Appendix B. The two-region open economy DSGE model (For online publication only)

In this appendix, we describe the two region open economy DSGE model that is used to assess the degree of US-TPR macroeconomic integration. Below, we describe the agents and their optimization problem and list the log-linearized optimality conditions. We do so for only the domestic economy as the foreign economy is modelled symmetrically.

Households

The economy includes a continuum of households, indexed by *j*, who maximize their lifetime utility function,

$$U_t(j) = E_0 \sum_{t=0}^{\infty} \tilde{\beta}^t \frac{\varepsilon_{c,t}}{1-\sigma} \left[\left(C_t(j) - \lambda C_{t-1}(j) \right) \exp\left(-\xi \frac{L_t(j)^{1+\sigma_l}}{1+\sigma_l} \right) \right]^{1-\sigma} N_t \,, \tag{B.1}$$

subject to a budget constraint given by,

$$\begin{aligned} N_t C_t(j) + \frac{B_{h,t}(j)}{R_t P_t} + E_t \frac{B_{f,t}(j)}{\varepsilon_{d,t} R_t^* P_t} + \frac{T_t}{P_t} \le \frac{W_t(j)}{P_t} N_t L_t(j) + \frac{B_{h,t-1}(j)}{P_t} + E_t \frac{B_{f,t-1}(j)}{\varepsilon_{d,t} P_t} \\ \Pi_{h,t} + \Pi_{f,t} + \frac{\kappa_w}{2} \left(\frac{W_t(j)/W_{t-1}(j)}{\gamma \pi_{t-1}^{\iota_w} \pi^{1-\iota_w}} - 1 \right)^2 \frac{W_t}{P_t} N_t L_t \end{aligned} \tag{B.2}$$

where P_t represents the price level in the economy. Households' consumption behavior is characterized by external habit persistence and their number, N_t, grows at the rate of η in the utility function above. The parameters where $\tilde{\beta}$, σ, σ_l and λ in this function denote the population-growth-adjusted time discount factor, the intertemporal elasticity of substitution, the inverse elasticity of labor supply and the external habit persistence parameter, respectively and the parameter ξ ensures that labor supply equals 1 at steady state. The utility function also includes a consumption shock, $\varepsilon_{c,t}$, that can be interpreted as an exogenous change in the consumers' preference for current consumption over next quarter's consumption. This shock, as well as the other shocks in the model, follows an AR(1) process given by $\varepsilon_{c,t} = \rho_c \varepsilon_{c,t-1} + \eta_{c,t}$ with ρ_c and $\eta_{c,t}$ denoting the persistence parameter and the shock innovation (*i.i.d.* normal with mean 0 and standard deviation σ_c), respectively. To maximize their life-time utility, households choose the level of consumption, C_t, the number of hours they work, L_t, and how much to save. The households save by holding 1 period nominal domestic and foreign bonds, $B_{h,t}(j)$ and $B_{f,t}(j)$, that are denominated in local currency and pay a risk-free interest rate of R_t and R_t^*, respectively. The latter are also the monetary policy rates in the two economies. The variable $\varepsilon_{d,t}$ is a domestic currency depreciation shock that can also be interpreted as a shock to the risk of holding domestic bonds. Households in also pay lump-sum taxes and collect profits, $\Pi_{h,t}$ and $\Pi_{f,t}$ from the domestic firms and importers that are described below.

We assume as in Rotemberg (1982) that the households have a monopoly over their labor services and the face quadratic adjustment costs when changing their wage rate. The last expression on the right hand side of the budget constraint therefore allows us to include wage stickiness in the model.[1] In this expression γ is the economy's steady state per-capita growth rate, and $\pi_t = P_t / P_{t-1}$ is the inflation rate. The labor services are hired by perfectly competitive intermediaries that combines these services to obtain aggregate labor supply as,

[1] The parameter κ_w is given by $\kappa_w = (1-\xi_w)(1-\xi_w\tilde{\beta})/6\xi_w$. ξ_w here is the probability that wages are not adjusted and ι_w captures the degree of wage indexation.

$$L_t = \left[\int_0^1 L_t(j)^{\frac{\Theta_{L,t}}{\Theta_{L,t}-1}} dj \right]^{\frac{\Theta_{L,t}-1}{\Theta_{L,t}}}$$ and maximize $W_t L_t - \int_0^1 W_t(j) L_t(j) dj$. This problem generates the following labor demand curve:

$$L_t(j) = \left[\frac{W_t(j)}{W_t} \right]^{-\Theta_{L,t}} L_t \quad . \tag{B.3}$$

where $\Theta_{L,t}$ is the elasticity of substitution between labor services. We include cost-push shocks in this formulation by assuming that wage mark-up rates, $\varepsilon_{w,t} = \Theta_{L,t} / (\Theta_{L,t} - 1)$, follow the AR(1) process, $\log \varepsilon_{w,t} = (1 - \rho_w) \log \phi_w + \rho_w \log \varepsilon_{w,t-1} + \eta_{w,t}$ with ϕ_w denoting the gross mark-up of real wages over the marginal rate of substitution between consumption and leisure.

Producers and Importers

Producers, indexed by *i*, are monopolistically competitive intermediaries that produce output according to the following function:

$$Y_t(i) = \varepsilon_{a,t} [Z_t(i) K_t(i)]^{\alpha} [A_t N_t L_t(i)]^{1-\alpha} - (\eta\gamma)^t f \tag{B.4}$$

where $\varepsilon_{a,t}$ is a productivity shock, $Y_t(i)$, $K_t(i)$, $L_t(i)$ and $Z_t(i)$ are firm *i*'s output, capital, labor and the capital utilization rate, A_t is the trend level of productivity that grows at the rate of γ and f is the fixed cost of production that grows at the rate of output growth.[2]

The producer-specific level of capital evolves according to:

[2] The parameter *f* is set equal to $(\theta - 1) Y_t / (\eta\gamma)^t$ to ensure that profits are zero along the balanced growth path.

$$K_t(i) = (1-\delta)K_{t-1}(i) + \left[1 - \frac{\varphi}{2}\left(\frac{I_t(i)}{\eta\gamma I_{t-1}(i)} - 1\right)^2\right]\varepsilon_{i,t} I_t(i) \tag{B.5}$$

where firm i incurs adjustment costs (regulated by parameter φ) when changing its level of investment and $\varepsilon_{i,t}$ is an investment-specific technology shock.

These producers sell their products to perfectly-competitive final goods producers who combine the intermediate goods according to:

$$Y_t = \left(\int_0^1 Y_t(i)^{\left(\frac{\Theta_{h,t}-1}{\Theta_{h,t}}\right)} di\right)^{\frac{\Theta_{h,t}}{\Theta_{h,t}-1}}, \tag{B.6}$$

and minimize costs to generate the following demand function:

$$Y_t(i) = \left(\frac{P_{h,t}(i)}{P_t}\right)^{-\Theta_{h,t}} Y_t \tag{B.7}$$

where Y_t is the amount of final goods and $\Theta_{h,t}$ represents the time-varying mark-up parameter. We assume that this mark-up is all subject to an AR(1) cost-push shock, $\varepsilon_{h,t}$, where $\varepsilon_{h,t} = \Theta_{h,t} / (\Theta_{h,t} - 1)$.

The intermediate goods producers maximize their profits by choosing the price of their goods and the amount of inputs and production. Their profit function is given by,

$$\pi_t(i) = P_{h,t}(i)Y_t(i) - W_t N_t L_t(i) - \left[MPK_t - \frac{\kappa_z}{1+\varpi}\left(z_t(i)^{1+\varpi} - 1\right)\right]K_t(i) - \frac{\kappa_{ph}}{2}\left(\frac{P_{h,t}(i)/P_{h,t-1}(i)}{\pi_{h,t-1}^{\iota_h}\pi^{1-\iota_h}} - 1\right)^2 \frac{P_{h,t}}{P_t} Y_t \tag{B.8}$$

where MPK_t is the marginal product of capital, $z_t(i)$ is the time-varying capacity utilization ratio and κ_z and ϖ are the fixed costs and the elasticity of the cost of adjusting capacity utilization, respectively. The firms also incur quadratic costs when the increase in their prices deviates from past inflation. Here, $\kappa_{ph} = (1-\xi_h)(1-\xi_h\tilde{\beta})/3.5\xi_h$ with ξ_h denoting the probability that prices are not adjusted and ι_h is the Calvo parameter regulating inflation indexation. These costs and the utilization ratio allows us to capture the persistence of inflation and the price stickiness in the data.

Capital is produced by perfectly competitive firms. These firms convert previous period's capital and new investment into capital. To do so, they buy capital from entrepreneurs at the price of Q_t and final goods (investment) from final goods producers at the price of $P_{i,t}$, and they sell the new capital to entrepreneurs again at a price of Q_t. Their profits are given by,

$$E_t \sum_{t=0}^{\infty} \tilde{\beta}^t \Lambda_t \left[Q_t K_t - Q_t (1-\delta) K_{t-1} - \frac{P_{i,t}}{P_t} I_t \right] \quad \text{(B.9)}$$

where Λ_t is the Lagrange multiplier and it is given by,

$$\Lambda_t = \frac{\varepsilon_{c,t}}{N_t} (C_t - \lambda C_{t-1})^{-\sigma} \exp\left(\frac{\sigma - 1}{1+\sigma_l} \xi L_t^{1+\sigma_l} \right) \quad \text{(B.10)}$$

The importers are monopolistically competitive import goods in foreign currency, differentiate these goods and sell them at a mark-up in the domestic economy. These imports are then converted to aggregate imports, $Y_{f,t}$ (with a price of $P_{f,t}$). Let $P_{f,t}(k)$ denote the price of importer *k's* good, the demand for this good, $Y_{f,t}(k)$, is given by

$$Y_{f,t}(k) = \left(\frac{P_{f,t}(k)}{P_{f,t}} \right)^{-\Theta_{f,t}} Y_{f,t} \quad \text{(B.11)}$$

where $\Theta_{f,t}$ is a time-varying mark-up parameter that is similarly subject to an AR(1) cost-push shock, $\varepsilon_{f,t} = \Theta_{f,t} / (\Theta_{f,t} - 1)$.

The importer *k*'s life-time profits are given by,

$$E_t \sum_{t=0}^{\infty} \Lambda_t \left[\left(P_{f,t}(k) - E_t P_{h,t}^{*}\right) Y_{f,t}(k) - \frac{\kappa_{pf}}{2} \left(\frac{P_{f,t}(k)/P_{f,t-1}(k)}{\pi_{f,t}^{\iota_f} \pi_f^{1-\iota_f}} - 1 \right)^2 P_{f,t} Y_{f,t} \right] \tag{B.12}$$

where $\kappa_{pf} = (1 - \xi_f)(1 - \xi_f \tilde{\beta}) / 6\xi_f$ with $\pi_{f,t}$ denoting the inflation rate for imported goods.

Financial Market

In each economy there is a single risk-neutral bank that lends to entrepreneurs who are also risk neutral. Entrepreneurs, indexed by *m*, finance their expenditure, $Q_t K_t(m)$, with their own net worth, $N_t(m)$, and bank loans and they pay back these loans, $B_t(m)$ (with interest) by using their returns from capital so that. $Q_t K_t(m) = N_t(m) + B_t(m)$. Similar to Bernanke et al. (1999), we assume that the returns to capital, $R_{k,t}(m)$, is subject to an idiosyncratic shock, $w_t(m)$, so that $R_{k,t}(m) = w_t(m) R_{k,t}$. Here, $R_{k,t}$ denotes the aggregate returns to capital and w_t is lognormally distributed (with a cumulative distribution $F(w)$, standard deviation $\sigma_{w,t}$, and mean $\mu_{w,t} = \sigma_{w,t}^2$). The contract between the bank and the entrepreneur is defined by the following condition,

$$[1 - F(\overline{w}_{t+1}(m))] R_{k,t+1}(m) B_t(m) + (1-\mu) \int_0^{\overline{w}_{t+1}(m)} w_{t+1} dF(w) P_{t+1} R_{k,t+1} Q_t K_t(m) = R_t B_t(m) \tag{B.13}$$

where the aggregate returns to capital is,

$$R_{k,t} = \frac{(1-\delta) Q_t + MPK_t}{Q_{t-1}} \tag{B.14}$$

According to the contract, if the idiosyncratic shock is below $\overline{w}_t(m) = R_{k,t+1}(m)B_t(m)/P_{t+1}R_{k,t+1}Q_tK_t(m)$, the entrepreneur defaults and the bank collects the returns to capital and sells the assets seizes but pays unit monitoring costs, μ. The terms of this contract, ensure that the bank collects the risk free rate by diversifying across the population of entrepreneurs. We assume that the borrowing rate of the entrepreneurs is subject to a systematic AR(1) shock, $\varepsilon_{k,t}$, that can be interpreted as a shock to the standard deviation of w_t.

Entrepreneur *m*'s net worth, $N_t(m)$ evolves according to:

$$N_t(m) = \gamma_{e,t}\left[1 - F(\overline{w}_t(m))\right]\left[R_{k,t}(m)Q_{t-1}K_{t-1}(m) - R_{e,t}(m)(Q_{t-1}K_{t-1}(m) - N_{t-1}(m))\right] + (1-\gamma_{e,t}) \quad \text{(B.15)}$$

where the entrepreneurs survive only at the rate of $\gamma_{e,t}$ so they cannot accumulate enough net worth to become self-sufficient. We assume that this survival rate and thus the entrepreneurs' net worth is subject to an AR(1) shock, $\varepsilon_{n,t}$.

Monetary Policy and Fiscal Balance

The monetary policy in the economy follows a Taylor-rule:

$$R_t = \rho R_{t-1} + (1-\rho)\left(\log R + \gamma_\pi \log\frac{\pi_t}{\pi} + \gamma_y \log\frac{Y_t}{(\gamma\eta)^t Y} + \gamma_{\Delta y}\log\frac{Y_t}{\gamma\eta Y_{t-1}}\right) + \varepsilon_{r,t} \quad \text{(B.16)}$$

where γ_π, γ_y and $\gamma_{\Delta y}$ are the inflation, output gap and output growth, parameters and R is the steady state level of the policy rate, ρ is the interest rate smoothing parameter. Monetary policy shocks are captured by $\varepsilon_{r,t}$. This shock similarly follows an AR(1) process.

The government expenditures G_t and debt payments are financed with taxes with bonds:

$$P_t G_t + B_{h,t-1} + B^*_{f,t-1} = T_t + \frac{B_{h,t}}{R_t} + \frac{B^*_{f,t}}{R_t} \quad \text{(B.17)}$$

where $B^*_{f,t}$ are the amount of bonds held by foreign households.

Composite Goods and Market Clearing Conditions

Consumption and investment goods are CES aggregates of domestic and foreign goods,

$$C_t = \left(\gamma_c^{1/\lambda_c} C_{h,t}^{(\lambda_c-1)/\lambda_c} + (1-\gamma_c)^{1/\lambda_c} C_{f,t}^{(\lambda_c-1)/\lambda_c}\right)^{\lambda_c/(\lambda_c-1)} \quad \text{(B.18)}$$

$$I_t = \left(\gamma_i^{1/\lambda_i} I_{h,t}^{(\lambda_i-1)/\lambda_i} + (1-\gamma_i)^{1/\lambda_i} I_{f,t}^{(\lambda_i-1)/\lambda_i}\right)^{\lambda_i/(\lambda_i-1)} \quad \text{(B.19)}$$

where γ_c and γ_i are the share of domestic goods in consumption and investment, respectively, and λ_c and λ_i determine the elasticity of substitution between home and foreign goods. The demand functions for home and foreign goods and the aggregate price indices are then given by,

$$C_{h,t} = \left(\frac{P_{h,t}}{P_t}\right)^{-\lambda_c} \gamma_c C_t \quad \text{and} \quad C_{f,t} = \left(\frac{P_{f,t}}{P_t}\right)^{-\lambda_c} (1-\gamma_c) C_t \quad \text{(B.20)}$$

$$I_{h,t} = \left(\frac{P_{h,t}}{P_{i,t}}\right)^{-\lambda_i} \gamma_i I_t \quad \text{and} \quad I_{f,t} = \left(\frac{P_{f,t}}{P_{i,t}}\right)^{-\lambda_i} (1-\gamma_i) I_t \quad \text{(B.21)}$$

$$P_t = \left(\gamma_c P_{h,t}^{1-\lambda_c} + (1-\gamma_c) P_{f,t}^{1-\lambda_c}\right)^{1/(1-\lambda_c)} \quad \text{(B.22)}$$

$$P_{i,t} = \left(\gamma_i P_{h,t}^{1-\lambda_i} + (1-\gamma_i) P_{f,t}^{1-\lambda_i}\right)^{1/(1-\lambda_i)} \quad \text{(B.23)}$$

The total output in the economy equals total expenditure so that,

$$Y_t = N_t C_{h,t} + I_{h,t} + G_t + N^*_t C^*_{f,t} + I^*_{f,t} \quad \text{(B.24)}$$

Optimality Conditions

Households' maximize utility with respect to bond holdings to generate the following intertemporal and uncovered interest parity conditions:

$$E_t\left[\tilde{\beta}\frac{\Lambda_{t+1}}{\Lambda_t}\frac{R_t^d}{\pi_{t+1}}\right]=1 \tag{B.25}$$

$$E_t\left[\tilde{\beta}\frac{\Lambda_{t+1}}{\Lambda_t\pi_{t+1}}\left(R_t-\varepsilon_{d,t}\frac{E_{t+1}}{E_t}R_t^*\right)\right]=0 \tag{B.26}$$

Labor supply decisions and wage setting behavior generates the following:

$$\varepsilon_{c,t}\left[(C_t-\lambda C_{t-1})\exp\left(-\xi\frac{L_t^{1+\sigma_l}}{1+\sigma_l}\right)\right]^{1-\sigma}\xi L_t^{\sigma_l}=\Lambda_t\Omega_t\frac{W_t}{P_t} \tag{B.27}$$

$$\left(\frac{\pi_{w,t}}{\gamma\pi_{t-1}^{\iota_w}\pi^{1-\iota_w}}-1\right)\frac{\pi_{w,t}}{\gamma\pi_{t-1}^{\iota_w}\pi^{1-\iota_w}}=E_t\left[\left(\tilde{\beta}\frac{\Lambda_{t+1}}{\Lambda_t}\right)\left(\frac{\pi_{w,t+1}}{\gamma\pi_t^{\iota_w}\pi^{1-\iota_w}}-1\right)\frac{\pi_{w,t+1}}{\gamma\pi_t^{\iota_w}\pi^{1-\iota_w}}\frac{\pi_{w,t+1}}{\pi_{t+1}}\frac{N_{t+1}}{N_t}\frac{L_{t+1}}{L_t}\right]+\Omega_t\frac{(\Theta_{L,t}-1)}{\kappa_w}\varepsilon_{w,t} \tag{B.28}$$

where $\Omega_t=W_t(i)\left(\frac{L_t(i)}{L_t}\right)^{1/\Theta_{L,t}}$.

The bank's optimization problem produces the standard positive leverage-borrowing-premium relationship as in Bernanke et al. (1999).

$$\frac{Q_tK_t}{N_t}=\nu_E\left(\frac{E_t\pi_{t+1}R_{k,t+1}}{R_{d,t}}\right) \tag{B.29}$$

The producers' maximization problem with respect to labor, capital and the utilization rate produces the following:

$$\Omega_{h,t}P_{h,t}(1-\alpha)\left(Y_t+(\eta\gamma)^t f\right)=W_tL_t \tag{B.30}$$

$$\Omega_{h,t}\frac{P_{h,t}}{P_t}\alpha\left(\frac{Y_t+(\eta\gamma)^t f}{K_t}\right)=MPK_t+\frac{\kappa_z}{1+\varpi}\left(Z_t^{1+\varpi}-1\right) \tag{B.31}$$

$$\Omega_{h,t}\frac{P_{h,t}}{P_t}\alpha\left(\frac{Y_t+(\eta\gamma)^t f}{K_t}\right)=\kappa_z Z_t^{1+\varpi} \tag{B.32}$$

where $\Omega_{h,t}$ is the Lagrange multiplier corresponding to the final goods producers budget constraint.

Price rigidity corresponding to intermediate goods producers' and importers' price setting behavior generate the following:

$$\left(\frac{\pi_{h,t}}{\pi_{t-1}^{\iota_h}\pi^{1-\iota_h}}-1\right)\frac{\pi_{h,t}}{\pi_{t-1}^{\iota_h}\pi^{1-\iota_h}}=E_t\left[\left(\tilde{\beta}\frac{\Lambda_{t+1}}{\Lambda_t}\right)\left(\frac{\pi_{h,t+1}}{\pi_t^{\iota_h}\pi^{1-\iota_h}}-1\right)\frac{\pi_{h,t+1}}{\pi_t^{\iota_h}\pi^{1-\iota_h}}\frac{Y_{t+1}}{Y_t}\right]+\Omega_{h,t}\frac{(\Theta_{h,t}-1)}{\kappa_{ph}}\varepsilon_{h,t} \tag{B.33}$$

$$\left(\frac{\pi_{f,t}}{\pi_{f,t-1}^{\iota_f}\pi^{1-\iota_f}}-1\right)\frac{\pi_{f,t}}{\pi_{f,t-1}^{\iota_f}\pi^{1-\iota_f}}=E_t\left[\left(\beta\frac{\Lambda_{t+1}}{\Lambda_t}\right)\left(\frac{\pi_{f,t+1}}{\pi_{f,t}^{\iota_f}\pi^{1-\iota_f}}-1\right)\frac{\pi_{f,t+1}}{\pi_{f,t}^{\iota_f}\pi^{1-\iota_f}}\frac{\pi_{f,t+1}}{\pi_{t+1}}\frac{Y_{f,t+1}}{Y_{t+1}}\right]+\frac{(\Theta_{f,t}-1)e_t P_{h,t}^*}{\kappa_{pf}P_{f,t}}\varepsilon_{f,t} \tag{B.34}$$

Capital producers' maximization with respect to investment goods produces:

$$q_t\varepsilon_{i,t}\left(1-\varphi\left(\frac{I_t}{\eta\gamma I_{t-1}}-1\right)\frac{I_t}{\eta\gamma I_{t-1}}-\frac{\varphi}{2}\left(\frac{I_t}{\eta\gamma I_{t-1}}-1\right)^2\right)+E_t\left[\frac{\beta\varphi\Lambda_{t+1}}{\Lambda_t}q_{t+1}\varepsilon_{i,t+1}\left(\frac{I_{t+1}}{\eta\gamma I_t}-1\right)\frac{I_{t+1}^2}{\eta\gamma I_t^2}\right]=\frac{P_{i,t}}{P_t} \tag{B.35}$$

The linearized model

Below we report the log-linearized equations of the model. The lower case letters represent deviations from steady state values and variables without time subscripts represent steady state values. There are four general categories of equations.

Demand for domestic and foreign consumption and investment goods:

$$c_t = \frac{\lambda/\gamma}{1+\lambda/\gamma} c_{t-1} + \frac{1}{1+\lambda/\gamma} E_t c_{t+1} + \frac{(1-\lambda/\gamma)}{\sigma(1+\lambda/\gamma)} \left[(\sigma-1)\xi(l_t - E_t l_{t+1}) - (r_t - E_t \pi_{t+1})\right] + \varepsilon_{c,t} \quad \text{(B.36)}$$

$$c_t = \gamma_c c_{h,t} + (1-\gamma_c) c_{f,t} \quad \text{(B.37)}$$

$$c_{h,t} - c_{f,t} = \lambda_c \left(p_{f,t} - p_{h,t}\right) \quad \text{(B.38)}$$

$$i_t = \frac{1}{1+\tilde{\beta}} i_{t-1} + \frac{\tilde{\beta}}{1+\tilde{\beta}} E_t i_{t+1} + \frac{1}{(1+\tilde{\beta})\varphi} \left(q_t - p_{i,t}\right) + \varepsilon_{i,t} \quad \text{(B.39)}$$

$$i_t = \gamma_i i_{h,t} + (1-\gamma_i) i_{f,t} \quad \text{(B.40)}$$

$$i_{h,t} - i_{f,t} = \lambda_i \left(p_{f,t} - p_{h,t}\right) \quad \text{(B.41)}$$

Domestic and foreign goods price and wage inflation:

$$\pi_t = \gamma_c \pi_{h,t} + (1-\gamma_c) \pi_{f,t} \quad \text{(B.42)}$$

$$p_{i,t} = \gamma_i p_{h,t} + (1-\gamma_i) p_{f,t} \quad \text{(B.43)}$$

$$\pi_{w,t} - \iota_w \pi_{t-1} = \tilde{\beta}\left(E_t \pi_{w,t+1} - \iota_w \pi_t\right) - \frac{(1-\xi_w)(1-\xi_w \tilde{\beta})}{6\xi_w} \left\{ w_t - \left[\sigma_l l_t + \frac{1}{1-\lambda/\gamma} \left(c_t - \frac{\lambda}{\gamma} c_{t-1} \right) \right] \right\} + \varepsilon_{w,t} \quad \text{(B.44)}$$

$$\pi_{w,t} = w_t - w_{t-1} + \pi_t \quad \text{(B.45)}$$

$$\pi_{h,t} = \frac{\iota_h}{1+\iota_h \tilde{\beta}} \pi_{h,t-1} + \frac{\tilde{\beta}}{1+\iota_h \tilde{\beta}} \pi_{h,t+1} - \frac{(1-\xi_h)(1-\xi_h \tilde{\beta})}{3.5\xi_h (1+\iota_h \tilde{\beta})} \left[p_{h,t} + \varepsilon_{a,t} + \alpha(z_t + k_t - l_t) - w_t \right] + \varepsilon_{h,t} \quad \text{(B.46)}$$

$$\pi_{h,t} - \pi_t = p_{h,t} - p_{h,t-1} \quad \text{(B.47)}$$

$$\pi_{f,t} = \frac{\iota_f}{1+\iota_f \tilde{\beta}} \pi_{f,t-1} + \frac{\tilde{\beta}}{1+\iota_f \tilde{\beta}} \pi_{f,t+1} - \frac{(1-\xi_f)(1-\xi_f \tilde{\beta})}{3.5\xi_f (1+\iota_f \tilde{\beta})} \left(p_{f,t} - rer_t - p^*_{h,t} \right) + \varepsilon_{f,t} \quad \text{(B.48)}$$

Production and market clearing:

$$y_t = \phi_p \left[\varepsilon_{a,t} + \alpha(z_t + k_t) + (1-\alpha) l_t \right] \quad \text{(B.49)}$$

$$mpk_t = -(z_t + k_t - l_t) + w_t \tag{B.50}$$

$$z_t = \frac{1}{\varpi} mpk_t\,, \tag{B.51}$$

$$k_t = ((1-\delta)/\eta\gamma)k_{t-1} + (1-(1-\delta)/\eta\gamma)(i_t + (1+\tilde{\beta})\varphi\varepsilon_{i,t}), \tag{B.52}$$

$$r_{k,t} = ((1-\delta)\tilde{\beta}/\eta\gamma)q_t + (1-(1-\delta)\tilde{\beta}/\eta\gamma)mpk_t - q_{t-1}\,. \tag{B.53}$$

$$y_t = \gamma_c \frac{C}{Y} c_{h,t} + \gamma_i \frac{I}{Y} i_{h,t} + \frac{G}{Y} g_t + (1-\gamma_c)\frac{C}{Y} c^*_{f,t} + (1-\gamma_i)\frac{I}{Y} i^*_{f,t} \tag{B.54}$$

The financial economy:

$$E_t r_{k,t+1} = r_t - E_t \pi_{t+1} + \chi(q_t + k_t - n_t) + \varepsilon_{k,t} \tag{B.55}$$

$$n_t = \frac{\gamma_e}{\gamma\eta} r_k (r_{k,t} + n_{t-1}) + \varepsilon_{n,t} \tag{B.56}$$

$$r_t = \rho r_{t-1} + (1-\rho)[r_\pi \pi_t + r_y y_t + r_{\Delta y}(y_t - y_{t-1})] + \varepsilon_{r,t} \tag{B.57}$$

$$rer_t - rer_{t-1} = d_t + \pi^*_t - \pi_t \tag{B.58}$$

Appendix C. Calibration and the posterior estimates of the structural and shock parameters in the DSGE model (For online publication only)

Table C.1. Calibration

Parameters	Description	Value
$\tilde{\beta}$	time discount parameter	0.995
α	share of capital	0.3
δ	capital depreciation	0.025
σ	inverse intertemporal elasticity of substitution	1
η	population growth rate	
γ	per-capita output growth rate	2
γ_i	share of domestic goods in the consumption aggregator	0.9
γ_c	elasticity of substitution between domestic and foreign goods	0.9
ϕ_p	price mark-up parameter	1.25
ϕ_w	wage mark-up parameter	1.5
γ_e	entrepreneurial survival rate	0.97

Notes: This table displays the values set for the level parameters in the model.

Table C.2. Estimates of structural parameters

	Posterior Means by model				
	Prior Densities	U.S.	TP	U.S.	CA&MX
χ	B (0.07, 0.02)	0.0169	0.0190	0.0280	0.0206
λ	B (0.7, 0.1)	0.9180	0.8638	0.8751	0.8766
σ_l	N (2, 0.75)	0.9968	2.6081	0.9939	1.9483
ψ	B (0.5, 0.2)	0.0512	0.2047	0.0686	0.5724
φ	N (4, 1.5)	7.7829	4.7516	6.3863	6.4444
ι_h	B (0.5, 0.15)	0.1867	0.6383	0.3041	0.3036
ι_f	B (0.5, 0.15)	0.2333	0.1699	0.3887	0.5182
ι_w	B (0.5, 0.15)	0.1329	0.3007	0.1308	0.1745
ξ_h	B (0.5, 0.1)	0.8089	0.8684	0.8754	0.6840
ξ_f	B (0.5, 0.1)	0.1979	0.3150	0.7633	0.7797
ξ_w	B (0.5, 0.1)	0.8638	0.6125	0.8752	0.8293
λ_c	G (1, 0.2)	1.0382	0.6025	0.5258	0.8387
λ_i	G (0.25, 0.2)	0.2040	0.2042	0.3787	0.3241
ρ	N (0.75, 0.1)	0.6121	0.6901	0.4798	0.2187
r_π	N (1.5, 0.25)	1.2962	1.0294	1.1795	1.2143
r_y	N (0.25, 0.12)	0.0190	0.0310	0.0204	0.0791
$r_{\Delta y}$	N (0.25, 0.12)	0.4824	0.2825	0.5642	0.4222

Notes: The prior distributions B, N and G are the Beta, Gamma and Normal distributions, respectively.

Table C.3. Estimates of shock parameters

	Prior Density	Posterior mean values of shock parameters by model				Posterior mean values of common shock parameters by model	
		U.S.	TP	U.S.	CA&MX	U.S./TP	U.S./CA&MX
Persistence parameters							
consumption	B (0.5, 0.2)	0.3354	0.3706	0.2402	0.2384	0.3637	0.2393
investment	B (0.5, 0.2)	0.5277	0.5710	0.3990	0.4092	0.5267	0.4076
government exp.	B (0.5, 0.2)	0.9841	0.9527	0.9805	0.9527	0.6857	0.9741
productivity	B (0.5, 0.2)	0.6108	0.9353	0.6069	0.9874	0.5629	0.7320
interest rate	B (0.5, 0.2)	0.0992	0.0439	0.0781	0.0265	0.0470	0.0839
price, domestic	B (0.5, 0.2)	0.2255	0.1027	0.0854	0.8171	0.1062	0.0972
price, foreign	B (0.5, 0.2)	0.9513	0.4144	0.1594	0.3860	0.9960	0.2004
wage	B (0.5, 0.2)	0.1864	0.9043	0.2296	0.5577	0.1064	0.2354
credit spread	B (0.5, 0.2)	0.4000	0.1613	0.5942	0.0588	0.6153	0.1085
net worth	B (0.5, 0.2)	0.3711	0.3513	0.1418	0.0990	0.3669	0.2224
depreciation	B (0.5, 0.2)	0.8827		0.8429			
Shock standard deviations							
consumption	IG (0.5%, inf)	0.0013	0.0038	0.0012	0.0032	0.0012	0.0015
investment	IG (0.5%, inf)	0.0032	0.0060	0.0039	0.0097	0.0021	0.0022
government exp.	IG (0.5%, inf)	0.0228	0.0286	0.0220	0.0301	0.0027	0.0032
productivity	IG (0.5%, inf)	0.0043	0.0080	0.0053	0.0071	0.0015	0.0014
interest rate	IG (0.5%, inf)	0.0026	0.0052	0.0017	0.0178	0.0029	0.0034
price, domestic	IG (0.5%, inf)	0.0011	0.0038	0.0012	0.0047	0.0011	0.0011
price, foreign	IG (0.5%, inf)	0.0185	0.0022	0.0167	0.0050	0.0252	0.0077
wage	IG (0.5%, inf)	0.0023	0.0038	0.0016	0.0072	0.0014	0.0017
credit spread	IG (0.5%, inf)	0.0045	0.0044	0.0047	0.0078	0.0018	0.0021
net worth	IG (0.5%, inf)	0.0029	0.0132	0.0024	0.0255	0.0093	0.0084
depreciation	IG (0.5%, inf)	0.0022		0.0054			
Shock correlations							
consumption	B (0.5, 0.2)	0.2341		0.2061			
investment	B (0.5, 0.2)	0.1760		0.2735			
government exp.	B (0.5, 0.2)	0.1499		0.1779			
productivity	B (0.5, 0.2)	0.1559		0.5267			
interest rate	B (0.5, 0.2)	0.3836		0.7086			
price, domestic	B (0.5, 0.2)	0.2029		0.3267			
price, foreign	B (0.5, 0.2)	0.6484		0.9311			
wage	B (0.5, 0.2)	0.1320		0.3349			
credit spread	B (0.5, 0.2)	0.2529		0.2717			
net worth	B (0.5, 0.2)	0.3929		0.1073			

Notes: The prior distributions B, and IG are the Beta, Inverse-Gamma distributions, respectively.