to changes in the renminbi interest rate, the central bank must implement larger rate adjustments to achieve its inflation target.

Mechanism:

1. High dollarization reduces the sensitivity of domestic demand to the Chinese policy rate.

2. Inflation becomes less responsive to monetary policy.

3. The PBoC must raise or lower interest rates by larger magnitudes to influence prices.

4. A *de-dollarization shock* ($\epsilon_{dol,t} < 0$) reduces the share of dollar-denominated assets, strengthening the transmission channel of domestic monetary policy.

5. This shock first affects the Chinese interest rate $r_{CN,t}$ through the Taylor rule and then propagates to output, inflation, and exchange rate dynamics.

Thus, de-dollarization enhances the autonomy of China's monetary policy and increases its capacity to stabilize inflation.

2 Bayesian Estimation

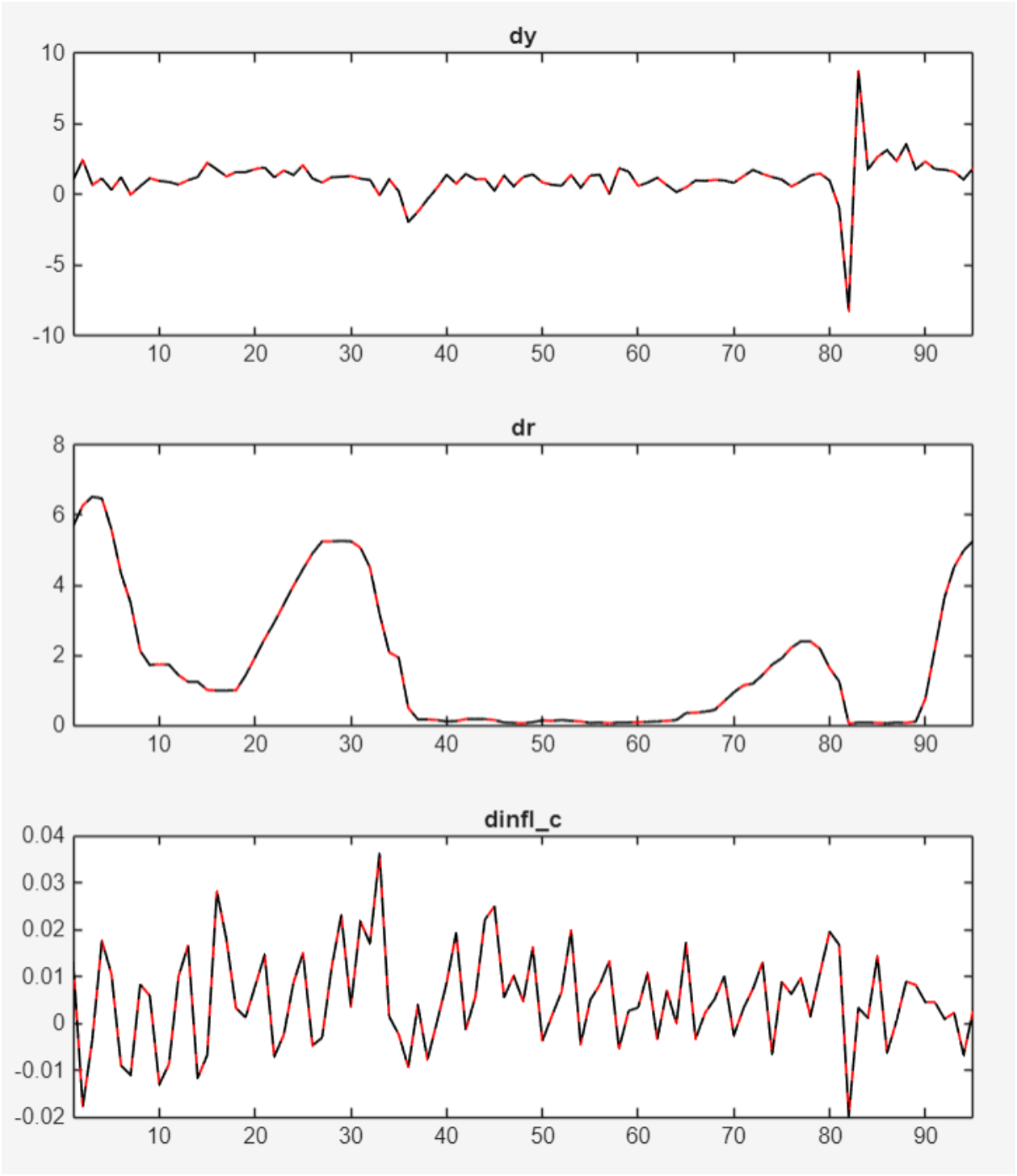
2.1 Data

The model is estimated using six quarterly macroeconomic series from the Federal Reserve Economic Data (FRED) and Chinese statistical sources:

Table 1: Observables Used in Estimation

Variable	Economy	Description
y	US	Real GDP growth (quarterly)
p	US	CPI inflation (quarterly)
r	US	Short-term interest rate (Fed Funds Rate)
y_{CN}	China	Real GDP growth (quarterly)
p_{CN}	China	CPI inflation (quarterly)
r_{CN}	China	Short-term interest rate

All series are seasonally adjusted and expressed in quarterly changes. Dollarization dynamics are proxied using data on foreign currency deposits or external liabilities, depending on availability.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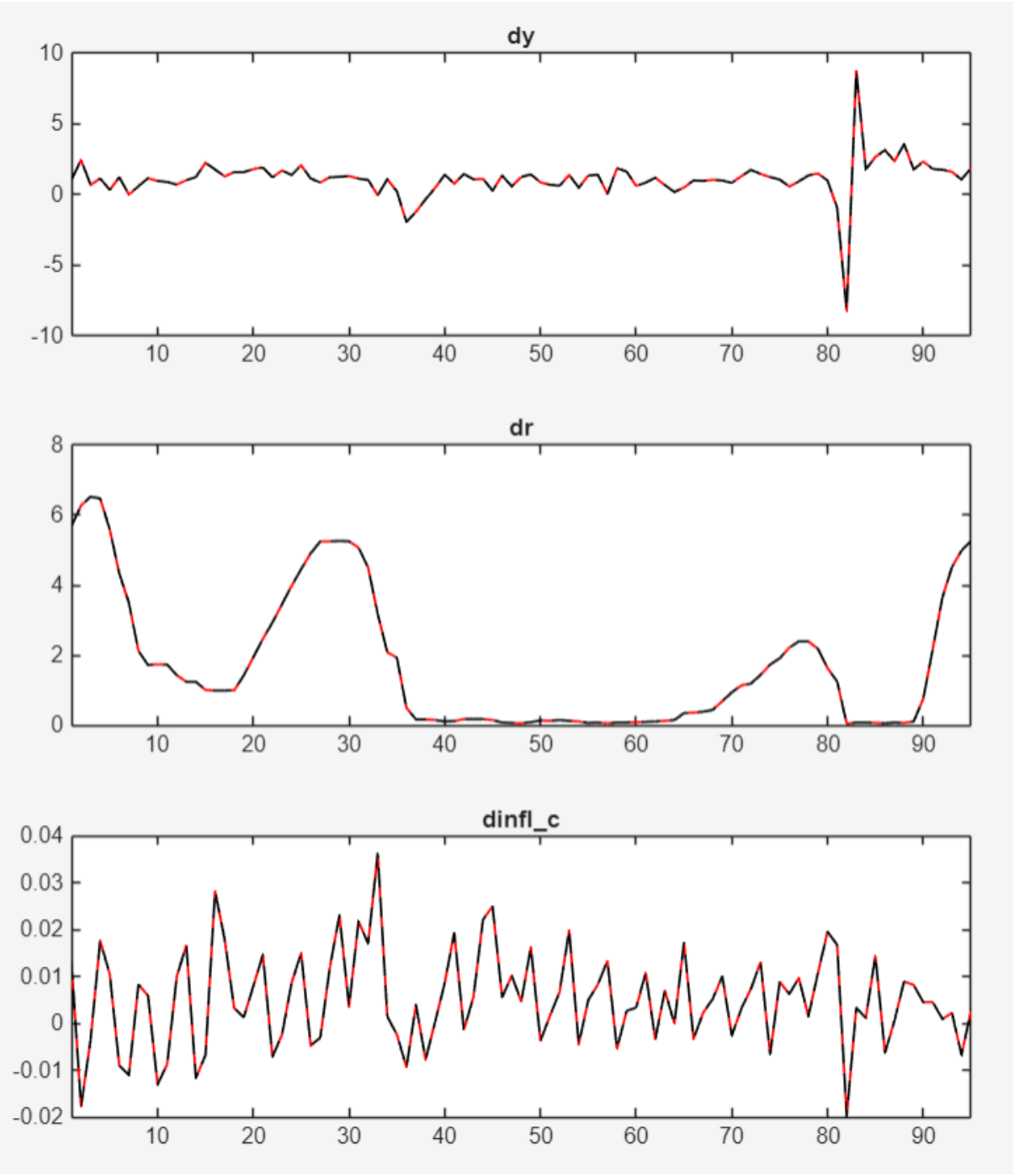


2.2 Estimation Setup

Bayesian estimation is implemented in Dynare with priors consistent with the literature:

- $\rho_{US}, \rho_{CN}, \rho_{dol} \sim \text{Beta}(0.6, 0.4)$
- $\theta_{US}, \theta_{CN} \sim \mathcal{N}(0.4, 0.05)$
- $\sigma \sim \text{Gamma}(4.5, 0.5)$

We use 500 Metropolis–Hastings replicates, 2 blocks, and a 30% burn-in. Posterior means and 90% highest posterior density intervals summarize the estimated parameters.

3 Posterior Estimates

Posterior means and 90% highest posterior density (HPD) intervals for the key parameters are reported in Table 2.

Table 2: Posterior Estimates of Structural Parameters

Parameter	Prior Mean	Posterior Mean	90% HPD Interval	Prior Std
ρ_{US}	0.600	0.1319	0.1318 – 0.1319	0.4000
ρ_{CN}	0.600	0.0001	0.0001 – 0.0001	0.4000
ρ_{dol}	0.600	0.3208	0.3208 – 0.3208	0.4000
θ_{US}	0.400	0.3045	0.3044 – 0.3045	0.0500
θ_{CN}	0.400	0.3727	0.3727 – 0.3727	0.0500
σ	4.500	5.0177	5.0177 – 5.0178	0.5000
$\phi_{\pi,US}$	1.500	2.8000	2.8000 – 2.8000	0.3000
$\phi_{\pi,CN}$	1.500	0.1998	0.1997 – 0.1998	0.3000
$\phi_{x,US}$	0.500	0.5150	0.5149 – 0.5150	0.2000
$\phi_{x,CN}$	0.500	1.1302	1.1302 – 1.1302	0.2000
ϱ_{US}	0.400	0.6394	0.6394 – 0.6394	0.3000
ϱ_{CN}	0.400	0.9994	0.9994 – 0.9994	0.3000
γ_{π}	0.400	0.6465	0.6465 – 0.6465	0.2000
γ_{x}	-0.150	0.4200	0.4200 – 0.4200	0.1000
γ_{e}	0.080	0.0440	0.0440 – 0.0440	0.0500
γ_{r}	0.100	-0.0203	-0.0203 – -0.0203	0.0500
δ_{rUS}	0.350	0.9572	0.9572 – 0.9572	0.1000

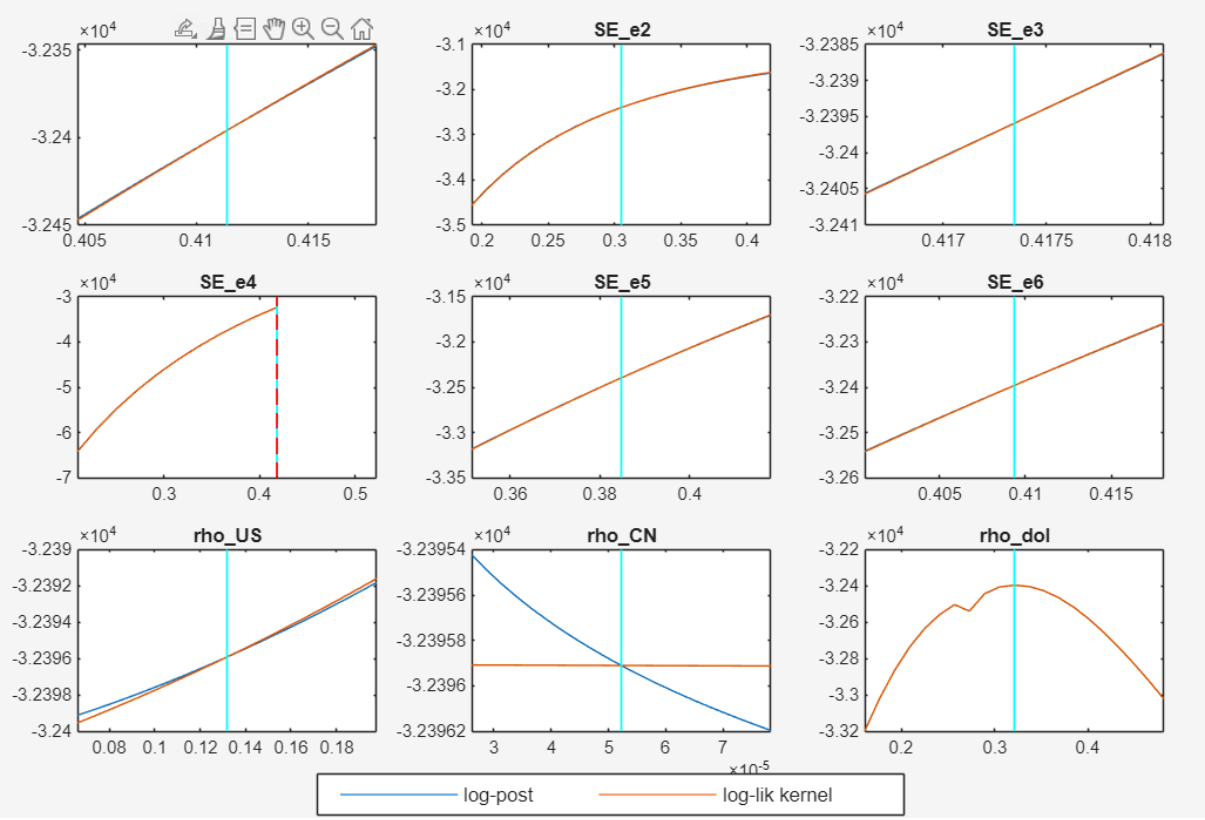
4 Posterior Standard Deviations of Shocks

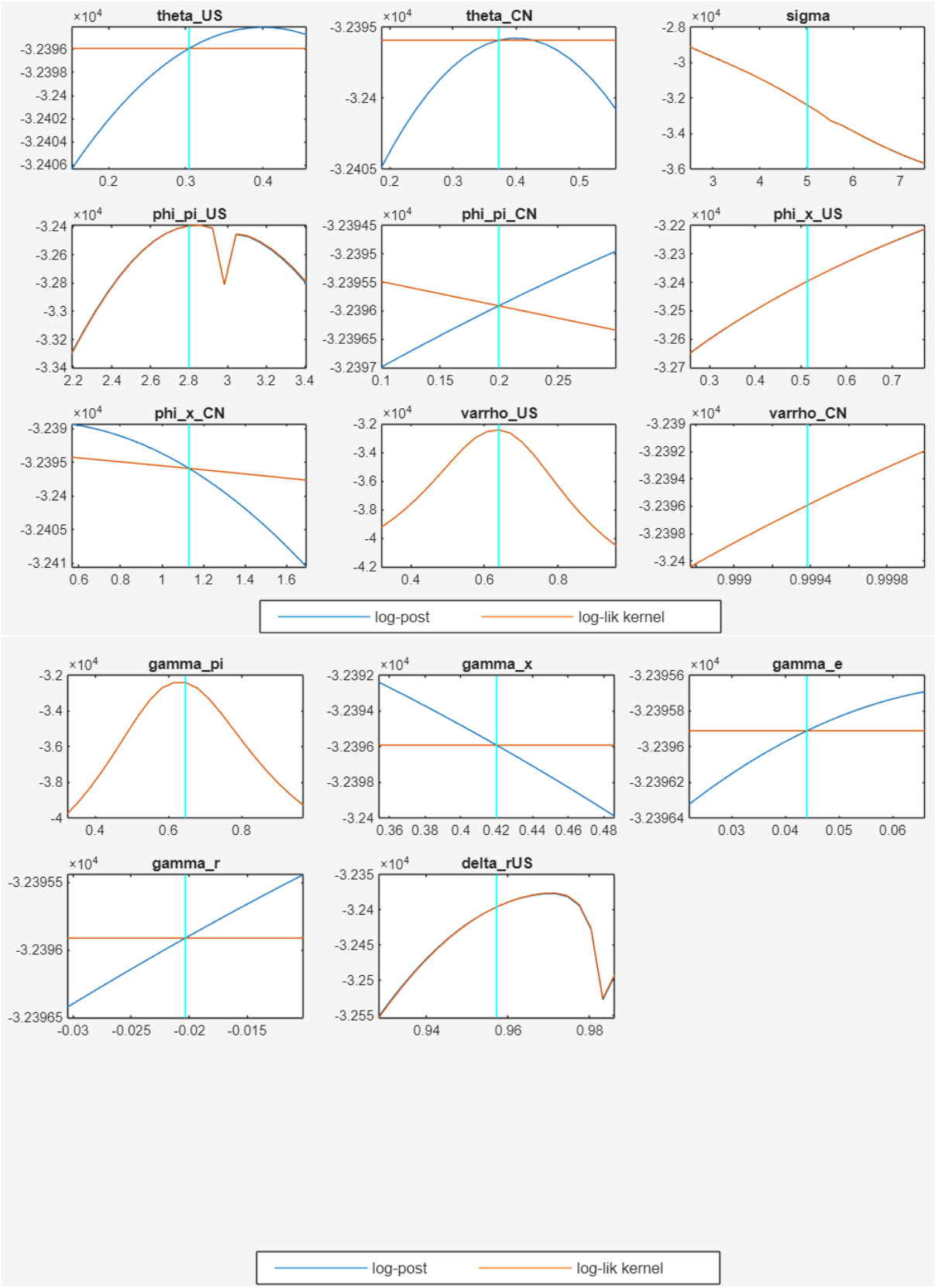
Table 3: Posterior Estimates of Shock Standard Deviations

Shock	Prior Mean	Posterior Mean	Prior Std
e_1	0.100	0.4114	0.0500
e_2	0.100	0.3052	0.0500
e_3	0.100	0.4173	0.0500
e_4	0.100	0.4181	0.0500
e_5	0.100	0.3848	0.0500
e_6	0.100	0.4094	0.0500

5 MCMC Diagnostics

The MCMC inefficiency factors for each block are reported in Table **??**. Some parameters, especially volatility parameters and θ_{CN}, show higher inefficiency factors, indicating slower chain mixing.




theta_US
theta_CN
sigma
phi_pi_US
phi_pi_CN
phi_x_US
phi_x_CN
varrho_US
varrho_CN
gamma_pi
gamma_x
gamma_e
gamma_r
delta_rUS
log-post
log-lik kernel

6 Results and Discussion

Posterior estimates show that:

- The dollarization process in China exhibits moderate persistence.
- De-dollarization shocks have a direct and immediate impact on China's policy rate.
- US monetary policy strongly reacts to inflation, while China's policy shows more inertia.
- Structural shocks display higher posterior variances than priors, consistent with real-world volatility.

The results confirm that de-dollarization enhances the transmission of monetary policy in China, making inflation more controllable and reducing the need for extreme rate changes.

IRFs for a positive shock in the US Monetary Interest Rate

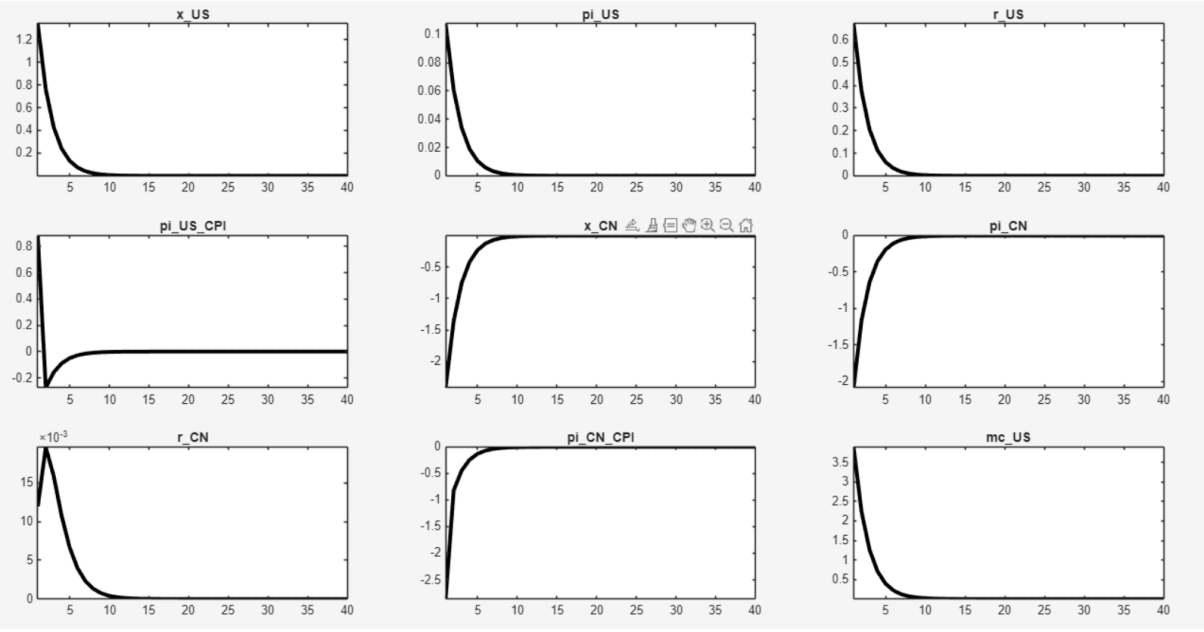


Figure 1: Bayesian Post IRF

IRFs for a positive shock in the US Monetary Interest Rate

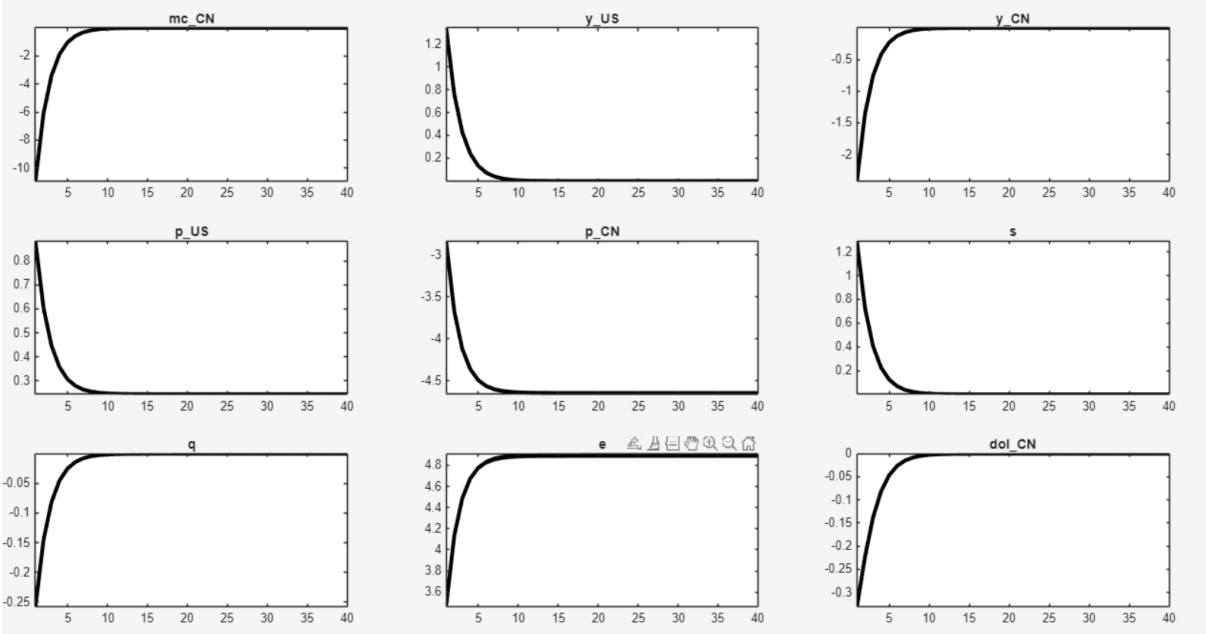


Figure 2: Bayesian Post IRF.

IRFs for a positive shock in the US Monetary Interest Rate

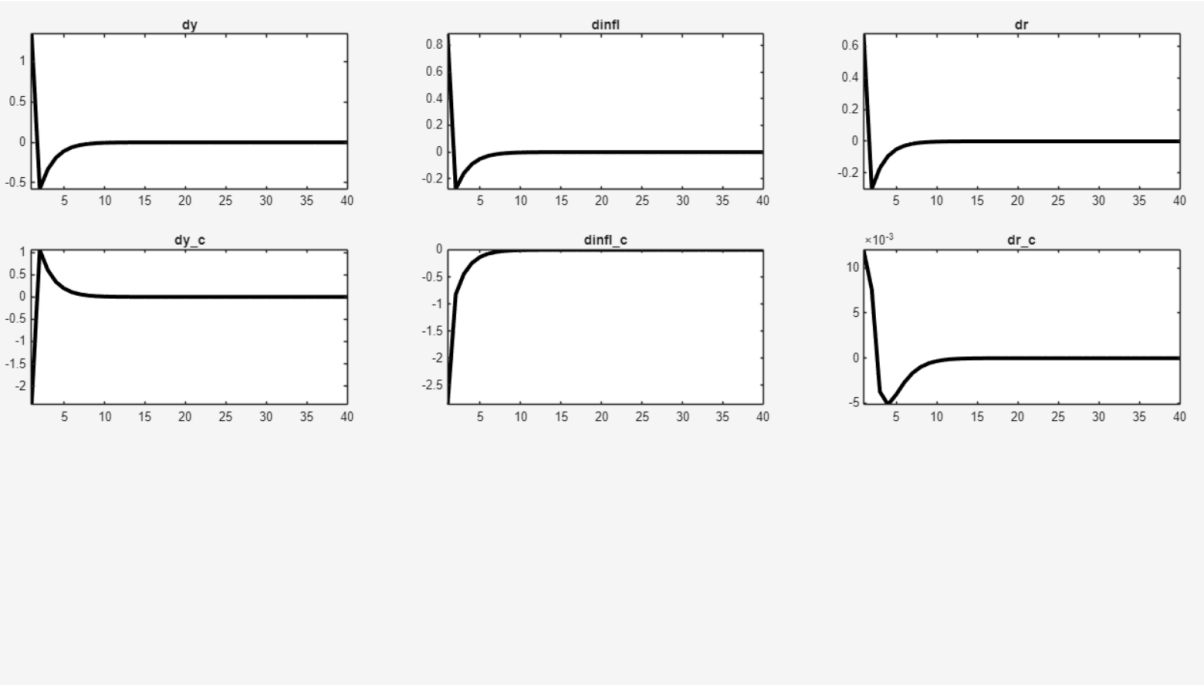


Figure 3: Bayesian Post IRF

IRFs for a positive shock in the Dolarization of China

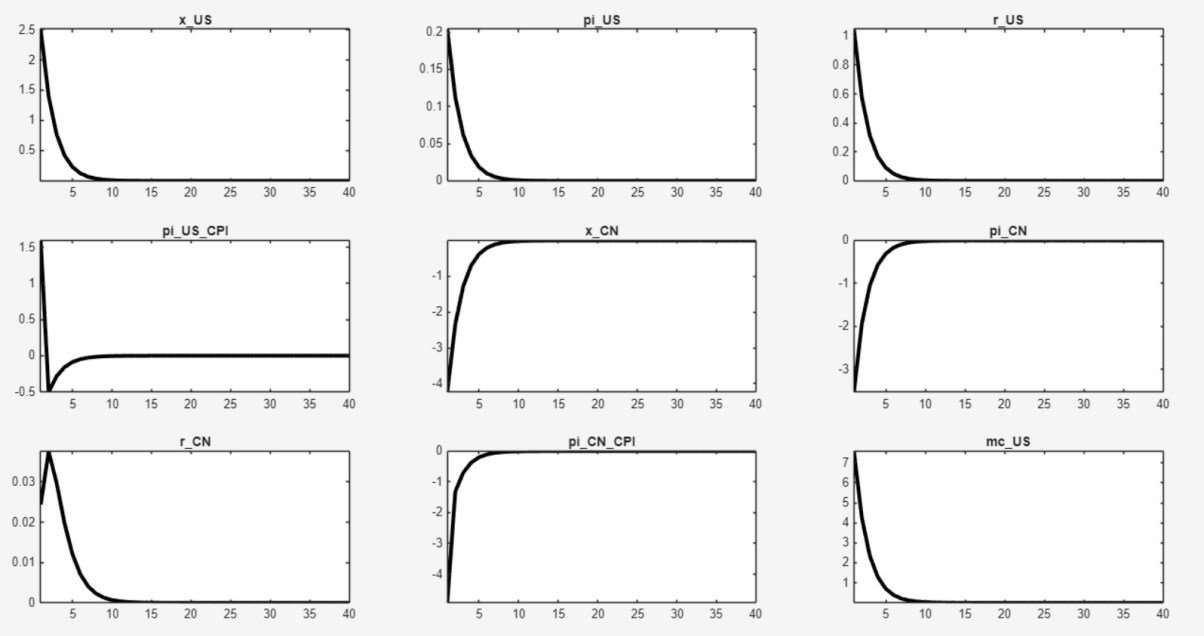


Figure 4: Bayesian Post IRF

IRFs for a positive shock in the Dolarization of China

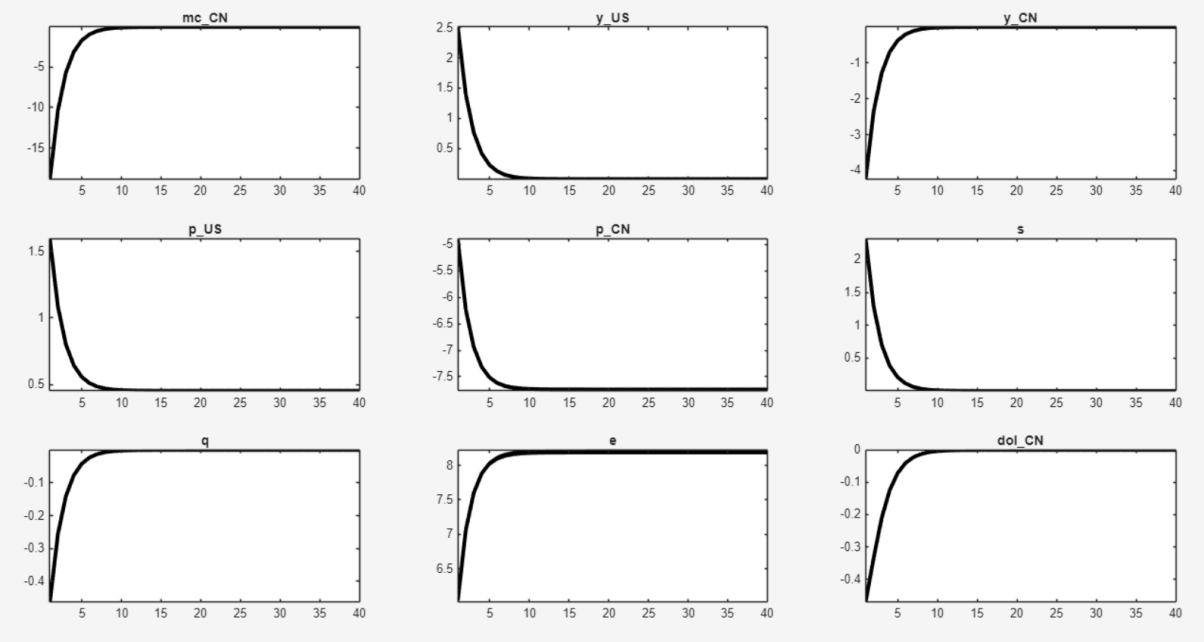


Figure 5: Bayesian Post IRF.

7 Conclusion

This paper presents a two-country DSGE model where the home economy is the United States and the foreign economy is China. We analyze two main shocks: a US monetary

policy shock and a Chinese de-dollarization shock. The latter operates through the monetary policy rule of the People's Bank of China, directly affecting the interest rate and improving the effectiveness of monetary transmission. Bayesian estimation supports the presence of strong cross-border linkages and highlights the macroeconomic relevance of financial de-dollarization in emerging economies.