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Abstract: This study builds a two-country New Keynesian DSGE model that distinguishes between an independent and a peg tariff policy rule, and demonstrate how the peg tariff rule fundamentally alters the direction and intensity of tariff shock transmission, thereby providing theoretical support for understanding policy gaming in real-world trade frictions. The theoretical mechanism reveals that tariff shocks affect the macroeconomy not only through direct effects but also through indirect transmission via the real exchange rate channel. Quantitative simulation further confirms that tariff shocks primarily affect the domestic economy through the real exchange rate channel. Under an independent tariff rule, an increase in foreign tariff has a direct effect of reducing exports, and an indirect effect through domestic currency depreciation that lowers export revenues and dampens consumption. Under a peg tariff rule, an increase in foreign tariffs triggers a domestic tariff policy response, which effectively offsets the adverse effects of the foreign tariff hikes through the real exchange rate channel, leading to an appreciation of the domestic currency rather than a depreciation. The dominant role of this exchange rate channel subsequently curbs inflationary pressures while boosting both consumption and output. Furthermore, the quantitative results of this paper indicate that capital controls serve as an exchange rate stabilizer in the face of tariff shocks.

Keywords: Tariff, exchange rate, capital control, macroeconomy, New Keynesian DSGE

JEL: F13, F31, F34, F41

1 Introduction

In recent years, global trade protectionism has intensified, with major economies, particularly China and the United States, engaging in increasingly frequent tariff disputes. Since the Trump administration took office in 2018, tariffs imposed by the United States on Chinese goods have risen steadily, climbing from 4.26% in June 2018 to 8.76% in July of the same year, and continuing to increase thereafter, reaching 21.15% by the end of 2019 (see table 1). Following the inauguration of the Biden administration in 2020, although the United States did not impose additional tariff hikes on Chinese imports, it maintained the tariffs at elevated levels. In response to the escalating unilateral trade protectionist measures taken by the United States, China implemented precise and reciprocal retaliatory tariff policies, reflecting the strategic logic of "fighting fire with fire" in tariff negotiations. Since July 2018, China's tariffs on U.S. goods have also exhibited a persistent upward trend, reaching 19.97% by December 2019. After Trump's return to office in 2025, the United States once again substantially raised tariffs on Chinese goods, with the rate reaching as high as 145% by April 2025. This time, China again opted for tariff retaliation, raising its

Table 1 Average Import Tariff Rates of China and the United States (%)

Time	CHN tariff	US tariff	Time	CHN tariff	US tariff
01/2018	5.75	4.40	01/2019	14.01	13.13
02/2018	5.96	4.51	02/2019	13.27	13.40
03/2018	6.06	3.63	03/2019	12.60	12.79
04/2018	6.25	3.78	04/2019	12.79	12.90
05/2018	6.33	3.92	05/2019	13.24	12.93
06/2018	6.07	4.26	06/2019	17.68	18.70
07/2018	7.79	8.76	07/2019	17.27	18.55
08/2018	8.36	8.70	08/2019	17.85	18.21
09/2018	11.08	9.05	09/2019	17.59	21.21
10/2018	14.43	12.44	10/2019	19.30	20.53
11/2018	14.23	12.32	11/2019	20.32	20.60
12/2018	14.09	12.92	12/2019	19.97	21.15

Notes. The data covers the period from January 2018 to December 2019. Both the tariff rates imposed by China on imports from the United States and those imposed by the United States on imports from China are monthly average rates. the data source is from <https://www.waugheconomics.com/>.

tariffs on U.S. goods to 125%. These developments have brought the macroeconomic implications of tariff war to the forefront of academic and policy discussions. Existing studies indicate that the trade war has not only severely undermined the stability of bilateral economic and trade relations, but have also has been posing significant downside risks to the macroeconomies and financial systems of both countries (Lashkaripour, 2021; Auclert et al., 2025; Rodríguez-Clare et al., 2025).

This study constructs a two-country New Keynesian DSGE model, building on the work of Auray et al. (2025a, b), to analyze the economic effects and transmission mechanisms of tariff shocks under two distinct tariff rules (tariff independence and tariff pegging). The theoretical mechanism reveals that both domestic and foreign tariff shocks affect the home economy not only through direct effects but also through indirect transmission via the real exchange rate channel. Quantitative simulation further confirms that tariff shocks primarily affect the domestic economy through the real exchange rate channel. First, under an independent tariff rule, an increase in domestic tariffs exerts an appreciation effect on the domestic currency, which dampens export quantities, but nonetheless boosts consumption and production through higher export earnings. Conversely, a rise in foreign tariff has a direct effect of reducing exports, and an indirect effect through domestic currency depreciation that lowers export revenues and dampens consumption. Moreover, the appreciation of the foreign currency raises import prices, leading to a decline in both domestic exports and imports, which further depresses output.

Second, under a tariff peg rule, the impact of an increase in foreign tariffs on the domestic economy is contrary to that observed under an independent policy regime. Specifically, such an increase exerts a positive effect on domestic real output and household consumption. This occurs because domestic tariff retaliation effectively offsets the adverse effects of the foreign tariff hikes through the real exchange rate channel, leading to an immediate depreciation of the real exchange rate (i.e., appreciation of the domestic currency and depreciation of the foreign currency). The dominant role of this exchange rate channel then curbs inflationary pressures, boosts consumption, and stimulates output growth from the demand side. Moreover, the appreciation of the domestic currency substantially suppresses exports and lowers export prices, while the sharp drop in import prices significantly reduces the production costs of intermediate

goods. In response, households rebalance their asset portfolios by reducing holdings of domestic bonds and increasing holdings of foreign bonds, resulting in persistent capital outflows.

Third, under both tariff rules, capital controls effectively buffer the impact of an increase in foreign import tariffs on the domestic economy. Under an independent tariff rule, capital controls significantly reduce the magnitude of real exchange rate appreciation and weaken the exchange rate transmission effect. With capital controls in place, the direct effect of the foreign tariff dominates, leading to a decline in inflation and a rise in consumption upon impact, thereby slightly boosting real output. Under a peg tariff rule, capital controls similarly curb capital outflows and exchange rate volatility, substantially attenuate the transmission of foreign tariffs through the exchange rate channel, and significantly reduce the responsiveness of macroeconomic variables. Overall, the core function of capital controls is to buffer the transmission via the real exchange rate channel, thus effectively stabilizing the domestic macroeconomy.

The marginal contributions of this paper are threefold. The marginal contributions of this paper are mainly threefold. First, this study builds a two-country New Keynesian DSGE model that distinguishes between an independent tariff rule and a peg tariff rule, and demonstrate how the peg tariff policy fundamentally alters the direction and intensity of tariff shock transmission, thereby providing theoretical support for understanding policy gaming in real-world trade frictions. Second, the study explicitly identifies the pivotal role of the real exchange rate channel in the transmission of tariff shocks, and clarify the core mechanism by which the relative strength of direct versus indirect exchange rate effects determines the ultimate macroeconomic outcomes. Third, the research incorporates capital controls into the analytical framework and confirm their effectiveness as an exchange rate stabilizer in the face of tariff shocks.

The remainder of this paper is organized as follows. Section II reviews the relevant literature. Section III constructs the two-country New Keynesian DSGE model and presents the mechanism analysis. Section IV calibrates the parameters and conducts quantitative simulation analysis. Section V discuss the role of capital controls. Section VI concludes the paper and gives policy implications.

2 Literature review

As a core instrument of international trade policy, the macroeconomic effects of tariffs have long been a central topic in international economics. The first strand of literature closely related to this paper focuses on the macroeconomic effects of tariff shocks, particularly against the backdrop of the U.S.-China trade war, with extensive theoretical and empirical research on the economic impact of import tariff shocks. At the theoretical level, Werning et al. (2025) offer an insightful analytical perspective, arguing that tariff policy in an open economy is exactly equivalent to a labor wedge shock in a closed economy, so that the effects of tariffs can be examined by analogy with cost-push shocks in standard New Keynesian models. This analogy provides a parsimonious and powerful theoretical tool for modeling tariff effects, revealing that tariffs are, in essence, a supply-side distortionary policy intervention.

Regarding the effects of tariffs on the U.S. economy itself, Rodríguez-Clare et al. (2025) point out that U.S. tariff increases not only inflict real income losses on the United States but also impose substantial real income losses on its major trading partners, such as Canada, Mexico, China, and Ireland. Moreover, if factors of production cannot move freely across sectors, the losses caused by rising trade costs are further amplified. In the presence of retaliation by trading partners, for the U.S. economy, retaliatory tariffs directly suppress exports, worsen the trade balance, exacerbate economic downturns

(Auclert et al., 2025; Rodríguez-Clare et al., 2025), and significantly reduce welfare (Ignatenko et al., 2025).

With respect to spillover effects on trading partners and globally, Caliendo et al. (2025) show that the global spillovers of U.S. tariff increases are such that countries with initial trade surpluses may actually benefit from such tariff changes: in response to declining income, these countries optimally reduce their surpluses to smooth consumption, thereby achieving increases in real consumption. This finding suggests that the winners and losers of tariff shocks are not determined simply by the dichotomy of "imposer" versus "target," but rather depend on countries' initial trade structures and policy response paths. However, from a global perspective, Lashkaripour (2021) finds that a global tariff war could reduce real GDP in a typical country by approximately 2.8%, and that the economic contraction would be further amplified due to increased dependence on intermediate goods trade and the exacerbation of existing markup distortions. This conclusion warns of the potential systemic risks of escalating tariff frictions.

The second strand of literature closely related to this paper concerns the exchange rate transmission channel of tariff shocks. A growing body of research recognizes that the effects of tariffs on the economy are not merely direct price effects, but rather generate extensive indirect transmission through real exchange rate movements, with the endogenous reaction of the exchange rate constituting a key channel for the propagation of tariff effects (Auray et al., 2022). Irwin (2025) explicitly states that the exchange rate regime is a critical institutional backdrop for the operation of a country's trade policy effects. Krugman (1982) early on pointed out that under floating exchange rates, protectionist policies tend to ultimately lead to economic contraction rather than the expected expansionary effects. The exchange rate regime not only affects the direction of tariff shock transmission but also fundamentally shapes the equilibrium level of trade protection. Auray et al. (2022) find that the level of trade protection under floating exchange rates is significantly higher than under fixed exchange rates. The mechanism is that the incentive to impose tariffs in the model arises from capturing terms-of-trade advantages, so the exchange rate regime becomes an important determinant of the sustainable equilibrium tariff. Under fixed exchange rates combined with price stickiness, neither tariff-setting party can affect the terms of trade by deviating from the trade agreement, so the equilibrium level of protection (i.e., the average tariff) under floating rates is higher than under fixed rates.

Jeanne and Son (2024) show that the tariffs imposed during the 2018–2019 U.S.-China trade war should have had a limited effect on the U.S. dollar exchange rate but could have caused a significant depreciation of the renminbi. Their findings indicate that tariff news can explain at most about one-fifth of the observed appreciation of the U.S. dollar effective exchange rate during the trade war, but about two-thirds of the depreciation of the renminbi effective exchange rate. The intensity and even the direction of tariff shock transmission through the exchange rate channel depend on the extent to which exchange rate pass-through affects import and export prices. Auray et al. (2026) emphasize that tariff increases by large economies alter the prices paid by importers, drive exchange rate movements, change export demand, reallocate expenditure between domestic and foreign goods, and affect the trade balance. However, the intensity and even the direction of these responses are highly dependent on the magnitude and structure of exchange rate pass-through. Ostry et al. (2025) further systematically examine the dynamic relationship between tariff shocks and exchange rate responses, revealing how retaliatory tariffs alter the equilibrium path of the exchange rate. These studies collectively show that the real exchange rate is not merely a passive "transmission conduit" in tariff shock propagation. Rather, the direction and magnitude of its own movement are profoundly shaped by the mode of tariff policy interaction. In this

context, tariff retaliation induces frequent changes in the terms of trade, further affecting the exchange rate and price levels, and may even generate deflationary effects (Boer and Rieth, 2024; Kalemli-Özcan et al., 2025; Auray et al., 2025a).

The third strand of literature related to this paper concerns the macroeconomic functions of capital controls. Following the 2008 global financial crisis, academics and policymakers gradually came to recognize that even economies with floating exchange rate regimes, in the absence of capital controls, remain vulnerable to the negative transmission of global financial shocks, leaving monetary policy to navigate a difficult trade-off between macroeconomic stability and financial stability, thus falling into a "dilemma" (Rey, 2015). This practical predicament has rekindled systematic scrutiny of the effectiveness of capital control policies. Capital controls can not only effectively attenuate the cross-border transmission of global financial shocks (Wang and Wu, 2021; Loipersberger and Matschke, 2022), but also significantly enhance monetary policy independence, creating room for domestic monetary policy to respond to domestic business cycles (Rey, 2015; Davis and Presno, 2017). Capital controls can be viewed as a Pigouvian tax that, by raising the cost of cross-border capital flows, effectively reduces the negative externalities arising from excessive borrowing in financial markets (Bianchi, 2011; Devereux et al., 2019; Devereux and Yu, 2019; Bianchi and Mendoza, 2020). On this basis, capital controls have also been endowed with macroprudential policy functions (Engel, 2015; Farhi and Werning, 2016; Erten et al., 2021; Tian et al. 2026). For economies maintaining fixed exchange rates, foreign exchange intervention itself is costly, so capital controls become an indispensable component of the optimal policy mix (Farhi and Werning, 2012; Benigno et al., 2016).

In summary, the existing literature has substantially advanced our understanding of the macroeconomic effects of tariff shocks, the transmission mechanisms of exchange rates. This study extends the literature along three dimensions. First, the study develops a two-country macroeconomic model that distinguishes between independent and pegged tariff policy rules, and systematically compares how alternative policy interaction modes shape the direction and intensity of tariff shock propagation. Second, the study explicitly highlights the real exchange rate channel as a pivotal conduit in this transmission, and demonstrates that the ultimate macroeconomic outcome hinges on the relative strength of the direct price effect versus the indirect exchange rate effect. Third, the study integrates capital controls into an analytical framework and assesses their buffering role under both tariff rules. This analysis provides new theoretical evidence on the effective boundaries of capital controls as a "stabilizer of exchange rates."

3 New Keynesian DSGE Model

This study follows Auray et al. (2025a, b) and constructs an open-economy New Keynesian DSGE model to analyze the effects of tariff shocks on the domestic economy. Since the focus is on the domestic economy and the behavior of domestic agents, we simplify the foreign economy and its agents (see Appendix A).

3.1 Households

The utility function of the representative domestic household is given by,

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t)^{1-\sigma}}{1-\sigma} - \frac{(L_t)^{1+\varphi}}{1+\varphi} \right] \quad (1)$$

where $\beta \in (0, 1)$ is the subjective discount factor. C_t denotes real consumption in period t , $\sigma > 0$ is

the coefficient of relative risk aversion, L_t denotes labor supply, and $\varphi > 0$ is the inverse of the Frisch elasticity of labor supply.

In each period, domestic residents earn labor income, capital rental income, and interest income from holding domestic and foreign government bonds. The representative household's budget constraint is,

$$\begin{aligned} & P_t C_t + B_t + \varepsilon_t B_t^* + P_t I_t \\ &= W_t L_t + P_t r_t K_{t-1} + (1 + i_{t-1}) B_{t-1} + (1 - \tau_t) (1 + i_{t-1}^*) \varepsilon_t B_{t-1}^* + \Phi_t \end{aligned} \quad (2)$$

The left-hand side of (2) represents expenditures, and the right-hand side represents income. P_t is the domestic general price index, W_t is the nominal wage rate. B_{t+1} is household holdings of domestic government bonds at the end of period t , and i_t is the domestic bond interest rate. ε_t is the nominal exchange rate (domestic currency price of foreign currency). B_{t+1}^* denotes foreign bond holdings, and i_t^* is the foreign interest rate. τ_t is the capital control tax rate imposed by the domestic government (with $\tau_t = 0$ corresponding to perfect capital mobility and no capital controls, positive or negative values indicate taxes or subsidies on capital outflows). Φ_t denotes profits distributed by domestic firms, K_t is the capital stock accumulated by entrepreneurs, and r_t is the rental rate of capital. The capital accumulation equation is,

$$K_t = (1 - \delta) K_{t-1} + \left[1 - \frac{\Omega}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 \right] I_t \quad (3)$$

Where I_t denotes the investment. $\delta > 0$ is the depreciation rate, and $\Omega > 0$ is the capital adjustment cost parameter.

Given $\{P_t, W_t, r_t, i_t, i_t^*, \varepsilon_t\}$, the household chooses $\{C_t, B_{t+1}/P_t, \varepsilon_t B_{t+1}^*/P_t, L_t, K_t, I_t\}$ to maximize utility subject to (2). The first-order conditions are given by,

$$\lambda_t = (C_t)^{-\sigma} \quad (4)$$

$$(L_t)^\varphi = w_t \lambda_t \quad (5)$$

$$\lambda_t = \beta E_t \frac{(1 + i_t)}{\pi_{t+1}} \lambda_{t+1} \quad (6)$$

$$\lambda_t = \beta E_t \frac{e_{t+1} (1 - \tau_t) (1 + i_t^*)}{\pi_{t+1}} \lambda_{t+1} \quad (7)$$

$$\lambda_t q_t^k = \beta E_t [\lambda_{t+1} r_{k,t+1} + q_{t+1}^k (1 - \delta)] \quad (8)$$

$$\lambda_t = \lambda_t q_t^k \left[1 - \frac{\Omega}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 - \Omega \left(\frac{I_t}{I_{t-1}} - 1 \right) \frac{I_t}{I_{t-1}} \right] + \beta E_t \left[\Omega \lambda_{t+1} q_{t+1}^k \left(\frac{I_{t+1}}{I_t} - 1 \right) \left(\frac{I_{t+1}}{I_t} \right)^2 \right] \quad (9)$$

Where λ_t is the Lagrange multiplier on the budget constraint, q_t^k is the shadow price of capital. $\pi_t \equiv P_t/P_{t-1}$ is domestic inflation, $e_t \equiv \varepsilon_t/\varepsilon_{t-1}$ is the nominal exchange rate change, and $w_t \equiv W_t/P_t$ is the real wage.

3.2 Final Goods Production

The representative final goods producer uses intermediate goods $Y_t(i)$ to produce the final consumption good Y_t according to the Dixit - Stiglitz aggregator.

$$Y_t = \left[\int_0^1 Y_t(i)^{\frac{\iota-1}{\iota}} di \right]^{\frac{\iota}{\iota-1}} \quad (10)$$

Where $\iota > 1$ is the elasticity of substitution among intermediate goods. Given the price index $P_t(i)$ of intermediate good $i \in (0,1)$ and the final good price index P_t , the final goods producer chooses intermediate inputs to maximize profits. The first-order condition is,

$$Y_t(i) = \left[\frac{P_t(i)}{P_t} \right]^{-\iota} Y_t \quad (11)$$

Combining (10) and (11) yields the relationship between the final goods price index and the intermediate goods prices index.

$$P_t = \left[\int_0^1 P_t(i)^{1-\iota} di \right]^{\frac{1}{1-\iota}} \quad (12)$$

3.3 Intermediate Goods Production

The representative monopolistically competitive intermediate goods firm i combines domestically produced intermediate goods $Y_{h,t}(i)$ and foreign-produced intermediate goods $Y_{f,t}(i)$ according to a CES aggregator.

$$Y_t(i) = \left[(1-\zeta)^{\frac{1}{\xi}} \left[Y_{h,t}(i) \right]^{\frac{\xi-1}{\xi}} + (\zeta)^{\frac{1}{\xi}} \left[Y_{f,t}(i) \right]^{\frac{\xi-1}{\xi}} \right]^{\frac{\xi}{\xi-1}} \quad (13)$$

Where $\xi > 1$ is the elasticity of substitution between domestic and foreign inputs, and $\zeta \in (0,1)$ is the degree of trade openness.

The intermediate goods firm chooses domestic and foreign inputs to minimize its real cost. The cost function is,

$$C_t(i) = P_{h,t} Y_{h,t}(i) + P_{f,t} Y_{f,t}(i) \quad (14)$$

where $P_{h,t}$ is the domestic-currency price index of the domestic input and $P_{f,t}$ is the domestic-currency price index of the imported input. The first-order conditions are,

$$Y_{h,t}(i) = (1-\zeta) \left(\frac{P_{h,t}}{\Lambda_t} \right)^{-\xi} Y_t(i) \quad (15)$$

$$Y_{f,t}(i) = \zeta \left(\frac{P_{f,t}}{\Lambda_t} \right)^{-\xi} Y_t(i) \quad (16)$$

where Λ_t is the nominal marginal cost. Combining (13), (15), and (16) yields the real marginal cost in terms of domestic and foreign input prices.

$$(\Lambda_t)^{1-\xi} = (1-\zeta) (p_{h,t})^{1-\xi} + \zeta (p_{f,t})^{1-\xi} \quad (17)$$

Where $\Delta_t \equiv \Lambda_t/P_t$, $p_{h,t} \equiv P_{h,t}/P_t$, $p_{f,t} \equiv P_{f,t}/P_t$.

At the same time, the intermediate goods firm chooses its price $P_t(i)$ to maximize the present value of profits.

$$E_t \sum_{s=0}^{\infty} \frac{\beta^s \lambda_{t+s} P_t}{\lambda_t P_{t+s}} \{P_t(i) Y_t(i) - C_t(i)\} \quad (18)$$

Following Calvo (1983), each period a fraction $\theta \in (0,1)$ of intermediate firms keep their prices unchanged from the previous period, while a fraction $1 - \theta$ set a new price $\tilde{P}_t(i)$. Then the first-order condition is,

$$\sum_{s=0}^{\infty} \frac{\beta^s \theta^s \lambda_{t+s} P_t}{\lambda_t P_{t+s}} Y_{t+s} \left\{ (\iota - 1) \left(\frac{\tilde{P}_t(i)}{P_{t+s}} \right)^{-\iota} \tilde{P}_t(i) - \iota \Lambda_t \left(\frac{\tilde{P}_t(i)}{P_{t+s}} \right)^{-\iota} \right\} = 0 \quad (19)$$

Since all firms that reset prices choose the same optimal price $\tilde{P}_t$, equation (12) can be rewritten as,

$$(P_t)^{1-\iota} = \int_0^1 P_t(i)^{1-\iota} di = \theta (P_{t-1})^{1-\iota} + (1-\theta) (\tilde{P}_t)^{1-\iota} \quad (20)$$

dividing by $(P_t)^{1-\iota}$,

$$1 = \theta (\pi_t)^{\iota-1} + (1-\theta) (\tilde{p}_t)^{1-\iota} \quad (21)$$

where $\tilde{p}_t \equiv \tilde{P}_t/P_t$.

Using the first-order condition (19), we define the marginal revenue mr_t and marginal cost mc_t .

$$mr_t = \frac{\iota-1}{\iota} E_t \sum_{s=0}^{\infty} \frac{\beta^s \theta^s \lambda_{t+s}}{\lambda_t} \left(\frac{\tilde{P}_t}{P_{t+s}} \prod_{n=1}^s \frac{1}{\pi_{t+n}} \right)^{1-\iota} Y_{t+s} \quad (22)$$

$$mc_t = \Delta_t E_t \sum_{s=0}^{\infty} \frac{\beta^s \theta^s \lambda_{t+s}}{\lambda_t} \left(\prod_{n=1}^s \frac{1}{\pi_{t+n}} \right)^{1-\iota} (\tilde{P}_t)^{-\iota} Y_{t+s} \quad (23)$$

Under profit maximization, marginal revenue is equated to marginal cost, namely,

$$mr_t = mc_t \quad (24)$$

with

$$mr_t = \frac{\iota-1}{\iota} (\tilde{P}_t)^{1-\iota} Y_t + \beta \theta E_t \frac{\lambda_{t+s}}{\lambda_t} \left(\frac{\tilde{P}_t}{P_{t+1}} \frac{1}{\pi_{t+1}} \right)^{1-\iota} mr_{t+1} \quad (25)$$

$$mc_t = \Delta_t (\tilde{P}_t)^{-\iota} Y_t + \beta \theta E_t \frac{\lambda_{t+s}}{\lambda_t} \left(\frac{\tilde{P}_t}{P_{t+1}} \right)^{-\iota} \left(\frac{1}{\pi_{t+s}} \right)^{-\iota} mc_{t+1} \quad (26)$$

In addition, we assume that the law of one price holds and that both countries impose tariffs on imports, so that import prices satisfy,

$$P_{h,t} = \frac{\varepsilon_t P_{h,t}^*}{(1 + \tau_t^{m*})} \quad (27)$$

$$P_{f,t} = \varepsilon_t P_{f,t}^* (1 + \tau_t^m) \quad (28)$$

where τ_t^m is the domestic tariff rate and τ_t^{m*} is the foreign import tariff rate.

The foreign import tariff follows an AR (1) process,

$$\ln \tau_t^{m*} = \ln \tau^{m*} + \rho^{m*} (\ln \tau_{t-1}^{m*} - \ln \tau^{m*}) + \rho^{m*m} \ln (\tau_{t-1}^m - \bar{\tau}^m) + v_t^{m*} \quad (29)$$

where τ^{m*} is the steady-state foreign tariff rate, ρ^{m*} is the smoothing coefficient, ρ^{m*m} is the response coefficient of the foreign tariff to the domestic tariff, and $\rho^{m*m} = 0$ corresponds to an independent domestic tariff policy. v_t^{m*} is the foreign tariff shock.

Similarly, the domestic import tariff follows:

$$\ln \tau_t^m = \ln \tau^m + \rho^m (\ln \tau_{t-1}^m - \ln \tau^m) + \rho^{mm*} \ln (\tau_{t-1}^{m*} - \tau^{m*}) + v_t^m \quad (30)$$

where τ^m is the steady-state domestic tariff rate, ρ^m is the smoothing coefficient, ρ^{mm*} is the response coefficient of the domestic tariff to the foreign tariff, and $\rho^{mm*} = 0$ corresponds to an independent domestic tariff policy. v_t^m is the domestic tariff shock.

3.4 Wholesale Production

The representative wholesale firm uses labor to produce a wholesale good X_t , which is then split into domestic use $Y_{h,t}$ and foreign use $Y_{f,t}^*$.

$$X_t = Y_{h,t} + Y_{h,t}^* \quad (31)$$

The domestic and foreign supplies equal the total demand from monopolistic intermediate goods producers: $Y_{h,t} = \int_0^1 Y_{h,t}(i) di$, $Y_{f,t} = \int_0^1 Y_{f,t}(i) di$. Aggregating (11) and (15) yields,

$$Y_{h,t} = (1 - \zeta) \left(\frac{p_{h,t}}{\Delta_t} \right)^{-\xi} Y_t \quad (32)$$

and similarly, from (11) and (16),

$$Y_{f,t} = \zeta \left(\frac{p_{f,t}}{\Delta_t} \right)^{-\xi} Y_t \quad (33)$$

the aggregate profit of intermediate goods firms is as the following.

$$\Phi_{It} = \int_0^1 P_t(i) Y_t(i) di - \int_0^1 P_{h,t} Y_{h,t}(i) di - \int_0^1 P_{f,t} Y_{f,t}(i) di \quad (34)$$

The wholesale firm's production function is Cobb - Douglas.

$$X_t = (K_{t-1})^\alpha (A_t L_t)^{1-\alpha} \quad (35)$$

Where $\alpha \in (0,1)$ is capital's share in wholesale income, and A_t is a technology shock following an AR (1) process.

$$\ln A_t = \ln A + \rho^A (\ln A_{t-1} - \ln A) + v_t^A \quad (36)$$

Where A is the steady-state technology level, ρ^A is the smoothing coefficient. v_t^A is the technology shock.

Given $P_{h,t}$, W_t and r_t , the wholesale firm chooses labor L_t to maximize profits.

$$\Phi_{Ut} = P_{h,t} X_t - W_t L_t - P_t r_t K_{t-1} \quad (37)$$

The first-order conditions are given as followings.

$$w_t = (1 - \alpha) \frac{p_{h,t} X_t}{L_t} \quad (38)$$

$$r_t = \alpha \frac{p_{h,t} X_t}{K_{t-1}} \quad (39)$$

3.5 Government

The domestic government uses capital control tax revenue and bond financing to finance government spending G_t and to service past government debt. Its budget constraint is,

$$b_t + \frac{\tau_t^m}{1 + \tau_t^m} p_{f,t} Y_{f,t} + \tau_t^{b*} (1 + i_{t-1}^*) \frac{e_t b_{t-1}^*}{\pi_t} = G_t + (1 + i_t) \frac{b_{t-1}}{\pi_t} \quad (40)$$

where $b_{t+1} \equiv B_{t+1}/P_t$ and $b_{t+1}^* \equiv \varepsilon_t B_{t+1}^*/P_t^*$.

Government spending follows an AR(1) process:

$$\ln G_t = \ln G + \rho^G (\ln G_{t-1} - \ln G) + v_t^G \quad (41)$$

where v_t^G is the government spending shock.

The central bank's monetary policy rule targets the output growth gap and inflation rate,

$$\ln \left(\frac{1 + i_t}{1 + \bar{i}} \right) = \rho^i \ln \left(\frac{1 + i_{t-1}}{1 + \bar{i}} \right) + (1 - \rho^i) \rho^y \ln \left(\frac{g_{y,t}}{\bar{g}_y} \right) + (1 - \rho^i) \rho^\pi \ln \left(\frac{\pi_t}{\bar{\pi}} \right) + v_t^i \quad (42)$$

where $g_{y,t} \equiv Y_t/Y_{t-1}$ denotes the real output growth rate. $\bar{i}$, $\bar{\pi}$ and $\bar{g}_y$ are steady-state values, ρ^π and ρ^y are response coefficients, and ρ^i is the smoothing coefficient. v_t^i is the monetary policy shock.

3.6 Market Equilibrium

In equilibrium, the domestic balance of payments holds.

$$b_t^* = (1 + i_{t-1}^*) \frac{e_t b_{t-1}^*}{\pi_t} + p_{h,t} Y_{h,t}^* - \frac{1}{1 + \tau_t^m} p_{f,t} Y_{f,t} \quad (43)$$

Household profits equal the sum of firm profits,

$$\phi_t = \phi_{It} + \phi_{Ut} \quad (44)$$

where $\phi_t \equiv \Phi_t/P_t$, $\phi_{It} \equiv \Phi_{It}/P_t$, $\phi_{Ut} \equiv \Phi_{Ut}/P_t$.

Combining the household budget constraint, government budget constraint, balance of payments, and profit equations gives the domestic resource constraint.

$$C_t + G_t + I_t = Y_t \quad (45)$$

3.7 Mechanism Analysis

In this section, we show how tariffs and exchange rate adjustments jointly determine fluctuations in domestic macroeconomic variables. Foreign tariffs reduce domestic exports, while the real exchange rate

simultaneously affects domestic and foreign relative prices and may reverse the two direct effects noted above. We derive the exchange rate response required for such a reversal and link the resulting price changes to macroeconomic fluctuations.

Define $\hat{x}_t \equiv (x_t - x)/x \equiv \ln(x_t/x)$ as the deviation of variable x_t from its steady-state value x . Log-linearizing equations (21), (24) - (26) yields:

$$\hat{p}_t = \frac{\theta}{1-\theta} \hat{\pi}_t \quad (46)$$

$$\overset{\circ}{m}r_t = \overset{\circ}{m}c_t \quad (47)$$

$$\overset{\circ}{m}r_t = (1-\beta\theta) \left[\hat{Y}_t + (1-\iota) \hat{p}_t \right] + \beta\theta E_t \left[\hat{\lambda}_{t+1} - \hat{\lambda}_t - (1-\iota) (\hat{p}_t - \hat{p}_{t+1} - \hat{\pi}_{t+1}) + \overset{\circ}{m}r_{t+1} \right] \quad (48)$$

$$\overset{\circ}{m}c_t = (1-\beta\theta) \left[\hat{\Delta}_t + \hat{Y}_t - \iota \hat{p}_t \right] + \beta\theta E_t \left[\hat{\lambda}_{t+1} - \hat{\lambda}_t - \iota (\hat{p}_t - \hat{p}_{t+1} - \hat{\pi}_{t+1}) + \overset{\circ}{m}c_{t+1} \right] \quad (49)$$

combining (47) - (49) with (46) gives the New Keynesian Phillips curve,

$$\hat{\pi}_t = A \hat{\Delta}_t + \beta E_t \hat{\pi}_{t+1} \quad (50)$$

where $A = (1-\beta\theta)(1-\theta)/\theta$.

Log-linearizing (17), (27), and (28) yields the following equations.

$$\hat{\Delta}_t = (1-\zeta) \hat{p}_{h,t} + \zeta \hat{p}_{f,t} \quad (51)$$

$$\hat{p}_{h,t} = \hat{p}_{h,t}^* - \hat{\tau}_t^{m*} + \hat{q}_t \quad (52)$$

$$\hat{p}_{f,t} = \hat{p}_{f,t}^* + \hat{\tau}_t^m + \hat{q}_t \quad (53)$$

Equation (52) shows that the domestic price of domestically produced intermediate goods is affected by the foreign import tariff policy, partly through the direct effect of the foreign tariff shock and partly through indirect transmission via real exchange rate movements. Specifically, under the law of one price, an increase in the foreign import tariff raises the real exchange rate (foreign currency appreciation, domestic currency depreciation). The direct effect lowers the domestic price of domestic intermediate goods, while the indirect effect through the real exchange rate channel raises it. The net price effect depends on the relative magnitudes of these two opposing forces. Similarly, equation (53) shows that the domestic price of imported foreign intermediate goods is affected both directly by the domestic tariff policy and indirectly by real exchange rate movements.

Combining (50) - (53), the New Keynesian Phillips curve can be further written as equation (54).

$$\hat{\pi}_t = \left[\zeta \hat{\tau}_t^m - A(1-\zeta) \hat{\tau}_t^{m*} \right] + \left[(1-\zeta) \hat{p}_{h,t}^* + A\zeta \hat{p}_{f,t}^* \right] + \left[1 + A(1-\zeta) \right] \hat{q}_t + \beta E_t \hat{\pi}_{t+1} \quad (54)$$

To derive key conclusions, assume domestic and foreign interest rates are equal and constant: $i_t^* = i_t = i$. Given steady-state inflation $\pi = 1$ and steady-state exchange rate change $e = 1$. Define $\hat{\tau}_t \equiv (\tau_t - \tau)/(1 - \tau)$, Log-linearizing (4) and (7) yields,

$$\hat{C}_t = E_t \hat{C}_{t+1} - \frac{1}{\sigma} E_t (\hat{e}_{t+1} - \hat{\pi}_{t+1}) + \frac{1}{\sigma} \hat{\tau}_t \quad (55)$$

Combining with the real exchange rate equation $q_t = q_{t-1} * e_t * \pi_t^* / \pi_t$ and ignoring foreign inflation changes, we can rewrite (55) as (56).

$$\hat{C}_t = E_t \hat{C}_{t+1} - \frac{1}{\sigma} E_t (\hat{q}_{t+1} - \hat{q}_t) + \frac{1}{\sigma} \hat{\tau}_t \quad (56)$$

Finally, Log-linearizing (45) gives equation (57).

$$\hat{Y}_t = \frac{C}{Y} \hat{C}_t + \frac{G}{Y} \hat{G}_t + \frac{I}{Y} \hat{I}_t \quad (57)$$

Case 1. Independent tariff rule.

Abstracting from changes in foreign intermediate goods prices, equation (54) indicates that domestic inflation is primarily determined by four factors: domestic and foreign import tariff policies, the real exchange rate, and expected inflation. Holding foreign tariffs fixed, an increase in the domestic import tariff exerts both a direct upward pressure on inflation and an indirect effect operating through the real exchange rate. Should the tariff hike induce an appreciation of the domestic currency (i.e., a decline in the real exchange rate), the exchange rate channel tends to mitigate the inflationary pressure. The net outcome hinges on the relative magnitudes of the direct effect and the exchange rate transmission. Equation (56) reveals that household consumption is driven by fluctuations in the real exchange rate: a domestic currency appreciation raises the domestic-currency value of export earnings, thereby boosting consumption. According to equation (57), domestic output responds to changes in consumption; thus, when a tariff increase stimulates consumption, aggregate demand expands, leading to a rise in output.

Conversely, for a given domestic tariff, the net effect of an increase in foreign tariffs on domestic inflation is determined by the interplay between the direct deflationary impact of the foreign tariff shock and its indirect transmission via the real exchange rate. The direct channel exerts downward pressure on domestic inflation, whereas the indirect channel raises it through an appreciation of the real exchange rate (i.e., domestic currency depreciation and foreign currency appreciation). A depreciation of the domestic currency lowers the domestic-currency value of export revenues, thereby reducing consumption and increasing saving. Equation (56) suggests that the capital control tax rate can offset the influence of real exchange rate fluctuations on consumption. Specifically, when capital controls are sufficiently effective in stabilizing the real exchange rate by moderating capital flow volatility, consumption is shielded from the contractionary effects of exchange rate movements.

Case 2. Peg tariff rule.

Under a peg tariff rule, an increase in the domestic tariff prompts a corresponding adjustment in the foreign tariff, and vice versa. In this setting, domestic inflation is jointly determined by the direct effects of both tariff hikes, the exchange rate transmission channel, and expected inflation. Specifically, the first term on the right-hand side of equation (54) indicates that domestic tariff retaliation mitigates the direct deflationary impact of a foreign tariff increase on domestic inflation. The third term reveals that such retaliation curbs real exchange rate volatility, thereby attenuating the indirect transmission of the foreign tariff shock through the real exchange rate channel. When a foreign tariff hike appreciates the real exchange rate, a domestic tariff increase can offset, or even reverse, this upward movement, leading to a real depreciation (i.e., domestic currency appreciation and foreign currency depreciation), which in turn exerts a dampening effect on domestic inflation via the exchange rate channel. Moreover, under the peg regime, the influence of the real exchange rate on domestic consumption hinges on the relative strength of the two countries' tariff changes in driving the real exchange rate. If the domestic tariff effect

Table 2 Parameters calibration

Parameters	Description	Value
β	Subjective discount factor	0.99
σ	Coefficient of relative risk aversion	2
φ	Inverse of the Frisch elasticity	2
δ	Capital depreciation rate	0.025
Ω	Coefficient of capital adjustment cost	4
ι	Elasticity of substitution between intermediate goods	11
ξ	Elasticity of substitution between domestic and foreign goods	1.5
ζ	Domestic trade openness	0.52
ζ^*	Foreign trade openness	0.56
θ	Degree of price stickiness	0.75
α	Capital-output elasticity	0.5
ρ^m	Smoothing coefficient for the domestic import tariff	0.9
ρ^{m*}	Smoothing coefficient for the foreign import tariff	0.9
ρ^τ	Smoothing parameter for capital control tax	0.9
ρ^A	Smoothing coefficient for the technology	0.9
ρ^i	Smoothing coefficient for the domestic interest rate	0.7
ρ^y	Response coefficient of the domestic interest rate to output	0.3
ρ^π	Response coefficient of the domestic interest rate to inflation	2.2
ρ^{i*}	Smoothing coefficient for the foreign interest rate	0.6
$\rho^{\pi*}$	Response coefficient of the foreign interest rate to inflation	1.5

dominates, resulting in foreign currency depreciation, domestic consumption rises. Conversely, if the foreign tariff effect prevails, causing real exchange rate appreciation, domestic consumption falls.

The above mechanism analysis delineates the transmission pathways through which foreign import tariff shocks affect domestic inflation, consumption, and output under alternative tariff policy frameworks, and also highlights the potential stabilizing role of capital controls. In the next step, the study calibrates the parameters and conduct a quantitative analysis of the theoretical mechanisms.

4 Quantitative Analysis

4.1 Parameter Calibration

The study calibrates the parameters of the model following the relevant literature (see Table 2). Following Poilly and Tripier (2025), let the subjective discount factor β to be 0.99. Following Chang et al. (2015), set the inverse Frisch elasticity of labor supply φ to 2 and the capital adjustment cost parameter Ω to 4. Following Davis and Presno (2017), let the depreciation rate δ to be 0.025. Following Poilly and Tripier (2025), set the elasticity of substitution among intermediate inputs ι to 11, corresponding to a steady-state markup of about 10%, set the elasticity of substitution between domestic and foreign goods ξ to 1.5, and set the price stickiness parameter θ to 0.75. Following Comin et al. (2017), set capital's share in wholesale production 0.5. Following Blejer et al. (2002), let the foreign interest rate smoothing coefficient ρ^{i*} to be 0.6, and consistent with much of the literature, set the foreign interest rate response to inflation $\rho^{\pi*}$ to 1.5. Let the domestic interest rate smoothing coefficient ρ^i to be 0.7, the domestic interest rate response to output growth ρ^y and inflation rate ρ^π to be 0.3 and 2.2, respectively. Let the

domestic trade openness ζ to be 0.52 and the foreign trade openness ζ^* to be 0.56. Set the persistence of domestic technology shocks ρ^A , domestic government spending ρ^G , domestic and foreign import tariff smoothing coefficients ρ^m and ρ^{m*} all to 0.9. Finally, set steady-state inflation $\bar{\pi}$ and steady-state output growth $\bar{g}_y$ to 1, and both steady-state domestic and foreign tariff rates $\bar{\tau}^m$ and $\bar{\tau}^{m*}$ to 0.05.

4.2 Economic effects of the domestic tariff shock under an Independent Tariff Rule

As specified in the theoretical model above, the domestic and foreign tariff rules are given by (58) and (59).

$$\ln \tau_t^{m*} = \ln \tau^{m*} + \rho^{m*} (\ln \tau_{t-1}^{m*} - \ln \tau^{m*}) + \rho^{m*m} \ln (\tau_{t-1}^m - \bar{\tau}^m) + \nu_t^{m*} \quad (58)$$

$$\ln \tau_t^m = \ln \tau^m + \rho^m (\ln \tau_{t-1}^m - \ln \tau^m) + \rho^{mm*} \ln (\tau_{t-1}^{m*} - \tau^{m*}) + \nu_t^m \quad (59)$$

Under the independent tariff rule, let $\rho^{m*m} = 0$ and $\rho^{mm*} = 0$, and analyze the responses of domestic economic variables to tariff shocks. Under the peg tariff rule, set both ρ^{m*m} and ρ^{mm*} to 0.1 and analyze the impacts of a foreign tariff shock on the domestic economy.

Figure 1 shows the economic effects of domestic tariff shock under the independent tariff rule. an increase in the domestic tariff raises both real output and household consumption, while exerting an immediate downward pressure on inflation rate. Consistent with the mechanism analysis, under an independent tariff rule, the net effect of a domestic tariff increase on domestic inflation is shaped by the interplay between its direct inflationary impact and the indirect transmission through the real exchange rate. The observed decline in inflation rate suggests that the direct price-raising effect is relatively modest, whereas the indirect dampening effect via the exchange rate channel predominates. Domestic currency appreciation implies that each unit of export earnings translates into higher domestic income, thereby stimulating consumption and boosting output from the demand side. However, in international trade markets, the decline in real exchange rate (quoted as domestic currency per unit of foreign currency)

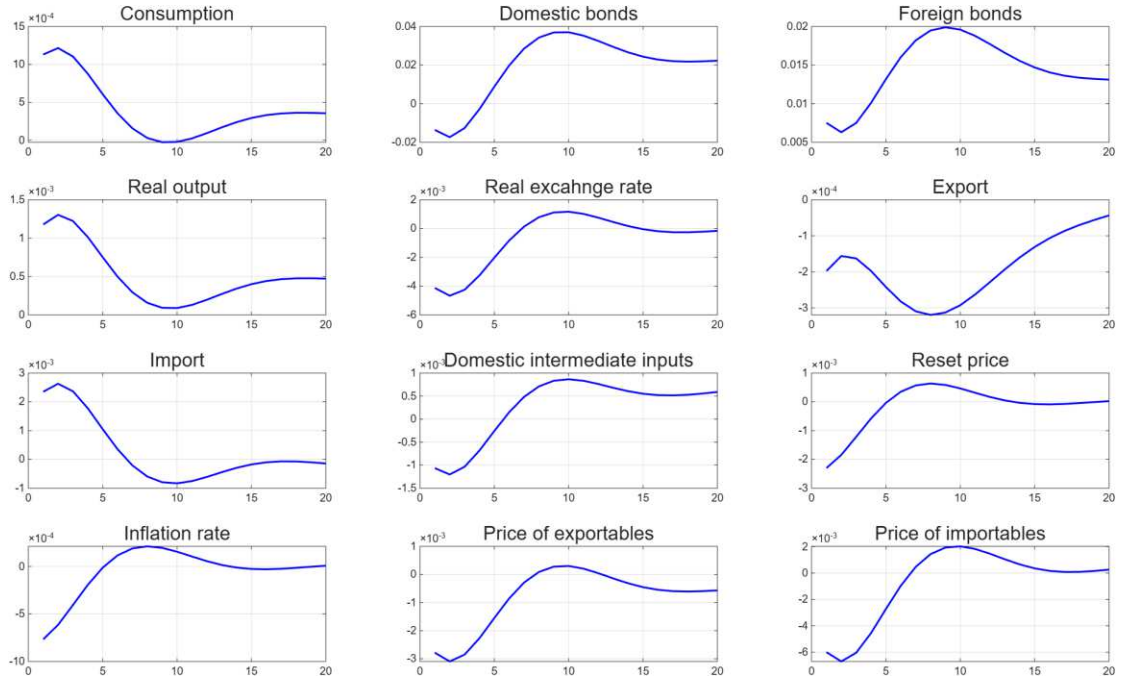


Fig.1 The impulse response of the domestic tariff shock under an independent tariff rule.

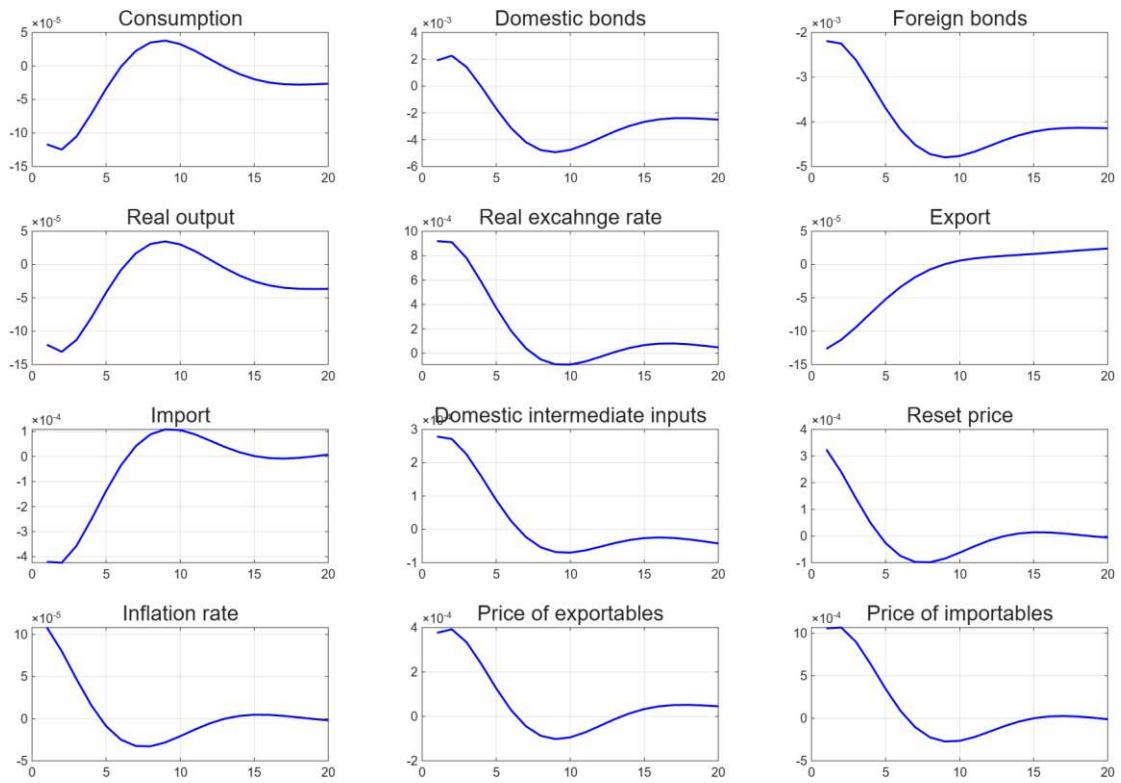


Fig.2 The impulse response of the foreign tariff shock under an independent tariff rule.

suppresses export. Furthermore, given that the exchange rate channel exerts a stronger influence than the direct tariff effect, the resulting fall in import prices stimulates an expansion in import.

4.3 Impacts of the foreign tariff shock under independent and peg tariff rules

Figure 2 presents the impulse responses to a foreign tariff shock under the independent tariff rule. An increase in the foreign tariff causes domestic real output, consumption, and inflation all to decline, with the real exchange rate channel playing the dominant role. The decline in inflation indicates that the direct deflationary effect of an increase in the foreign tariff is relatively limited, while the real exchange rate channel dominates. As shown in the figure, the burden of the foreign tariff shock falls primarily on domestic exporters. The rise in export costs induces firms to raise export prices, thereby suppressing foreign demand for domestic goods and leading to a decline in export. Meanwhile, the appreciation of the foreign currency raises the domestic-currency price of imported goods, which transmits to the domestic production sector and induces firms to curtail their demand for imports. Furthermore, consistent with the mechanism analysis, the depreciation of the domestic currency implies that each unit of exports generates less domestic-currency income, thereby dampening household consumption and increasing holdings of domestic government bonds. The contraction in consumption weighs on output from the demand side. Overall, under an independent tariff policy rule, an increase in the foreign tariff exerts negative effects on the domestic macroeconomy.

Figure 3 presents the impulse responses of the foreign tariff shock under the peg tariff rule. Under a peg tariff rule, an increase in the foreign tariff exerts positive effects on domestic real output, consumption, and other macroeconomic variables. This is because, an increase in the foreign tariff triggers a domestic tariff response that effectively hedges the transmission path and intensity of the foreign tariff shock through the real exchange rate channel, leading to different impulse responses for

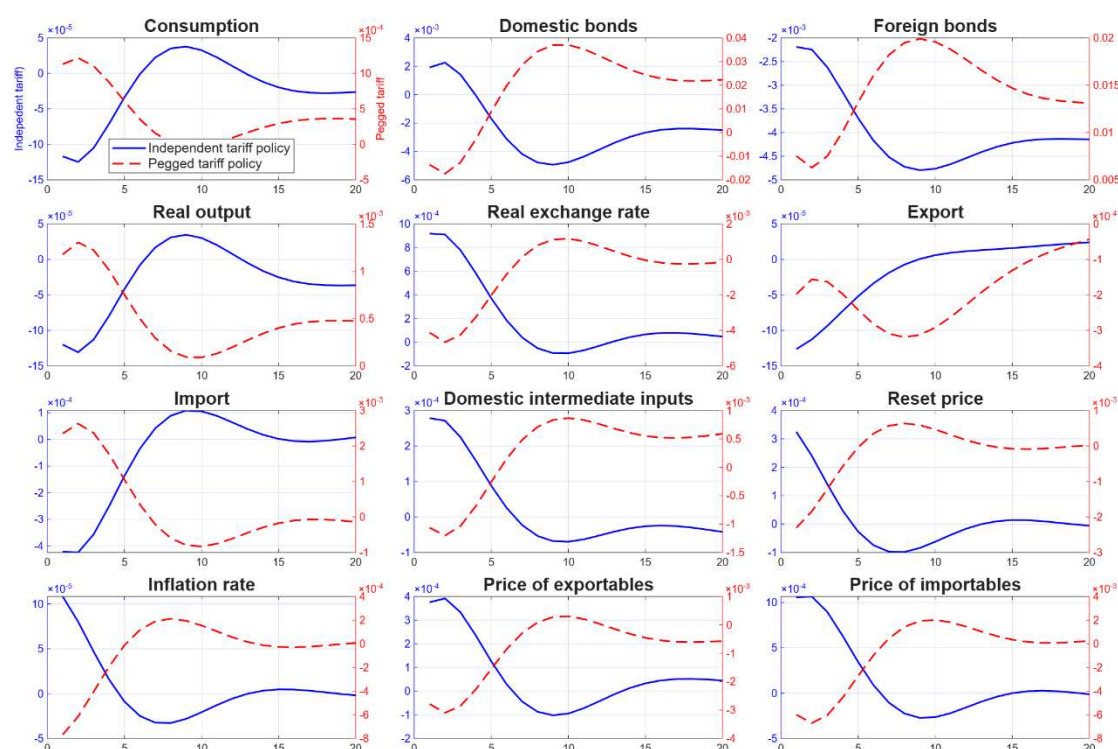


Fig.3 The impulse response of the foreign tariff shock under a peg tariff rule.

output, and most other macroeconomic variables. Under the peg rule, an increase in foreign tariffs does not lead to a rise in the real exchange rate, rather, it results in a decline in the real exchange rate (foreign currency depreciation, domestic currency appreciation). Again, with the exchange rate channel playing the dominant role, the foreign tariff shock lowers domestic inflation and raises consumption, boosting output from the demand side. However, domestic currency appreciation leads to a larger decline in exports, as well as the sharp drop in export prices. Furthermore, A decline in the real exchange rate substantially reduces import prices, significantly lowers the production costs of domestic firms, and prompts them to reduce their newly set prices. Such a real exchange rate movement also alters households' portfolio allocation, households decrease their holdings of domestic bonds and increase their holdings of foreign bonds, leading to persistent capital outflows.

Comparison with Empirical Evidence

Figure 4 presents the evolution of import tariff rates and the real effective exchange rate between China and the United States during the tariff war in 2025. On February 1, 2025, the United States announced an additional 10% tariff on all Chinese goods, bringing the average tariff rate to 30.7%. On February 4, China imposed retaliatory tariffs, levying 15% on U.S. coal and liquefied natural gas, and 10% on crude oil, agricultural machinery, large-displacement automobiles, and pickup trucks. On average, China's tariff rate on U.S. imports stood at 21.4%. As shown in the figure, under China's retaliatory tariff policy, the bilateral exchange rate (quoted as RMB per USD) did not appreciate but rather declined, from 7.31 in January to 7.28 in February. In March, the United States further raised tariffs on Chinese goods, lifting the average rate to 41.4%, followed by China's tariff increases on U.S. agricultural and other imports, raising its average rate to 22.4%, with the exchange rate further declining to 7.25. On April 2, the United States introduced a "baseline tariff plus reciprocal tariff" policy, bringing the combined tariff rate on Chinese goods to 54%. On April 4, China announced a 34% tariff on all U.S. imports. On April 8, the

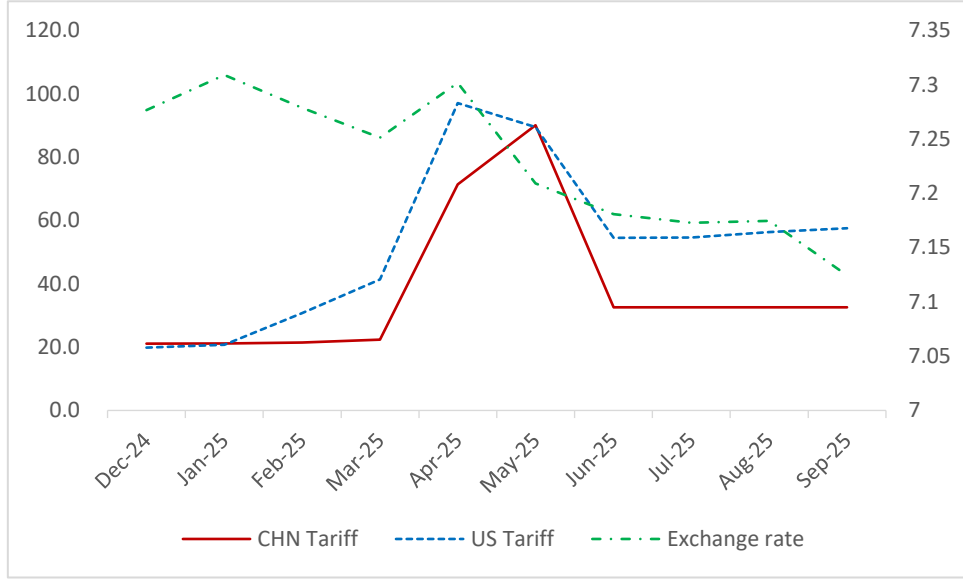


Fig.4 Tariff rates and exchange rate. *Note:* China and the U.S. The data covers the period from December 2024 to September 2025. The data of tariff rates imposed by China on imports from the United States (%), the tariff rates imposed by the United States on imports from China (%), and the exchange rate are all monthly average values. The tariff data for China and the United States are sourced from <https://www.piic.com>, and the data of RMB-USD exchange rate is obtained from the IMF.

United States raised tariffs on Chinese goods to 104%, and on April 10, further increased them to 125%, for a cumulative total of 145%. Over April, the average U.S. tariff rate on Chinese imports reached 97.1%, while China's retaliatory tariffs continued to escalate, reaching an average of 90.1% on U.S. imports by May, at which point the exchange rate fell to 7.21.

Moreover, during the first half of 2025, the U.S. federal funds rate remained in the range of 4.25%–4.50%, implying that the fluctuations in the RMB-USD exchange rate were predominantly driven by the tariff war. These evidence of exchange rate fluctuation corroborate the mechanisms identified in this study regarding the impact of foreign tariff shock on bilateral exchange rates under a peg tariff rule. Specifically, under a peg tariff rule, the domestic tariff response triggered by a foreign tariff shock can effectively offset—or even reverse—the impact of exchange rate, thereby altering the transmission path to the domestic macroeconomy through the exchange rate channel.

The Role of Macroprudential Policy

Given that the exchange rate channel plays a dominant role in the impact of foreign tariff shocks, the domestic government can implement macroprudential policy by controlling capital flows to stabilize exchange rate volatility. Assuming the government implements macroprudential policy by adjusting the capital control tax rate according to,

$$\tau_t = \rho^b \tau_{t-1} + \kappa (b_t^* - b^*) \quad (60)$$

where ρ^b is the smoothing coefficient of the capital control tax, b^* is the steady-state capital outflow, and κ is the response coefficient of the capital control tax to capital outflows. We set $\rho^\tau = 0.9$ and $\kappa = 0.01$.

Figure 5 shows the impulse responses under the independent tariff rule with capital controls. Under

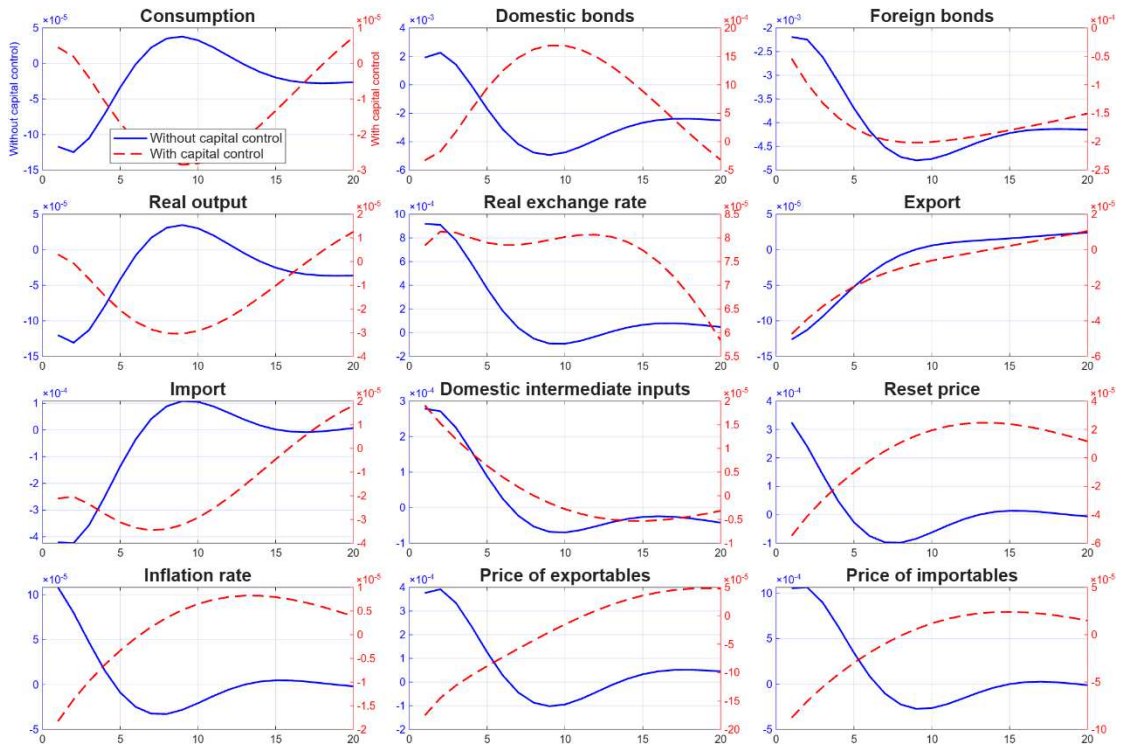


Fig.5 The impulse response of the foreign tariff shock under an independent tariff rule: with and without capital controls.

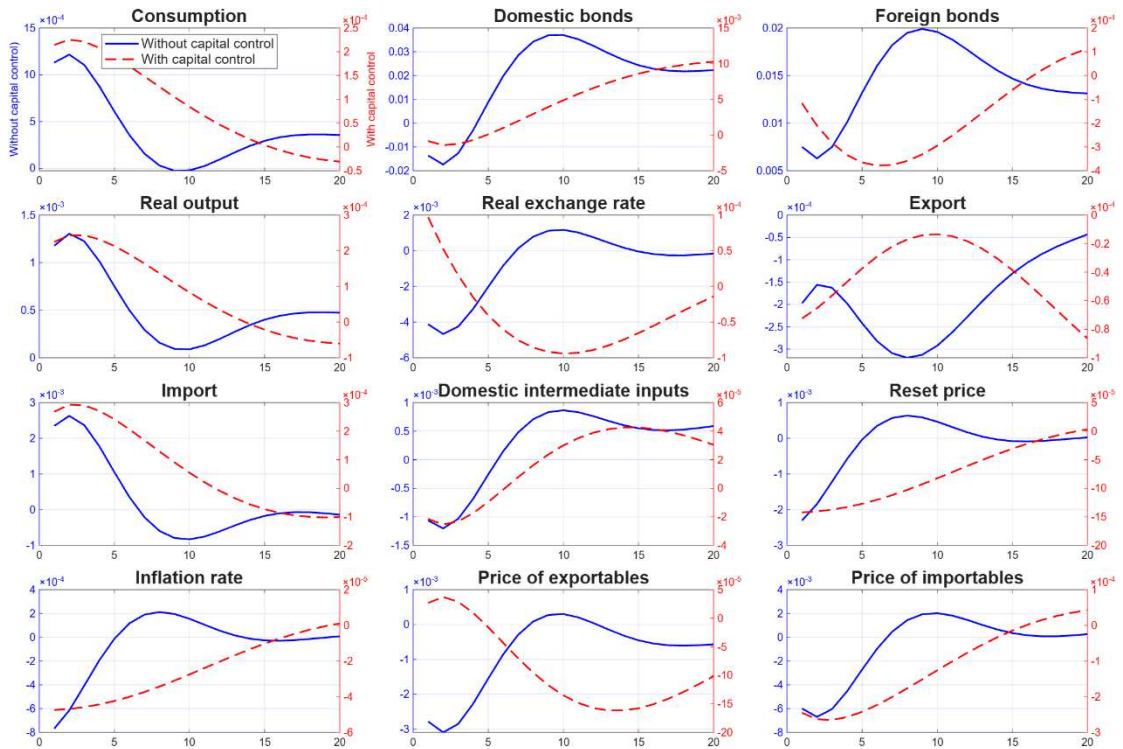


Fig.6 The impulse response of the foreign tariff shock under a peg tariff rule: with and without capital controls.

capital controls, the impact of a foreign tariff shock on domestic macroeconomic variables is significantly attenuated. As shown in the figure, domestic real output and household consumption do not decline in

the shock period, instead, they rise marginally. This is because capital controls effectively reduce the magnitude of real exchange rate fluctuations, thereby dampening the transmission of the foreign tariff shock to the domestic economy through the real exchange rate channel. With capital controls, the substantial reduction in real exchange rate volatility implies that the effect of the foreign tariff increase on domestic inflation is primarily driven by its direct effect, leading to a decline in inflation rate. The resulting fall in prices raises household consumption. The rise in consumption, in turn, stimulates real output from the demand side. Overall, capital controls can effectively cushion the transmission of foreign import tariff shocks to the domestic macroeconomy via the real exchange rate channel.

Figure 6 presents impulse responses under the peg tariff rule with capital controls. Again, the impacts of a foreign tariff shock on domestic real output and other macroeconomic variables are significantly attenuated, indicating that capital controls effectively reduce capital outflows and dampen real exchange rate fluctuation, thereby substantially weakening the transmission of foreign tariff increases through the real exchange rate channel.

Conclusion and Suggestion

This study builds a two-country New Keynesian DSGE model to analyze the economic effects and transmission mechanisms of tariff shocks under the independent and the peg tariff rules. The theoretical mechanism reveals that both domestic and foreign tariff shocks affect the home economy not only through direct effects but also through indirect transmission via the real exchange rate channel. Quantitative simulation further confirms that tariff shocks primarily affect the domestic economy through the real exchange rate channel. First, under an independent tariff rule, an increase in domestic tariffs exerts an appreciation effect on the domestic currency, which dampens export quantities, but nonetheless boosts consumption and production through higher export earnings. Conversely, a rise in foreign tariff has a direct effect of reducing exports, and an indirect effect through domestic currency depreciation that lowers export revenues and dampens consumption. Moreover, the appreciation of the foreign currency raises import prices, leading to a decline in both domestic exports and imports, which further depresses output.

Second, under a tariff peg rule, the impact of an increase in foreign tariffs on the domestic economy is contrary to that observed under an independent policy regime. Specifically, such an increase exerts a positive effect on domestic real output and household consumption. This occurs because domestic tariff retaliation effectively offsets the adverse effects of the foreign tariff hikes through the real exchange rate channel, leading to an immediate decline in the real exchange rate. The dominant role of this exchange rate channel then curbs inflationary pressures, boosts consumption, and stimulates output growth from the demand side. Moreover, the appreciation of the domestic currency substantially suppresses exports and lowers export prices, while the sharp drop in import prices significantly reduces the production costs of intermediate goods. In response, households rebalance their asset portfolios by reducing holdings of domestic bonds and increasing holdings of foreign bonds, resulting in persistent capital outflows.

Third, under both tariff rules, capital controls effectively buffer the impact of an increase in foreign import tariffs on the domestic economy. Under an independent tariff rule, capital controls significantly reduce the magnitude of real exchange rate appreciation and weaken the exchange rate transmission effect. With capital controls in place, the direct effect of the foreign tariff dominates, leading to a decline in inflation and a rise in consumption upon impact, thereby slightly boosting real output. Under a peg tariff rule, capital controls similarly curb capital outflows and exchange rate volatility, substantially attenuate the transmission of foreign tariffs through the exchange rate channel, and significantly reduce

the responsiveness of macroeconomic variables. Overall, the core function of capital controls is to buffer the transmission via the real exchange rate channel, thus effectively stabilizing the domestic macroeconomy.

Based on these findings, the study proposes four policy implications. First and foremost, tariff measures should be employed with prudence, with due regard to the indirect effects transmitted through the exchange rate channel. The consequences of tariff policy are not confined to direct trade restrictions, they also engender complex indirect transmission mechanisms via real exchange rate movements. Policymakers are therefore advised to thoroughly evaluate the interconnected effects of exchange rate changes on export revenues, import costs, and household consumption, so as to avert inadvertent macroeconomic volatility that may arise from excessive reliance on tariff instruments. Second, retaliation strategies should be contingent and dynamically adjusted in response to evolving circumstances. Under a peg tariff regime, retaliation can effectively hedge against the adverse effects of foreign tariff shocks. However, its ultimate efficacy hinges upon the relative strength of the two countries' tariffs in shaping the real exchange rate. It is advisable to adopt flexible retaliatory approaches in international trade negotiations, with tariff intensity and timing being dynamically calibrated in light of exchange rate movements and domestic macroeconomic conditions, thereby maximizing the beneficial impact of retaliation. Third, capital controls should be deployed moderately as a buffer against external shocks. The findings indicate that capital controls can effectively insulate the domestic economy from tariff shocks by curbing transmission through the real exchange rate channel, thereby significantly mitigating external disturbances. In response to large-scale external tariff shocks, this study recommends moderately reinforcing cross-border capital flow management in order to forestall excessive exchange rate volatility that might pose secondary risks to the real economy and financial stability. Fourth, international macroeconomic policy coordination should be strengthened to mitigate spillover risks arising from tariff frictions. Tariff shocks have pronounced international transmission effects, unilateral tariff measures not only affect the imposing country, but also exert significant impacts on its trading partners through exchange rate and trade channels. Countries should therefore enhance policy communication and coordination within multilateral frameworks, eschew "beggar-thy-neighbor" tariff competition, and jointly uphold the stability and predictability of the international trade order.

Appendix A

A.1 Foreign Household Sector

The utility function of the representative foreign household is,

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t^*)^{1-\sigma}}{1-\sigma} - \frac{(L_t^*)^{1+\varphi}}{1+\varphi} \right] \quad (\text{A-1})$$

where C_t^* is foreign real consumption and L_t^* is foreign labor supply.

The foreign household's budget constraint is,

$$P_t^* C_t^* + B_t^{f*} = W_t^* L_t^* + (1 + i_{t-1}^*) B_{t-1}^{f*} + \Phi_t^* + T_t^* \quad (\text{A-2})$$

where P_t^* is the foreign price index, W_t^* is the foreign nominal wage, B_t^{f*} denotes foreign government bond holdings, and i_t^* denotes the foreign interest rate. Φ_t^* is profit owed from firms, and T_t^* is lump-sum transfers.

The first-order conditions are,

$$\lambda_t^* = (C_t^*)^{-\sigma} \quad (\text{A-3})$$

$$(L_t^*)^\varphi = w_t^* \lambda_t^* \quad (\text{A-4})$$

$$\lambda_t^* = \beta E_t \frac{\lambda_{t+1}^* (1+i_t^*)}{\pi_{t+1}^*} \quad (\text{A-5})$$

where λ_t^* is the Lagrange multiplier on the budget constraint. $\pi_{t+1}^* \equiv P_{t+1}/P_t$ is foreign inflation, $w_t^* \equiv W_t^*/P_t^*$ is the real wage.

A.2 Firm Sector

The representative final goods producer combines its domestically produced intermediate goods $Y_{f,t}^*$ and imported intermediate goods $Y_{h,t}^*$ to produce the final consumption good Y_t^* .

$$Y_t^* = \left[(1-\zeta^*)^{\frac{1}{\zeta}} [Y_{f,t}^*]^{\frac{\zeta-1}{\zeta}} + (\zeta^*)^{\frac{1}{\zeta}} [Y_{h,t}^*]^{\frac{\zeta-1}{\zeta}} \right]^{\frac{\zeta}{\zeta-1}} \quad (\text{A-6})$$

Where $\zeta^* \in (0,1)$ is the degree of trade openness of foreign country.

Given $\{P_t^*, P_{f,t}^*, P_{h,t}^*\}$, the foreign firm chooses inputs to maximize the profits.

$$\Phi_{lt}^* = P_t^* Y_t^* - P_{h,t}^* Y_{h,t}^* - P_{f,t}^* Y_{f,t}^* \quad (\text{A-7})$$

The first-order conditions are,

$$Y_{f,t}^* = (1-\zeta^*) \left[\frac{P_{f,t}}{q_t (1+\tau_t^m)} \right]^{-\zeta} Y_t^* \quad (\text{A-8})$$

$$Y_{h,t}^* = \zeta^* \left[\frac{P_{h,t}}{q_t} (1+\tau_t^{m*}) \right]^{-\zeta} Y_t^* \quad (\text{A-9})$$

where $q_t = \varepsilon_t P_t^*/P_t$ is the real exchange rate.

The representative foreign wholesale firm uses labor to produce a wholesale good X_t^* , which is then split into domestic use $Y_{f,t}^*$ and export abroad $Y_{f,t}$.

$$X_t^* = Y_{f,t}^* + Y_{f,t} \quad (\text{A-10})$$

The wholesale firm's production function is Cobb–Douglas.

$$X_t^* = A_t^* (L_t^*)^{1-\alpha} \quad (\text{A-11})$$

Given P_t^* and W_t^* , the wholesale firm chooses labor L_t^* to maximize profits.

$$\Phi_{Ut}^* = P_{f,t}^* X_t^* - W_t^* L_t^* \quad (\text{A-12})$$

Profit maximization gives the first order equation as the following.

$$w_t^* = (1-\alpha) \frac{P_{f,t}}{q_t (1+\tau_t^m)} \frac{X_t^*}{L_t^*} \quad (\text{A-13})$$

A.3 Foreign Government

The foreign monetary policy rule is,

$$\ln \frac{i_t^*}{\bar{i}^*} = \rho^{i^*} \ln \frac{i_{t-1}^*}{\bar{i}^*} + (1 - \rho^{i^*}) \rho^{\pi^*} \ln \pi_t^* + v_t^{i^*} \quad (\text{A-14})$$

where ρ^{i^*} denotes the smoothing coefficient, ρ^{π^*} denotes the response coefficient, $\bar{i}^*$ is the steady-state interest rate. $v_t^{i^*}$ denotes foreign monetary policy shock.

A.4 Foreign Market Equilibrium

Foreign profits equal the sum of firm profits.

$$\phi_t^* = \phi_{It}^* + \phi_{Ut}^* \quad (\text{A-15})$$

Where $\phi_t^* = \Phi_t^*/P_t^*$, $\phi_{It}^* = \Phi_{It}^*/P_t^*$, $\phi_{Ut}^* = \Phi_{Ut}^*/P_t^*$.

The foreign resource constraint is,

$$C_t^* + b_t^{f*} = (1 + i_{t-1}^*) \frac{b_{t-1}^{f*}}{\pi_t} + \frac{p_{f,t}}{q_t(1 + \tau_t^m)} X_t^* + \tau_t^{m*} \frac{p_{h,t}}{q_t} Y_{h,t}^* \quad (\text{A-16})$$

with $T_t^*/P_t^* = \tau_t^{m*} p_{h,t} Y_{h,t}^*/q_t$.

Foreign bond issuance is zero in equilibrium.

$$b_t^{f*} + \frac{b_t^*}{q_t} = 0 \quad (\text{A-17})$$

Finally, the real exchange rate evolves according to the following equation.

$$q_t = q_{t-1} \frac{e_t \pi_t^*}{\pi_t} \quad (\text{A-18})$$

A.5 Domestic and Foreign Equilibrium System

Given exogenous processes $\{A_t, G_t, \tau_t, \tau_t^m, \tau_t^{m*}, i_t, i_t^*\}$, the equilibrium consists of the following system:

- (1) Domestic household budget constraint and optimality conditions: equations (3) through (9),
- (2) Domestic firm production and optimality conditions: equations (17), (21), (24) - (26), (31) - (33), (35), (38)-(39),
- (3) Domestic government budget constraint: equation (40),
- (4) Domestic market equilibrium: equations (43), (45),
- (5) Foreign household budget constraint and optimality conditions: equations (A-3) - (A-5),
- (6) Foreign firm production and optimality conditions: equations (A-6), (A-8) - (A-11), (A-13),
- (7) Foreign market equilibrium: equations (A-16) - (A-18).

$$\lambda_t = (C_t)^{-\sigma} \quad (\text{A-19})$$

$$(L_t)^\varphi = w_t \lambda_t \quad (\text{A-20})$$

$$\lambda_t = \beta E_t \frac{(1 + i_t)}{\pi_{t+1}} \lambda_{t+1} \quad (\text{A-21})$$

$$1+i_t = E_t e_{t+1} (1-\tau_t) (1+i_t^*) \quad (\text{A-22})$$

$$\lambda_t q_t^k = \beta E_t \left[\lambda_{t+1} r_{k,t+1} + q_{t+1}^k (1-\delta) \right] \quad (\text{A-23})$$

$$\lambda_t = \lambda_t q_t^k \left[1 - \frac{\Omega}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 - \Omega \left(\frac{I_t}{I_{t-1}} - 1 \right) \frac{I_t}{I_{t-1}} \right] + \beta E_t \left[\Omega \lambda_{t+1} q_{t+1}^k \left(\frac{I_{t+1}}{I_t} - 1 \right) \left(\frac{I_{t+1}}{I_t} \right)^2 \right] \quad (\text{A-24})$$

$$K_t = (1-\delta) K_{t-1} + \left[1 - \frac{\Omega}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 \right] I_t \quad (\text{A-25})$$

$$(\Delta_t)^{1-\xi} = (1-\zeta) (p_{h,t})^{1-\xi} + \zeta (p_{f,t})^{1-\xi} \quad (\text{A-26})$$

$$1 = \theta (\pi_t)^{t-1} + (1-\theta) (\tilde{p}_t)^{1-t} \quad (\text{A-27})$$

$$mr_t = mc_t \quad (\text{A-28})$$

$$mr_t = \frac{t-1}{t} (\wp_t)^{1-t} Y_t + \beta \theta E_t \frac{\lambda_{t+s}}{\lambda_t} \left(\frac{\wp_t}{\wp_{t+1}} \frac{1}{\pi_{t+1}} \right)^{1-t} mr_{t+1} \quad (\text{A-29})$$

$$mc_t = \Delta_t (\wp_t)^{-t} Y_t + \beta \theta E_t \frac{\lambda_{t+s}}{\lambda_t} \left(\frac{\wp_t}{\wp_{t+1}} \right)^{-t} \left(\frac{1}{\pi_{t+s}} \right)^{-t} mc_{t+1} \quad (\text{A-30})$$

$$X_t = Y_{h,t} + Y_{h,t}^* \quad (\text{A-31})$$

$$Y_{h,t} = (1-\zeta) \left(\frac{p_{h,t}}{\Delta_t} \right)^{-\xi} Y_t \quad (\text{A-32})$$

$$Y_{f,t} = \zeta \left(\frac{p_{f,t}}{\Delta_t} \right)^{-\xi} Y_t \quad (\text{A-33})$$

$$X_t = (K_{t-1})^\alpha (A_t L_t)^{1-\alpha} \quad (\text{A-34})$$

$$w_t = (1-\alpha) \frac{p_{h,t} X_t}{L_t} \quad (\text{A-35})$$

$$r_t = \alpha \frac{p_{h,t} X_t}{K_{t-1}} \quad (\text{A-36})$$

$$b_t + \frac{\tau_t^m}{1+\tau_t^m} p_{f,t} Y_{f,t} + \tau_{t-1} (1+i_{t-1}^*) \frac{e_t b_{t-1}^*}{\pi_t} = G_t + (1+i_t) \frac{b_{t-1}}{\pi_t} \quad (\text{A-37})$$

$$b_t^* = (1+i_{t-1}^*) \frac{e_t b_{t-1}^*}{\pi_t} + p_{h,t} Y_{h,t}^* - \frac{1}{1+\tau_t^m} p_{f,t} Y_{f,t} \quad (\text{A-38})$$

$$C_t + G_t + I_t = Y_t \quad (\text{A-39})$$

$$\lambda_t^* = (C_t^*)^{-\sigma} \quad (\text{A-40})$$

$$(L_t^*)^\varphi = w_t^* \lambda_t^* \quad (\text{A-41})$$

$$\lambda_t^* = \beta E_t \frac{\lambda_{t+1}^* (1 + i_t^*)}{\pi_{t+1}^*} \quad (\text{A-42})$$

$$Y_t^* = \left[(1 - \zeta^*)^{\frac{1}{\xi}} [Y_{f,t}^*]^{\frac{\xi-1}{\xi}} + (\zeta^*)^{\frac{1}{\xi}} [Y_{h,t}^*]^{\frac{\xi-1}{\xi}} \right]^{\frac{\xi}{\xi-1}} \quad (\text{A-43})$$

$$Y_{f,t}^* = (1 - \zeta^*) \left[\frac{p_{f,t}}{q_t (1 + \tau_t^m)} \right]^{-\xi} Y_t^* \quad (\text{A-44})$$

$$Y_{h,t}^* = \zeta \left[\frac{p_{h,t}}{q_t} (1 + \tau_t^{m*}) \right]^{-\xi} Y_t^* \quad (\text{A-45})$$

$$X_t^* = Y_{f,t}^* + Y_{h,t}^* \quad (\text{A-46})$$

$$X_t^* = A_t^* (L_t^*)^{1-\alpha} \quad (\text{A-47})$$

$$w_t^* = (1 - \alpha) \frac{p_{f,t}}{q_t (1 + \tau_t^m)} \frac{X_t^*}{L_t^*} \quad (\text{A-48})$$

$$C_t^* + b_t^{f*} = (1 + i_{t-1}^*) \frac{b_{t-1}^{f*}}{\pi_t} + \frac{p_{f,t}}{q_t (1 + \tau_t^m)} X_t^* + \tau_t^{m*} \frac{p_{h,t}}{q_t} Y_{h,t}^* \quad (\text{A-49})$$

$$b_t^{f*} + \frac{b_t^*}{q_t} = 0 \quad (\text{A-50})$$

$$q_t = q_{t-1} \frac{e_t \pi_t^*}{\pi_t} \quad (\text{A-51})$$

$$g_{y,t} = \frac{Y_t}{Y_{t-1}} \quad (\text{A-52})$$

Declarations

Conflict of interest

I confirm that the author(s) do not have any conflict of interest.

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