house p

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

$$\psi(L_t^p)^{\varphi} = \lambda_t^p (1-\tau_m^G) W_t^p$$

$$\lambda_t^p = \beta_p E_t \left(\frac{\lambda_{t+1}^p r_t^b}{\pi_{t+1}} \right)$$

$$q_t^p = \beta_p E_t \left\{ \frac{\lambda_{t+1}^p}{\lambda_t^p} [r_{t+1}^k + (1-\delta_k) q_{t+1}^p] \right\}$$

$$1 = q_t^p \left[1 - \frac{\Omega}{2} \left(\frac{i_t^p}{i_{t-1}^p} - 1 \right)^2 - \Omega \left(\frac{i_t^p}{i_{t-1}^p} \right) \left(\frac{i_t^p}{i_{t-1}^p} - 1 \right) \right] + \Omega \beta_p E_t \left\{ q_{t+1}^p \frac{\lambda_{t+1}^p}{\lambda_t^p} \left[\left(\frac{i_{t+1}^p}{i_t^p} \right)^2 \left(\frac{i_{t+1}^p}{i_t^p} - 1 \right) \right] \right\}$$

$$K_t^p = (1-\delta_k) K_{t-1}^p + \left[1 - \frac{\Omega}{2} \left(\frac{i_t^p}{i_{t-1}^p} - 1 \right)^2 \right] i_t^p$$

$$C_t^P + i_t^P + d_t^P = r_t^k K_{t-1}^P + \frac{r_{t-1}^b}{\pi_t} d_{t-1}^p + (1-\tau_m^G) W_t^p L_t^p + T_{G,t}$$

house e

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

$$\psi(L_t^e)^{\varphi} = \lambda_t^e (1-\tau_m^G) W_t^e$$

$$\lambda_t^e = \beta_e E_t \left(\frac{\lambda_{t+1}^e r_t^b}{\pi_{t+1}} \right)$$

$$q_t^e = \beta_e E_t \left\{ \frac{\lambda_{t+1}^e}{\lambda_t^e} [r_{t+1}^k + (1-\delta_k) q_{t+1}^e] \right\}$$

$$1 = q_t^e \left[1 - \frac{\Omega}{2} \left(\frac{i_t^e}{i_{t-1}^e} - 1 \right)^2 - \Omega \left(\frac{i_t^e}{i_{t-1}^e} \right) \left(\frac{i_t^e}{i_{t-1}^e} - 1 \right) \right] + \Omega \beta_e E_t \left\{ q_{t+1}^e \frac{\lambda_{t+1}^e}{\lambda_t^e} \left[\left(\frac{i_{t+1}^e}{i_t^e} \right)^2 \left(\frac{i_{t+1}^e}{i_t^e} - 1 \right) \right] \right\}$$

$$K_t^e = (1-\delta_k) K_{t-1}^e + \left[1 - \frac{\Omega}{2} \left(\frac{i_t^e}{i_{t-1}^e} - 1 \right)^2 \right] i_t^e$$

$$C_t^e + i_t^e + d_t^e = r_t^k K_{t-1}^e + \frac{r_{t-1}^b}{\pi_t} d_{t-1}^e + (1-\tau_m^G) W_t^e L_t^e$$

government

$$g_t + \frac{r_{t-1}^b}{\pi_t} d_t + \tau_{D,t}^R S_t + T_{G,t} = d_t + \tau_m^G (W_t^P L_t^p + W_t^e L_t^e)$$

central bank

$$\frac{r_t^b}{r^b} = \left(\frac{r_{t-1}^b}{r^b} \right)^{\rho_r} \left[\left(\frac{\pi_t}{\pi} \right)^{\Phi_\pi} \left(\frac{Y_t}{Y} \right)^{\Phi_Y} \right]^{1-\rho_r} e^{\varepsilon_t^m}$$

medium goods

$$r_t^k = \beta_0 (1-\gamma) mc_t \frac{Y_t}{K_{t-1}}$$

$$W_t^p = (1-\beta_0)(1-\gamma) mc_t \frac{Y_t}{L_{pf,t}}$$

$$W_t^e = (1-\beta_1)\gamma mc_t \frac{Y_t}{L_{ef,t}}$$

$$\pi_t(\pi_t - \pi) = \beta_p E_t \left[\frac{\lambda_{t+1}^p}{\lambda_t^p} \pi_{t+1} (\pi_{t+1} - \pi) \frac{Y_{t+1}}{Y_t} \right] + \frac{\varepsilon}{\theta} \left(mc_t - \frac{\varepsilon - 1}{\varepsilon} \right)$$

$$Y_t = C_t + i_t + g_t + (1+\tau_{D,t}^R) S_t + \frac{\theta}{2} (\pi_t - \pi)^2 Y_t$$

$$Y_t = [(K_t)^{\beta_0} (L_{pf,t})^{1-\beta_0}]^{1-\gamma} [(D_t)^{\beta_1} (L_{pf,t})^{1-\beta_1}]^{\gamma}$$

$$C_t = C_t^p + C_t^e$$

$$K_t = K_t^p + K_t^e$$

$$i_t = i_t^p + i_t^e$$

$$dt = d_t^p + d_t^e$$

$$L_t = L_t^p + L_t^e$$

$$L_t^p = L_{pf,t}$$

$$L_t^e = L_{pf,t} + L_{D,t}^e$$

research

$$D_{V,t} = \chi_t^Y Y_t$$

$$D_{G,t} = \chi_t^C C_t$$

$$N_t^D = \omega_D [(1+\tau_{D,t}^R) S_t]^{\alpha} (L_{D,t}^e)^{1-\alpha} + (1-\delta_D) N_{t-1}^D$$

$$B_t = D_{G,t}^{\nu} (N_t^D)^{1-\nu}$$

$$D_t = \xi D_{V,t} + (1-\xi) B_t$$

$$S_t + W_t^e L_{D,t}^e = Y_t \left[1 - (1-\beta_1\gamma) mc_t - \frac{\theta}{2} (\pi_t - \pi)^2 \right]$$

$$W_t^e = \omega_D (1-\alpha)^2 \frac{Y_t \left[1 - (1-\beta_1\gamma) mc_t - \frac{\theta}{2} (\pi_t - \pi)^2 \right]}{D_t} \left(\frac{D_{G,t}}{N_t^D} \right)^{\nu} \left[\frac{(1+\tau_{D,t}^R) S_t}{L_{D,t}^e} \right]^{\alpha}$$

shocks

$$\log(T_{G,t}) = (1-\rho_{TG})\log\left(\overline{T_G}\right) + \rho_{TG}\log(T_{G,t-1}) + \varepsilon_t^{T_G}$$

$$\varepsilon_t^{T_G} \sim N(0, \sigma_{T_G}^2)$$

$$\log(\chi_t^Y) = (1-\rho_{\chi^Y})\log\left(\overline{\chi^Y}\right) + \rho_{\chi^Y}\log(\chi_{t-1}^Y) + \varepsilon_t^{\chi^Y}$$

$$\varepsilon_t^{\chi^Y} \sim N(0, \sigma_{\chi^Y}^2)$$

$$\log(\chi_t^C) = (1-\rho_{\chi^C})\log\left(\overline{\chi^C}\right) + \rho_{\chi^C}\log(\chi_{t-1}^C) + \varepsilon_t^{\chi^C}$$

$$\varepsilon_t^{\chi^C} \sim N(0, \sigma_{\chi^C}^2)$$

$$\log(g_t) = (1-\rho_g)\log(\overline{g}) + \rho_g\log(g_{t-1}) + \varepsilon_t^g$$

$$\varepsilon_t^g \sim N(0, \sigma_g^2)$$

$$\varepsilon_t^m \sim N(0, \sigma_m^2)$$