

1 CONSUMER

1.1 Optimisation problem

$$\max_{C_t, K_t, I_t, B_t, z_t} U_t = \beta \mathbf{E}_t [U_{t+1}] + \epsilon_t^b \left((1 - \sigma^c)^{-1} (C_t - H_t)^{1 - \sigma^c} - \omega \epsilon_t^l (1 + \sigma^l)^{-1} L_t^{s1 + \sigma^l} \right) \quad (1.1)$$

s.t. :

$$C_t + I_t + B_t R_t^{-1} = D \dot{w}_t - T_t + B_{t-1} \pi_t^{-1} + L_t W_t + K_{t-1} r_t^k z_t - \psi^{-1} r_{ss}^k K_{t-1} \left(-1 + e^{\psi(-1+z_t)} \right) \quad (\lambda_t) \quad (1.2)$$

$$K_t = K_{t-1} (1 - \tau) + I_t \left(1 - 0.5 \varphi (-1 + I_{t-1}^{-1} \epsilon_t^l I_t)^2 \right) \quad (q_t) \quad (1.3)$$

1.2 Identities

$$H_t = h C_{t-1} \quad (1.4)$$

$$Q_t = \lambda_t^{-1} q_t \quad (1.5)$$

1.3 First order conditions

$$-\lambda_t + \epsilon_t^b (C_t - H_t)^{-\sigma^c} = 0 \quad (C_t) \quad (1.6)$$

$$-q_t + \beta \left((1 - \tau) \mathbf{E}_t [q_{t+1}] + \mathbf{E}_t \left[\lambda_{t+1} \left(r_{t+1}^k z_{t+1} - \psi^{-1} r_{ss}^k \left(-1 + e^{\psi(-1+z_{t+1})} \right) \right) \right] \right) = 0 \quad (K_t) \quad (1.7)$$

$$-\lambda_t + q_t \left(1 - 0.5 \varphi (-1 + I_{t-1}^{-1} \epsilon_t^l I_t)^2 - \varphi I_{t-1}^{-1} \epsilon_t^l I_t (-1 + I_{t-1}^{-1} \epsilon_t^l I_t) \right) + \beta \varphi I_t^{-2} \mathbf{E}_t \left[\epsilon_{t+1}^l q_{t+1} I_{t+1}^2 (-1 + I_t^{-1} \epsilon_{t+1}^l I_{t+1}) \right] = 0 \quad (I_t) \quad (1.8)$$

$$\beta \mathbf{E}_t [\lambda_{t+1} \pi_{t+1}^{-1}] - \lambda_t R_t^{-1} = 0 \quad (B_t) \quad (1.9)$$

$$\lambda_t \left(K_{t-1} r_t^k - r_{ss}^k K_{t-1} e^{\psi(-1+z_t)} \right) = 0 \quad (z_t) \quad (1.10)$$

2 PREFERENCE SHOCKS

2.1 Identities

$$\log \epsilon_t^b = \eta_t^b + \rho^b \log \epsilon_{t-1}^b \quad (2.1)$$

$$\log \epsilon_t^L = -\eta_t^L + \rho^L \log \epsilon_{t-1}^L \quad (2.2)$$

3 INVESTMENT COST SHOCKS

3.1 Identities

$$\log \epsilon_t^I = \eta_t^I + \rho^I \log \epsilon_{t-1}^I \quad (3.1)$$

4 WAGE SETTING PROBLEM

4.1 Identities

$$f_t^1 = \beta \xi^w \mathbf{E}_t \left[f_{t+1}^1 \left(w_t^{*-1} w_{t+1}^* \right)^{\lambda^{w-1}} \left(\pi_{t+1}^{-1} \pi_t \gamma^w \right)^{-\lambda^{w-1}} \right] + \lambda_t w_t^* L_t (1 + \lambda^w)^{-1} \pi_t^{*w - \lambda^{w-1}(1 + \lambda^w)} \quad (4.1)$$

$$f_t^2 = \beta \xi^w \mathbf{E}_t \left[f_{t+1}^2 \left(w_t^{*-1} w_{t+1}^* \right)^{\lambda^{w-1}(1 + \lambda^w)(1 + \sigma^1)} \left(\pi_{t+1}^{-1} \pi_t \gamma^w \right)^{-\lambda^{w-1}(1 + \lambda^w)(1 + \sigma^1)} \right] + \omega \epsilon_t^b \epsilon_t^L \left(L_t \pi_t^{*w - \lambda^{w-1}(1 + \lambda^w)} \right)^{1 + \sigma^1} \quad (4.2)$$

$$f_t^1 = \eta_t^w + f_t^2 \quad (4.3)$$

$$\pi_t^{*w} = w_t^* W_t^{-1} \quad (4.4)$$

5 WAGE EVOLUTION

5.1 Identities

$$1 = (1 - \xi^w) \pi_t^{*w - \lambda^{w-1}} + \xi^w (W_{t-1} W_t^{-1})^{-\lambda^{w-1}} \left(\pi_t^{-1} \pi_{t-1} \gamma^w \right)^{-\lambda^{w-1}} \quad (5.1)$$

6 LABOUR AGGREGATION

6.1 Identities

$$\nu_t^w = (1 - \xi^w) \pi_t^{*w - \lambda^{w-1}(1 + \lambda^w)} + \xi^w \nu_{t-1}^w \left(W_{t-1} \pi_t^{-1} W_t^{-1} \pi_{t-1} \gamma^w \right)^{-\lambda^{w-1}(1 + \lambda^w)} \quad (6.1)$$

$$L_t = \nu_t^{w-1} L_t^s \quad (6.2)$$

7 CONSUMER FLEXIBLE

7.1 Optimisation problem

$$\max_{C_t^f, K_t^f, I_t^f, B_t^f, z_t^f, L_t^f} U_t^f = \beta \mathbf{E}_t [U_{t+1}^f] + \epsilon_t^b \left((1 - \sigma^c)^{-1} (C_t^f - H_t^f)^{1 - \sigma^c} - \omega \epsilon_t^L (1 + \sigma^l)^{-1} L_t^{s^{f1 + \sigma^l}} \right) \quad (7.1)$$

s.t. :

$$C_t^f + I_t^f + B_t^f R_t^{f-1} = B_{t-1}^f + D\dot{w}_t^f + \Pi_t^{ws^f} - T_t^f + L_t^{sf} W_t^{\text{disutil}^f} + K_{t-1}^f r_t^{kf} z_t^f - \psi^{-1} r_{ss}^{kf} K_{t-1}^f \left(-1 + e^{\psi(-1 + z_t^f)} \right) \quad (\lambda_t^f) \quad (7.2)$$

$$K_t^f = K_{t-1}^f (1 - \tau) + I_t^f \left(1 - 0.5\varphi \left(-1 + I_{t-1}^{f-1} \epsilon_t^I I_t^f \right)^2 \right) \quad (q_t^f) \quad (7.3)$$

7.2 Identities

$$H_t^f = h C_{t-1}^f \quad (7.4)$$

$$Q_t^f = \lambda_t^{f-1} q_t^f \quad (7.5)$$

7.3 First order conditions

$$-\lambda_t^f + \epsilon_t^b (C_t^f - H_t^f)^{-\sigma^c} = 0 \quad (C_t^f) \quad (7.6)$$

$$-q_t^f + \beta \left((1 - \tau) \mathbf{E}_t [q_{t+1}^f] + \mathbf{E}_t \left[\lambda_{t+1}^f \left(r_{t+1}^{kf} z_{t+1}^f - \psi^{-1} r_{ss}^{kf} \left(-1 + e^{\psi(-1 + z_{t+1}^f)} \right) \right) \right] \right) = 0 \quad (K_t^f) \quad (7.7)$$

$$-\lambda_t^f + q_t^f \left(1 - 0.5\varphi \left(-1 + I_{t-1}^{f-1} \epsilon_t^I I_t^f \right)^2 - \varphi I_{t-1}^{f-1} \epsilon_t^I I_t^f \left(-1 + I_{t-1}^{f-1} \epsilon_t^I I_t^f \right) \right) + \beta \varphi I_t^{f-2} \mathbf{E}_t \left[\epsilon_{t+1}^I q_{t+1}^f I_{t+1}^{f-2} \left(-1 + I_t^{f-1} \epsilon_{t+1}^I I_{t+1}^f \right) \right] = 0 \quad (I_t^f) \quad (7.8)$$

$$\beta \mathbf{E}_t [\lambda_{t+1}^f] - \lambda_t^f R_t^{f-1} = 0 \quad (B_t^f) \quad (7.9)$$

$$\lambda_t^f \left(K_{t-1}^f r_t^{k^f} - r_{ss}^{k^f} K_{t-1}^f e^{\psi(-1+z_t^f)} \right) = 0 \quad (z_t^f) \quad (7.10)$$

$$\lambda_t^f W_t^{\text{disutil}^f} - \omega \epsilon_t^b \epsilon_t L_t^{s^f \sigma^1} = 0 \quad (L_t^{s^f}) \quad (7.11)$$

8 FLEXIBLE MONOPOLISTIC WORKER

8.1 Optimisation problem

$$\max_{W_t^{i^f}, L_t^{i^{*f}}} \Pi_t^{\text{ws}^f} = L_t^{i^{*f}} \left(-W_t^{\text{disutil}^f} + W_t^{i^f} \right) \quad (8.1)$$

s.t. :

$$L_t^{i^{*f}} = L_t^f \left(W_t^{i^f} W_t^{f-1} \right)^{\lambda^w - 1(-1 - \lambda^w)} \quad \left(\lambda_t^{\text{FLEXIBLEMONOPOLISTICWORKER}^1} \right) \quad (8.2)$$

8.2 Identities

$$L_t^{i^{*f}} = L_t^{i^f} \quad (8.3)$$

8.3 First order conditions

$$L_t^{i^{*f}} + \lambda^{w-1} \lambda_t^{\text{FLEXIBLEMONOPOLISTICWORKER}^1} L_t^f W_t^{f-1} (-1 - \lambda^w) \left(W_t^{i^f} W_t^{f-1} \right)^{-1 + \lambda^w - 1(-1 - \lambda^w)} = 0 \quad (W_t^{i^f}) \quad (8.4)$$

$$-\lambda_t^{\text{FLEXIBLEMONOPOLISTICWORKER}^1} - W_t^{\text{disutil}^f} + W_t^{i^f} = 0 \quad (L_t^{i^{*f}}) \quad (8.5)$$

8.4 First order conditions after reduction

$$L_t^{i^{*f}} + \lambda^{w-1} L_t^f W_t^{f-1} (-1 - \lambda^w) \left(-W_t^{\text{disutil}^f} + W_t^{i^f} \right) \left(W_t^{i^f} W_t^{f-1} \right)^{-1 + \lambda^w - 1(-1 - \lambda^w)} = 0 \quad (W_t^{i^f}) \quad (8.6)$$

9 LABOUR AGGREGATION FLEXIBLE

9.1 Identities

$$L_t^{s^f} = L_t^{i^f} \quad (9.1)$$

$$L_t^f = L_t^{s^f} \quad (9.2)$$

10 FIRM

10.1 Optimisation problem

$$\max_{K_t^j, L_t^j} tc_t^j = -r_t^k K_t^j - L_t^j W_t \quad (10.1)$$

s.t. :

$$Y_t^j = -\Phi + \epsilon_t^a K_t^j{}^\alpha L_t^j{}^{1-\alpha} \quad (mc_t) \quad (10.2)$$

10.2 First order conditions

$$-r_t^k + \alpha \epsilon_t^a mc_t K_t^j{}^{\alpha-1} L_t^j{}^{1-\alpha} = 0 \quad (K_t^j) \quad (10.3)$$

$$-W_t + \epsilon_t^a mc_t (1 - \alpha) K_t^j{}^\alpha L_t^j{}^{-\alpha} = 0 \quad (L_t^j) \quad (10.4)$$

11 TECHNOLOGY

11.1 Identities

$$\log \epsilon_t^a = \eta_t^a + \rho^a \log \epsilon_{t-1}^a \quad (11.1)$$

12 PRICE SETTING PROBLEM

12.1 Identities

$$g_t^1 = \eta_t^p + g_t^2 (1 + \lambda^p) \quad (12.1)$$

$$g_t^1 = \lambda_t \pi_t^* Y_t + \beta \xi^p \pi_t^* E_t \left[g_{t+1}^1 \pi_{t+1}^{*-1} \left(\pi_{t+1}^{-1} \pi_t^{\gamma^p} \right)^{-\lambda^p-1} \right] \quad (12.2)$$

$$g_t^2 = \beta \xi^p E_t \left[g_{t+1}^2 \left(\pi_{t+1}^{-1} \pi_t^{\gamma^p} \right)^{-\lambda^p-1(1+\lambda^p)} \right] + \lambda_t mc_t Y_t \quad (12.3)$$

13 PRICE EVOLUTION

13.1 Identities

$$1 = \xi^p \left(\pi_t^{-1} \pi_{t-1}^{\gamma^p} \right)^{-\lambda^p-1} + (1 - \xi^p) \pi_t^{*-\lambda^p-1} \quad (13.1)$$

14 FACTOR DEMAND AGGREGATION

14.1 Identities

$$K_t^d = K_t^{j^d} \quad (14.1)$$

$$L_t^d = L_t^{j^d} \quad (14.2)$$

15 PRODUCT AGGREGATION

15.1 Identities

$$Y_t^s = Y_t^j \quad (15.1)$$

$$\nu_t^p = (1 - \xi^p) \pi_t^{*-\lambda^{p-1}(1+\lambda^p)} + \xi^p \nu_{t-1}^p \left(\pi_t^{-1} \pi_{t-1} \gamma^p \right)^{-\lambda^{p-1}(1+\lambda^p)} \quad (15.2)$$

$$\nu_t^p Y_t = Y_t^s \quad (15.3)$$

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16 FIRM FLEXIBLE

16.1 Optimisation problem

$$\max_{K_t^{j^{df}}, L_t^{j^{df}}} t c_t^{j^f} = -r_t^{k^f} K_t^{j^{df}} - L_t^{j^{df}} W_t^f \quad (16.1)$$

s.t. :

$$Y_t^{j^f} = -\Phi + \epsilon_t^a K_t^{j^{df}\alpha} L_t^{j^{df}1-\alpha} (m c_t^f) \quad (16.2)$$

16.2 First order conditions

$$-r_t^{k^f} + \alpha \epsilon_t^a m c_t^f K_t^{j^{df}-1+\alpha} L_t^{j^{df}1-\alpha} = 0 \quad \left(K_t^{j^{df}} \right) \quad (16.3)$$

$$-W_t^f + \epsilon_t^a m c_t^f (1 - \alpha) K_t^{j^{df}\alpha} L_t^{j^{df}-\alpha} = 0 \quad \left(L_t^{j^{df}} \right) \quad (16.4)$$

17 PRICE SETTING PROBLEM FLEXIBLE

17.1 Optimisation problem

$$\max_{Y_t^{jf}, P_t^{jf}} \Pi_t^{\text{PS}^f} = Y_t^{jf} \left(-mc_t^f + P_t^{jf} \right) \quad (17.1)$$

s.t. :

$$Y_t^{jf} = Y_t^f \left(P_t^{f-1} P_t^{jf} \right)^{-\lambda^{p-1}(1+\lambda^p)} \left(\lambda_t^{\text{PRICESETTINGPROBLEMFLEXIBLE}^1} \right) \quad (17.2)$$

17.2 First order conditions

$$-\lambda_t^{\text{PRICESETTINGPROBLEMFLEXIBLE}^1} - mc_t^f + P_t^{jf} = 0 \quad \left(Y_t^{jf} \right) \quad (17.3)$$

$$Y_t^{jf} - \lambda^{p-1} \lambda_t^{\text{PRICESETTINGPROBLEMFLEXIBLE}^1} P_t^{f-1} Y_t^f (1 + \lambda^p) \left(P_t^{f-1} P_t^{jf} \right)^{-1-\lambda^{p-1}(1+\lambda^p)} = 0 \quad \left(P_t^{jf} \right) \quad (17.4)$$

17.3 First order conditions after reduction

$$Y_t^{jf} - \lambda^{p-1} P_t^{f-1} Y_t^f (1 + \lambda^p) \left(-mc_t^f + P_t^{jf} \right) \left(P_t^{f-1} P_t^{jf} \right)^{-1-\lambda^{p-1}(1+\lambda^p)} = 0 \quad \left(P_t^{jf} \right) \quad (17.5)$$

18 FACTOR DEMAND AGGREGATION FLEXIBLE

18.1 Identities

$$K_t^{\text{df}} = K_t^{\text{jdf}} \quad (18.1)$$

$$L_t^{\text{df}} = L_t^{\text{jdf}} \quad (18.2)$$

19 PRODUCT AGGREGATION FLEXIBLE

19.1 Identities

$$Y_t^{\text{sf}} = Y_t^{\text{jf}} \quad (19.1)$$

$$Y_t^f = Y_t^{\text{sf}} \quad (19.2)$$

20 PRICE EVOLUTION FLEXIBLE

20.1 Identities

$$P_t^f = 1 \quad (20.1)$$

21 GOVERNMENT

21.1 Identities

$$G_t = G^{\text{bar}} \epsilon_t^G \quad (21.1)$$

$$G_t + B_{t-1} \pi_t^{-1} = T_t + B_t R_t^{-1} \quad (21.2)$$

22 GOVERNMENT SPENDING SHOCK

22.1 Identities

$$\log \epsilon_t^G = \eta_t^G + \rho^G \log \epsilon_{t-1}^G \quad (22.1)$$

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23 GOVERNMENT FLEXIBLE

23.1 Identities

$$G_t^f = G^{\text{bar}} \epsilon_t^G \quad (23.1)$$

$$B_{t-1}^f + G_t^f = T_t^f + B_t^f R_t^{f-1} \quad (23.2)$$

24 MONETARY POLICY AUTHORITY

24.1 Identities

$$\alpha \log R_{ss}^{-1} R_t + \log (R_{ss}^{-1} R_t) = \eta_t^R + r^{\Delta \pi} (-\log (\pi_{ss}^{-1} \pi_{t-1}) + \log (\pi_{ss}^{-1} \pi_t)) + r^{\Delta y} (-\log (Y_{ss}^{-1} Y_{t-1}) + \log (Y_{ss}^{-1} Y_t) + \log (Y_{ss}^{f-1} Y_{t-1}^f) - \log (Y_{ss}^{f-1} Y_t^f)) + \rho \log (R_{ss}^{-1} R_{t-1}) + (1 - \rho) (\log (24.1)$$

$$\log \pi_t^{\text{obj}} = \eta_t^\pi + \rho^{\pi^{\text{bar}}} \log \pi_{t-1}^{\text{obj}} + \log \alpha \log \pi^{\text{obj}} (1 - \rho^{\pi^{\text{bar}}}) \quad (24.2)$$

25 EQUILIBRIUM

25.1 Identities

$$K_t^d = K_{t-1}z_t \quad (25.1)$$

$$L_t = L_t^d \quad (25.2)$$

$$B_t = 0 \quad (25.3)$$

$$D\dot{w}_t = Y_t - L_t^d W_t - r_t^k K_t^d \quad (25.4)$$

26 EQUILIBRIUM FLEXIBLE

26.1 Identities

$$K_t^{df} = K_{t-1}^f z_t^f \quad (26.1)$$

$$L_t^f = L_t^{df} \quad (26.2)$$

$$B_t^f = 0 \quad (26.3)$$

$$D\dot{w}_t^f = Y_t^f - L_t^{df} W_t^f - r_t^{kf} K_t^{df} \quad (26.4)$$

27 Equilibrium relationships (after reduction)

$$-q_t + \beta \left((1 - \tau) E_t [q_{t+1}] + E_t \left[\epsilon_{t+1}^b \left(r_{t+1}^k z_{t+1} - \psi^{-1} r_{ss}^k \left(-1 + e^{\psi(-1+z_{t+1})} \right) \right) (C_{t+1} - hC_t)^{-\sigma^c} \right] \right) = 0 \quad (27.1)$$

$$-q_t^f + \beta \left((1 - \tau) E_t [q_{t+1}^f] + E_t \left[\epsilon_{t+1}^b \left(r_{t+1}^{kf} z_{t+1}^f - \psi^{-1} r_{ss}^{kf} \left(-1 + e^{\psi(-1+z_{t+1}^f)} \right) \right) (C_{t+1}^f - hC_t^f)^{-\sigma^c} \right] \right) = 0 \quad (27.2)$$

$$-r_t^k + \alpha \epsilon_t^a m c_t L_t^{1-\alpha} (K_{t-1} z_t)^{-1+\alpha} = 0 \quad (27.3)$$

$$-r_t^{kf} + \alpha \epsilon_t^a m c_t^f L_t^{f1-\alpha} (K_{t-1}^f z_t^f)^{-1+\alpha} = 0 \quad (27.4)$$

$$-G_t + T_t = 0 \quad (27.5)$$

$$-G_t + G^{\text{bar}} \epsilon_t^G = 0 \quad (27.6)$$

$$-G_t^f + T_t^f = 0 \quad (27.7)$$

$$-G_t^f + G^{\text{bar}} \epsilon_t^G = 0 \quad (27.8)$$

$$-L_t + \nu_t^w L_t^s = 0 \quad (27.9)$$

$$-L_t^{s^f} + L_t^f (W_t^{i^f} W_t^{f-1})^{\lambda^w - 1(-1 - \lambda^w)} = 0 \quad (27.10)$$

$$L_t^{s^f} - L_t^f = 0 \quad (27.11)$$

$$L_t^{s^f} + \lambda^w L_t^f W_t^{f-1} (-1 - \lambda^w) (-W_t^{\text{disutil}^f} + W_t^{i^f}) (W_t^{i^f} W_t^{f-1})^{-1 + \lambda^w - 1(-1 - \lambda^w)} = 0 \quad (27.12)$$

$$\Pi_t^{\text{ws}^f} - L_t^{s^f} (-W_t^{\text{disutil}^f} + W_t^{i^f}) = 0 \quad (27.13)$$

$$\Pi_t^{\text{ps}^f} - Y_t^f (-m C_t^f + P_t^{j^f}) P_t^{j^f - \lambda^p - 1(1 + \lambda^p)} = 0 \quad (27.14)$$

$$-Q_t + \epsilon_t^b q_t (C_t - h C_{t-1})^{\sigma^c} = 0 \quad (27.15)$$

$$-Q_t^f + \epsilon_t^b q_t^f (C_t^f - h C_{t-1}^f)^{\sigma^c} = 0 \quad (27.16)$$

$$-W_t + \epsilon_t^a m C_t (1 - \alpha) L_t^{-\alpha} (K_{t-1} z_t)^\alpha = 0 \quad (27.17)$$

$$-W_t^f + \epsilon_t^a m C_t^f (1 - \alpha) L_t^{f-\alpha} (K_{t-1}^f z_t^f)^\alpha = 0 \quad (27.18)$$

$$-Y_t^f + Y_t^{s^f} = 0 \quad (27.19)$$

$$Y_t^s - \nu_t^p Y_t = 0 \quad (27.20)$$

$$-Y_t^{s^f} + Y_t^f P_t^{j^f - \lambda^p - 1(1 + \lambda^p)} = 0 \quad (27.21)$$

$$\beta \mathbf{E}_t \left[\epsilon_{t+1}^b (C_{t+1}^f - hC_t^f)^{-\sigma^c} \right] - \epsilon_t^b R_t^{f-1} (C_t^f - hC_{t-1}^f)^{-\sigma^c} = 0 \quad (27.22)$$

$$\beta \mathbf{E}_t \left[\epsilon_{t+1}^b \pi_{t+1}^{-1} (C_{t+1} - hC_t)^{-\sigma^c} \right] - \epsilon_t^b R_t^{-1} (C_t - hC_{t-1})^{-\sigma^c} = 0 \quad (27.23)$$

$$Y_t^f P_t^{j^f - \lambda^{p-1}(1+\lambda^p)} - \lambda^p Y_t^f (1 + \lambda^p) \left(-m c_t^f + P_t^{j^f} \right) P_t^{j^f - 1 - \lambda^{p-1}(1+\lambda^p)} = 0 \quad (27.24)$$

$$\epsilon_t^b W_t^{\text{disutil}^f} (C_t^f - hC_{t-1}^f)^{-\sigma^c} - \omega \epsilon_t^b \epsilon_t^L L_t^{s^f \sigma^1} = 0 \quad (27.25)$$

$$-1 + \xi^p \left(\pi_t^{-1} \pi_{t-1}^{\gamma^p} \right)^{-\lambda^{p-1}} + (1 - \xi^p) \pi_t^*^{-\lambda^{p-1}} = 0 \quad (27.26)$$

$$-1 + (1 - \xi^w) (w_t^* W_t^{-1})^{-\lambda^{w-1}} + \xi^w (W_{t-1} W_t^{-1})^{-\lambda^{w-1}} \left(\pi_t^{-1} \pi_{t-1}^{\gamma^w} \right)^{-\lambda^{w-1}} = 0 \quad (27.27)$$

$$-\Phi - Y_t^s + \epsilon_t^a L_t^{1-\alpha} (K_{t-1} z_t)^\alpha = 0 \quad (27.28)$$

$$-\Phi - Y_t^f P_t^{j^f - \lambda^{p-1}(1+\lambda^p)} + \epsilon_t^a L_t^{1-\alpha} (K_{t-1}^f z_t^f)^\alpha = 0 \quad (27.29)$$

$$\eta_t^b - \log \epsilon_t^b + \rho^b \log \epsilon_{t-1}^b = 0 \quad (27.30)$$

$$-\eta_t^L - \log \epsilon_t^L + \rho^L \log \epsilon_{t-1}^L = 0 \quad (27.31)$$

$$\eta_t^I - \log \epsilon_t^I + \rho^I \log \epsilon_{t-1}^I = 0 \quad (27.32)$$

$$\eta_t^w - f_t^1 + f_t^2 = 0 \quad (27.33)$$

$$\eta_t^a - \log \epsilon_t^a + \rho^a \log \epsilon_{t-1}^a = 0 \quad (27.34)$$

$$\eta_t^p - g_t^1 + g_t^2 (1 + \lambda^p) = 0 \quad (27.35)$$

$$\eta_t^G - \log \epsilon_t^G + \rho^G \log \epsilon_{t-1}^G = 0 \quad (27.36)$$

$$-f_t^1 + \beta \xi^w \mathbf{E}_t \left[f_{t+1}^1 \left(w_t^{*-1} w_{t+1}^* \right)^{\lambda^w - 1} \left(\pi_{t+1}^{-1} \pi_t \gamma^w \right)^{-\lambda^w - 1} \right] + \epsilon_t^b w_t^* L_t (1 + \lambda^w)^{-1} (C_t - hC_{t-1})^{-\sigma^c} (w_t^* W_t^{-1})^{-\lambda^w - 1(1 + \lambda^w)} = 0 \quad (27.37)$$

$$-f_t^2 + \beta \xi^w \mathbf{E}_t \left[f_{t+1}^2 \left(w_t^{*-1} w_{t+1}^* \right)^{\lambda^w - 1(1 + \lambda^w)(1 + \sigma^1)} \left(\pi_{t+1}^{-1} \pi_t \gamma^w \right)^{-\lambda^w - 1(1 + \lambda^w)(1 + \sigma^1)} \right] + \omega \epsilon_t^b \epsilon_t^L \left(L_t (w_t^* W_t^{-1})^{-\lambda^w - 1(1 + \lambda^w)} \right)^{1 + \sigma^1} = 0 \quad (27.38)$$

$$-g_t^1 + \beta \xi^p \pi_t^* \mathbf{E}_t \left[g_{t+1}^1 \pi_{t+1}^{*-1} \left(\pi_{t+1}^{-1} \pi_t \gamma^p \right)^{-\lambda^p - 1} \right] + \epsilon_t^b \pi_t^* Y_t (C_t - hC_{t-1})^{-\sigma^c} = 0 \quad (27.39)$$

$$-g_t^2 + \beta \xi^p \mathbf{E}_t \left[g_{t+1}^2 \left(\pi_{t+1}^{-1} \pi_t \gamma^p \right)^{-\lambda^p - 1(1 + \lambda^p)} \right] + \epsilon_t^b m \epsilon_t Y_t (C_t - hC_{t-1})^{-\sigma^c} = 0 \quad (27.40)$$

$$-\nu_t^w + (1 - \xi^w) (w_t^* W_t^{-1})^{-\lambda^w - 1(1 + \lambda^w)} + \xi^w \nu_{t-1}^w \left(W_{t-1} \pi_t^{-1} W_t^{-1} \pi_{t-1} \gamma^w \right)^{-\lambda^w - 1(1 + \lambda^w)} = 0 \quad (27.41)$$

$$-\nu_t^p + (1 - \xi^p) \pi_t^{*-1} \pi_{t-1}^{-1} \left(\pi_t^{-1} \pi_{t-1} \gamma^p \right)^{-\lambda^p - 1(1 + \lambda^p)} = 0 \quad (27.42)$$

$$-K_t + K_{t-1} (1 - \tau) + I_t \left(1 - 0.5\varphi \left(-1 + I_{t-1}^{-1} \epsilon_t^I I_t \right)^2 \right) = 0 \quad (27.43)$$

$$-K_t^f + K_{t-1}^f (1 - \tau) + I_t^f \left(1 - 0.5\varphi \left(-1 + I_{t-1}^{f-1} \epsilon_t^I I_t^f \right)^2 \right) = 0 \quad (27.44)$$

$$U_t - \beta \mathbf{E}_t [U_{t+1}] - \epsilon_t^b \left((1 - \sigma^c)^{-1} (C_t - hC_{t-1})^{1 - \sigma^c} - \omega \epsilon_t^L (1 + \sigma^1)^{-1} L_t^{s^{1 + \sigma^1}} \right) = 0 \quad (27.45)$$

$$U_t^f - \beta \mathbf{E}_t [U_{t+1}^f] - \epsilon_t^b \left((1 - \sigma^c)^{-1} (C_t^f - hC_{t-1}^f)^{1 - \sigma^c} - \omega \epsilon_t^L (1 + \sigma^1)^{-1} L_t^{s^{f^{1 + \sigma^1}}} \right) = 0 \quad (27.46)$$

$$-\epsilon_t^b (C_t - hC_{t-1})^{-\sigma^c} + q_t \left(1 - 0.5\varphi \left(-1 + I_{t-1}^{-1} \epsilon_t^I I_t \right)^2 - \varphi I_{t-1}^{-1} \epsilon_t^I I_t \left(-1 + I_{t-1}^{-1} \epsilon_t^I I_t \right) \right) + \beta \varphi I_t^{-2} \mathbf{E}_t \left[\epsilon_{t+1}^I q_{t+1} I_{t+1}^2 \left(-1 + I_t^{-1} \epsilon_{t+1}^I I_{t+1} \right) \right] = 0 \quad (27.47)$$

$$-\epsilon_t^b (C_t^f - hC_{t-1}^f)^{-\sigma^c} + q_t^f \left(1 - 0.5\varphi \left(-1 + I_{t-1}^{f-1} \epsilon_t^I I_t^f \right)^2 - \varphi I_{t-1}^{f-1} \epsilon_t^I I_t^f \left(-1 + I_{t-1}^{f-1} \epsilon_t^I I_t^f \right) \right) + \beta \varphi I_t^{f-2} \mathbf{E}_t \left[\epsilon_{t+1}^I q_{t+1}^f I_{t+1}^{f2} \left(-1 + I_t^{f-1} \epsilon_{t+1}^I I_{t+1}^f \right) \right] = 0 \quad (27.48)$$

$$\eta_t^\pi - \log \pi_t^{\text{obj}} + \rho^{\pi^{\text{bar}}} \log \pi_{t-1}^{\text{obj}} + \log \text{allr}^{\pi^{\text{obj}}} \left(1 - \rho^{\pi^{\text{bar}}} \right) = 0 \quad (27.49)$$

$$-C_t - I_t - T_t + Y_t - \psi^{-1} r_{\text{ss}}^k K_{t-1} \left(-1 + e^{\psi(-1 + z_t)} \right) = 0 \quad (27.50)$$

$$-\alpha \ln r^\pi + \eta_t^R - \log(R_{ss}^{-1} R_t) + r^{\Delta^\pi} \left(-\log(\pi_{ss}^{-1} \pi_{t-1}) + \log(\pi_{ss}^{-1} \pi_t) \right) + r^{\Delta^y} \left(-\log(Y_{ss}^{-1} Y_{t-1}) + \log(Y_{ss}^{-1} Y_t) + \log(Y_{ss}^{-1} Y_{t-1}^f) - \log(Y_{ss}^{-1} Y_t^f) \right) + \rho \log(R_{ss}^{-1} R_{t-1}) + (1 - \rho) \left(\log \right. \\ \left. (27.51) \right)$$

$$-C_t^f - I_t^f + \Pi_t^{ws^f} - T_t^f + Y_t^f + L_t^s W_t^{\text{disutil}^f} - L_t^f W_t^f - \psi^{-1} r_{ss}^{k^f} K_{t-1}^f \left(-1 + e^{\psi(-1+z_t^f)} \right) = 0 \quad (27.52)$$

$$\epsilon_t^b \left(K_{t-1}^k r_t^k - r_{ss}^k K_{t-1}^k e^{\psi(-1+z_t)} \right) (C_t - h C_{t-1})^{-\sigma^c} = 0 \quad (27.53)$$

$$\epsilon_t^b \left(K_{t-1}^f r_t^{k^f} - r_{ss}^{k^f} K_{t-1}^f e^{\psi(-1+z_t^f)} \right) (C_t^f - h C_{t-1}^f)^{-\sigma^c} = 0 \quad (27.54)$$

28 Steady state relationships (after reduction)

$$-q_{ss} + \beta \left(q_{ss} (1 - \tau) + \epsilon_{ss}^b \left(r_{ss}^k z_{ss} - \psi^{-1} r_{ss}^k \left(-1 + e^{\psi(-1+z_{ss})} \right) \right) \right) (C_{ss} - h C_{ss})^{-\sigma^c} = 0 \quad (28.1)$$

$$-q_{ss}^f + \beta \left(q_{ss}^f (1 - \tau) + \epsilon_{ss}^b \left(r_{ss}^{k^f} z_{ss}^f - \psi^{-1} r_{ss}^{k^f} \left(-1 + e^{\psi(-1+z_{ss}^f)} \right) \right) \right) (C_{ss}^f - h C_{ss}^f)^{-\sigma^c} = 0 \quad (28.2)$$

$$-r_{ss}^k + \alpha \epsilon_{ss}^a m c_{ss} L_{ss}^{1-\alpha} (z_{ss} K_{ss})^{-1+\alpha} = 0 \quad (28.3)$$

$$-r_{ss}^{k^f} + \alpha \epsilon_{ss}^a m c_{ss}^f L_{ss}^{1-\alpha} (z_{ss}^f K_{ss}^f)^{-1+\alpha} = 0 \quad (28.4)$$

$$-G_{ss} + T_{ss} = 0 \quad (28.5)$$

$$-G_{ss} + G^{\text{bar}} \epsilon_{ss}^G = 0 \quad (28.6)$$

$$-G_{ss}^f + T_{ss}^f = 0 \quad (28.7)$$

$$-G_{ss}^f + G^{\text{bar}} \epsilon_{ss}^G = 0 \quad (28.8)$$

$$-L_{ss} + \nu_{ss}^w L_{ss}^s = 0 \quad (28.9)$$

$$-L_{ss}^f + L_{ss}^f \left(W_{ss}^{i^f} W_{ss}^{f-1} \right)^{\lambda^w - 1} = 0 \quad (28.10)$$

$$L_{ss}^{sf} - L_{ss}^f = 0 \quad (28.11)$$

$$L_{ss}^{sf} + \lambda^{w-1} L_{ss}^f W_{ss}^{f-1} (-1 - \lambda^w) \left(-W_{ss}^{\text{disutil}^f} + W_{ss}^{if} \right) \left(W_{ss}^{if} W_{ss}^{f-1} \right)^{-1 + \lambda^{w-1} (-1 - \lambda^w)} = 0 \quad (28.12)$$

$$\Pi_{ss}^{ws^f} - L_{ss}^{sf} \left(-W_{ss}^{\text{disutil}^f} + W_{ss}^{if} \right) = 0 \quad (28.13)$$

$$\Pi_{ss}^{ps^f} - Y_{ss}^f \left(-m_{ss}^f + P_{ss}^{jf} \right) P_{ss}^{jf - \lambda^{p-1} (1 + \lambda^p)} = 0 \quad (28.14)$$

$$-Q_{ss} + \epsilon_{ss}^b{}^{-1} q_{ss} (C_{ss} - hC_{ss})^{\sigma^c} = 0 \quad (28.15)$$

$$-Q_{ss}^f + \epsilon_{ss}^b{}^{-1} q_{ss}^f (C_{ss}^f - hC_{ss}^f)^{\sigma^c} = 0 \quad (28.16)$$

$$-W_{ss} + \epsilon_{ss}^a m_{ss} (1 - \alpha) L_{ss}^{-\alpha} (z_{ss} K_{ss})^\alpha = 0 \quad (28.17)$$

$$-W_{ss}^f + \epsilon_{ss}^a m_{ss}^f (1 - \alpha) L_{ss}^{f-\alpha} (z_{ss}^f K_{ss}^f)^\alpha = 0 \quad (28.18)$$

$$-Y_{ss}^f + Y_{ss}^{sf} = 0 \quad (28.19)$$

$$Y_{ss}^s - \nu_{ss}^p Y_{ss} = 0 \quad (28.20)$$

$$-Y_{ss}^{sf} + Y_{ss}^f P_{ss}^{jf - \lambda^{p-1} (1 + \lambda^p)} = 0 \quad (28.21)$$

$$\beta \epsilon_{ss}^b (C_{ss}^f - hC_{ss}^f)^{-\sigma^c} - \epsilon_{ss}^b R_{ss}^{f-1} (C_{ss}^f - hC_{ss}^f)^{-\sigma^c} = 0 \quad (28.22)$$

$$-\epsilon_{ss}^b R_{ss}^{-1} (C_{ss} - hC_{ss})^{-\sigma^c} + \beta \epsilon_{ss}^b \pi_{ss}^{-1} (C_{ss} - hC_{ss})^{-\sigma^c} = 0 \quad (28.23)$$

$$Y_{ss}^f P_{ss}^{jf - \lambda^{p-1} (1 + \lambda^p)} - \lambda^{p-1} Y_{ss}^f (1 + \lambda^p) \left(-m_{ss}^f + P_{ss}^{jf} \right) P_{ss}^{jf - 1 - \lambda^{p-1} (1 + \lambda^p)} = 0 \quad (28.24)$$

$$\epsilon_{ss}^b W_{ss}^{\text{disutil}^f} (C_{ss}^f - hC_{ss}^f)^{-\sigma^c} - \omega \epsilon_{ss}^b \epsilon_{ss}^L L_{ss}^{sf \sigma^1} = 0 \quad (28.25)$$

$$-1 + \xi^p \left(\pi_{ss}^{-1} \pi_{ss}^{\gamma^p} \right)^{-\lambda^{p-1}} + (1 - \xi^p) \pi_{ss}^{\star - \lambda^{p-1}} = 0 \quad (28.26)$$

$$-1 + (1 - \xi^w) (w_{ss}^* W_{ss}^{-1})^{-\lambda^{w-1}} + \xi^w 1^{-\lambda^{w-1}} (\pi_{ss}^{-1} \pi_{ss} \gamma^w)^{-\lambda^{w-1}} = 0 \quad (28.27)$$

$$-\Phi - Y_{ss}^s + \epsilon_{ss}^a L_{ss}^{1-\alpha} (z_{ss} K_{ss})^\alpha = 0 \quad (28.28)$$

$$-\Phi - Y_{ss}^f P_{ss}^{f-\lambda^{p-1}(1+\lambda^p)} + \epsilon_{ss}^a L_{ss}^{f1-\alpha} (z_{ss}^f K_{ss}^f)^\alpha = 0 \quad (28.29)$$

$$-\log \epsilon_{ss}^b + \rho^b \log \epsilon_{ss}^b = 0 \quad (28.30)$$

$$-\log \epsilon_{ss}^L + \rho^L \log \epsilon_{ss}^L = 0 \quad (28.31)$$

$$-\log \epsilon_{ss}^I + \rho^I \log \epsilon_{ss}^I = 0 \quad (28.32)$$

$$-f_{ss}^1 + f_{ss}^2 = 0 \quad (28.33)$$

$$-\log \epsilon_{ss}^a + \rho^a \log \epsilon_{ss}^a = 0 \quad (28.34)$$

$$-g_{ss}^1 + g_{ss}^2 (1 + \lambda^p) = 0 \quad (28.35)$$

$$-\log \epsilon_{ss}^G + \rho^G \log \epsilon_{ss}^G = 0 \quad (28.36)$$

$$-f_{ss}^1 + \beta \xi^w f_{ss}^1 1^{\lambda^{w-1}} (\pi_{ss}^{-1} \pi_{ss} \gamma^w)^{-\lambda^{w-1}} + \epsilon_{ss}^b w_{ss}^* L_{ss} (1 + \lambda^w)^{-1} (C_{ss} - hC_{ss})^{-\sigma^c} (w_{ss}^* W_{ss}^{-1})^{-\lambda^{w-1}(1+\lambda^w)} = 0 \quad (28.37)$$

$$-f_{ss}^2 + \omega \epsilon_{ss}^b \epsilon_{ss}^L \left(L_{ss} (w_{ss}^* W_{ss}^{-1})^{-\lambda^{w-1}(1+\lambda^w)} \right)^{1+\sigma^1} + \beta \xi^w f_{ss}^2 1^{\lambda^{w-1}(1+\lambda^w)(1+\sigma^1)} (\pi_{ss}^{-1} \pi_{ss} \gamma^w)^{-\lambda^{w-1}(1+\lambda^w)(1+\sigma^1)} = 0 \quad (28.38)$$

$$-g_{ss}^1 + \beta \xi^p g_{ss}^1 (\pi_{ss}^{-1} \pi_{ss} \gamma^p)^{-\lambda^{p-1}} + \epsilon_{ss}^b \pi_{ss}^* Y_{ss} (C_{ss} - hC_{ss})^{-\sigma^c} = 0 \quad (28.39)$$

$$-g_{ss}^2 + \beta \xi^p g_{ss}^2 (\pi_{ss}^{-1} \pi_{ss} \gamma^p)^{-\lambda^{p-1}(1+\lambda^p)} + \epsilon_{ss}^b m c_{ss} Y_{ss} (C_{ss} - hC_{ss})^{-\sigma^c} = 0 \quad (28.40)$$

$$-\nu_{ss}^w + (1 - \xi^w) (w_{ss}^* W_{ss}^{-1})^{-\lambda^{w-1}(1+\lambda^w)} + \xi^w \nu_{ss}^w (\pi_{ss}^{-1} \pi_{ss} \gamma^w)^{-\lambda^{w-1}(1+\lambda^w)} = 0 \quad (28.41)$$

$$-\nu_{ss}^p + (1 - \xi^p) \pi_{ss}^* - \lambda^{p-1}(1+\lambda^p) + \xi^p \nu_{ss}^p \left(\pi_{ss}^{-1} \pi_{ss}^{\gamma^p} \right)^{-\lambda^{p-1}(1+\lambda^p)} = 0 \quad (28.42)$$

$$-K_{ss} + I_{ss} \left(1 - 0.5\varphi (-1 + \epsilon_{ss}^I)^2 \right) + K_{ss} (1 - \tau) = 0 \quad (28.43)$$

$$-K_{ss}^f + I_{ss}^f \left(1 - 0.5\varphi (-1 + \epsilon_{ss}^I)^2 \right) + K_{ss}^f (1 - \tau) = 0 \quad (28.44)$$

$$U_{ss} - \beta U_{ss} - \epsilon_{ss}^b \left((1 - \sigma^c)^{-1} (C_{ss} - hC_{ss})^{1-\sigma^c} - \omega \epsilon_{ss}^L (1 + \sigma^l)^{-1} L_{ss}^{s^{1+\sigma^l}} \right) = 0 \quad (28.45)$$

$$U_{ss}^f - \beta U_{ss}^f - \epsilon_{ss}^b \left((1 - \sigma^c)^{-1} (C_{ss}^f - hC_{ss}^f)^{1-\sigma^c} - \omega \epsilon_{ss}^L (1 + \sigma^l)^{-1} L_{ss}^{s^{f^{1+\sigma^l}}} \right) = 0 \quad (28.46)$$

$$-\epsilon_{ss}^b (C_{ss} - hC_{ss})^{-\sigma^c} + q_{ss} \left(1 - 0.5\varphi (-1 + \epsilon_{ss}^I)^2 - \varphi \epsilon_{ss}^I (-1 + \epsilon_{ss}^I) \right) + \beta \varphi \epsilon_{ss}^I q_{ss} (-1 + \epsilon_{ss}^I) = 0 \quad (28.47)$$

$$-\epsilon_{ss}^b (C_{ss}^f - hC_{ss}^f)^{-\sigma^c} + q_{ss}^f \left(1 - 0.5\varphi (-1 + \epsilon_{ss}^I)^2 - \varphi \epsilon_{ss}^I (-1 + \epsilon_{ss}^I) \right) + \beta \varphi \epsilon_{ss}^I q_{ss}^f (-1 + \epsilon_{ss}^I) = 0 \quad (28.48)$$

$$-\log \pi_{ss}^{\text{obj}} + \rho^{\pi^{\text{bar}}} \log \pi_{ss}^{\text{obj}} + \log \text{altr}^{\pi^{\text{obj}}} \left(1 - \rho^{\pi^{\text{bar}}} \right) = 0 \quad (28.49)$$

$$-C_{ss} - I_{ss} - T_{ss} + Y_{ss} - \psi^{-1} r_{ss}^k K_{ss} \left(-1 + e^{\psi(-1+z_{ss})} \right) = 0 \quad (28.50)$$

$$-\text{altr}^{\pi} + (1 - \rho) \left(\log \pi_{ss}^{\text{obj}} - r^{\pi} \log \pi_{ss}^{\text{obj}} \right) = 0 \quad (28.51)$$

$$-C_{ss}^f - I_{ss}^f + \Pi_{ss}^{\text{ws}^f} - T_{ss}^f + Y_{ss}^f + L_{ss}^f W_{ss}^{\text{disutil}^f} - L_{ss}^f W_{ss}^f - \psi^{-1} r_{ss}^{k^f} K_{ss}^f \left(-1 + e^{\psi(-1+z_{ss}^f)} \right) = 0 \quad (28.52)$$

$$\epsilon_{ss}^b \left(r_{ss}^k K_{ss} - r_{ss}^k K_{ss} e^{\psi(-1+z_{ss})} \right) (C_{ss} - hC_{ss})^{-\sigma^c} = 0 \quad (28.53)$$

$$\epsilon_{ss}^b \left(r_{ss}^{k^f} K_{ss}^f - r_{ss}^{k^f} K_{ss}^f e^{\psi(-1+z_{ss}^f)} \right) (C_{ss}^f - hC_{ss}^f)^{-\sigma^c} = 0 \quad (28.54)$$

29 Calibrating equations

$$-1.408 + Y_{ss}^s{}^{-1} (\Phi + Y_{ss}^s) = 0 \quad (29.1)$$

$$-1 + \pi_{ss}^{\text{obj}} = 0 \quad (29.2)$$

$$-0.6 + C_{ss}^f Y_{ss}^f{}^{-1} = 0 \quad (29.3)$$

$$-0.18 + G_{ss} Y_{ss}{}^{-1} = 0 \quad (29.4)$$

$$\pi_{ss} - \pi_{ss}^{\text{obj}} = 0 \quad (29.5)$$

30 Parameter settings

$$\alpha = 0.3 \quad (30.1)$$

$$\beta = 0.99 \quad (30.2)$$

$$\gamma^w = 0.763 \quad (30.3)$$

$$\gamma^p = 0.469 \quad (30.4)$$

$$h = 0.573 \quad (30.5)$$

$$\lambda^w = 0.5 \quad (30.6)$$

$$\omega = 1 \quad (30.7)$$

$$\psi = 0.169 \quad (30.8)$$

$$r^\pi = 1.684 \quad (30.9)$$

$$r^Y = 0.099 \quad (30.10)$$

$$r^{\Delta\pi} = 0.14 \quad (30.11)$$

$$r^{\Delta y} = 0.159 \quad (30.12)$$

$$\rho = 0.961 \quad (30.13)$$

$$\rho^b = 0.855 \quad (30.14)$$

$$\rho^L = 0.889 \quad (30.15)$$

$$\rho^I = 0.927 \quad (30.16)$$

$$\rho^a = 0.823 \quad (30.17)$$

$$\rho^G = 0.949 \quad (30.18)$$

$$\rho^{\pi^{\text{bar}}} = 0.924 \quad (30.19)$$

$$\sigma^c = 1.353 \quad (30.20)$$

$$\sigma^l = 2.4 \quad (30.21)$$

$$\tau = 0.025 \quad (30.22)$$

$$\varphi = 6.771 \quad (30.23)$$

$$\xi^w = 0.737 \quad (30.24)$$

$$\xi^P = 0.908 \quad (30.25)$$

31 Steady-state values

	Steady-state value
ϵ^G	1
ϵ^b	1
ϵ^L	1
ϵ^I	1
ϵ^a	1
f^1	8.7708
f^2	8.7708
g^1	48.8253
g^2	35.7045
$m\epsilon$	0.7313
$m\epsilon^f$	0.7313
ν^w	1
ν^p	1
π	1
π^*	1
π^{obj}	1
q	2.4577
q^f	2.4577
r^k	0.0351
r^{kf}	0.0351
w^*	1.1227
z	1
z^f	1
C	1.2049
C^f	1.2049
G	0.3615
G^f	0.3615
I	0.4418
I^f	0.4418
K	17.6712
K^f	17.6712
L	1.2891
L^s	1.2891
L^{sf}	1.2891
L^f	1.2891
P^j	1
Π^{ws^f}	0.4824
Π^{ps^f}	0.5396
Q	1
Q^f	1
R	1.0101
R^f	1.0101
T	0.3615
T^f	0.3615
U	-427.937
U^f	-427.937
W	1.1227
W^{disutil^f}	0.7485
W^i	1.1227
W^f	1.1227
Y	2.0081
Y^f	2.0081
Y^s	2.0081
Y^{sf}	2.0081

32 The solution of the 1st order perturbation

Matrix P

$$\begin{matrix}
 & \epsilon_{t-1}^G & \epsilon_{t-1}^b & \epsilon_{t-1}^L & \epsilon_{t-1}^I & \epsilon_{t-1}^a & \nu_{t-1}^w & \nu_{t-1}^p & \pi_{t-1} & \pi_{t-1}^{\text{obj}} & C_{t-1} & C_{t-1}^f & I_{t-1} \\
 \begin{matrix}
 \epsilon_t^G \\
 \epsilon_t^b \\
 \epsilon_t^L \\
 \epsilon_t^I \\
 \epsilon_t^a \\
 \nu_t^w \\
 \nu_t^p \\
 \pi_t \\
 \pi_t^{\text{obj}} \\
 C_t \\
 C_t^f \\
 I_t \\
 I_t^f \\
 K_t \\
 K_t^f \\
 R_t \\
 W_t \\
 Y_t \\
 Y_t^f
 \end{matrix} & \left(\begin{array}{cccccccccccc}
 0.949 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0.855 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0.889 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0.927 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0.823 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0.737 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0.908 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0.0024 & 0.0073 & 0.0041 & -0.0067 & -0.0394 & 0 & 0.0228 & 0.4946 & 0.1645 & 0.0019 & -0.0003 & 0.003 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.924 & 0 & 0 & 0 & 0 \\
 -0.0324 & 0.1846 & -0.0529 & 0.0399 & 0.2119 & 0 & -0.0342 & 0.144 & 0.4554 & 0.5364 & 0.0163 & -0.0377 & 0 \\
 -0.0775 & 0.0319 & -0.1757 & 0.0293 & 0.7993 & 0 & 0 & 0 & 0 & 0 & 0.4108 & 0 & 0 \\
 -0.0366 & -0.1263 & -0.0776 & -0.2809 & 0.2914 & 0 & -0.0118 & 0.1232 & 0.7412 & -0.023 & 0.0055 & 0.8715 & 0 \\
 -0.0763 & -0.288 & -0.1823 & -0.2646 & 0.7367 & 0 & 0 & 0 & 0 & 0 & -0.0965 & 0 & 0 \\
 -0.0009 & -0.0032 & -0.0019 & -0.007 & 0.0073 & 0 & -0.0003 & 0.0031 & 0.0185 & -0.0006 & 0.0001 & 0.0218 & 0 \\
 -0.0019 & -0.0072 & -0.0046 & -0.0066 & 0.0184 & 0 & 0 & 0 & 0 & 0 & -0.0024 & 0 & 0 \\
 0.008 & 0.0277 & 0.0205 & -0.0006 & -0.1412 & 0 & 0.0372 & 0.0274 & 0.0918 & 0.0649 & -0.0429 & 0.035 & 0 \\
 0.0058 & 0.0265 & 0.0177 & -0.0043 & 0.0069 & 0 & 0.0672 & 0.2413 & 0.1275 & 0.0108 & 0.0007 & 0.0083 & 0 \\
 0.1797 & 0.1096 & -0.0565 & -0.0481 & -0.0432 & 0 & 0.209 & 0.1993 & 0.5734 & 0.3967 & 0.0139 & 0.2124 & 0 \\
 0.1324 & -0.0545 & -0.1792 & -0.05 & 0.7899 & 0 & 0 & 0 & 0 & 0 & 0.2773 & 0 & 0
 \end{array} \right)
 \end{matrix}$$

Matrix Q

$$\begin{matrix}
 & \eta^b & \eta^L & \eta^I & \eta^w & \eta^a & \eta^p & \eta^G & \eta^R & \eta^\pi \\
 \begin{matrix}
 \epsilon^G \\
 \epsilon^b \\
 \epsilon^L \\
 \epsilon^I \\
 \epsilon^a \\
 \nu^w \\
 \nu^p \\
 \pi \\
 \pi^{\text{obj}} \\
 C \\
 C^f \\
 I \\
 I^f \\
 K \\
 K^f \\
 R \\
 W \\
 Y \\
 Y^f
 \end{matrix} & \left(\begin{array}{cccccccccc}
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 0.0085 & -0.0046 & -0.0072 & 0.0002 & -0.0478 & 0.0019 & 0.0025 & -0.4977 & 0.178 & 0 \\
 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
 0.2159 & 0.0595 & 0.043 & -0.0001 & 0.2575 & -0.0001 & -0.0341 & -2.3545 & 0.4928 & 0 \\
 0.0373 & 0.1977 & 0.0316 & 0 & 0.9712 & 0 & -0.0816 & 0 & 0 & 0 \\
 -0.1477 & 0.0873 & -0.303 & -0.0001 & 0.3541 & -0.0006 & -0.0386 & -3.5517 & 0.8022 & 0 \\
 -0.3369 & 0.2051 & -0.2854 & 0 & 0.8952 & 0 & -0.0804 & 0 & 0 & 0 \\
 -0.0037 & 0.0022 & -0.0076 & 0 & 0.0089 & 0 & -0.001 & -0.0888 & 0.0201 & 0 \\
 -0.0084 & 0.0051 & -0.0071 & 0 & 0.0224 & 0 & -0.002 & 0 & 0 & 0 \\
 0.0324 & -0.0231 & -0.0007 & 0.0002 & -0.1716 & 0.0002 & 0.0085 & 0.4614 & 0.0993 & 0 \\
 0.031 & -0.0199 & -0.0046 & 0.0042 & 0.0084 & -0.002 & 0.0061 & -0.6233 & 0.1379 & 0 \\
 0.1282 & 0.0635 & -0.0519 & 0.001 & -0.0525 & -0.0007 & 0.1894 & -2.8795 & 0.6206 & 0 \\
 -0.0637 & 0.2015 & -0.054 & 0 & 0.9598 & 0 & 0.1395 & 0 & 0 & 0
 \end{array} \right)
 \end{matrix}$$

Matrix R

	ϵ_{t-1}^G	ϵ_{t-1}^b	ϵ_{t-1}^L	ϵ_{t-1}^I	ϵ_{t-1}^a	ν_{t-1}^w	ν_{t-1}^p	π_{t-1}	π_{t-1}^{obj}	C_{t-1}	C_{t-1}^f
f_t^1	0.1646	0.206	0.0045	-0.2276	-0.7571	0	0.5698	0.1379	-0.6135	0.1277	-0.0153
f_t^2	0.1646	0.206	0.0045	-0.2276	-0.7571	0	0.5698	0.1379	-0.6135	0.1277	-0.0153
g_t^1	0.2158	0.364	0.1053	-0.4043	-0.7294	0	0.6712	0.5495	4.9089	0.1393	-0.0119
g_t^2	0.2158	0.364	0.1053	-0.4043	-0.7294	0	0.6712	0.5495	4.9089	0.1393	-0.0119
mc_t	0.0101	0.0229	0.0111	-0.0047	-0.8567	0	0.0851	0.183	0.1117	0.0207	0.001
mc_t^f	0	0	0	0	0	0	0	0	0	0	0
π_t^*	0.0236	0.0718	0.0402	-0.0656	-0.3884	0	0.2248	0.253	1.6235	0.0191	-0.0031
q_t	0.0648	0.0955	0.0581	0.0073	-0.1656	0	0.1344	-0.0042	-0.5062	0.0056	0.0014
q_t^f	0.0745	0.1365	0.0808	-0.016	-0.2258	0	0	0	0	0	0.0132
r_t^k	0.0199	0.0146	-0.0042	-0.0056	-0.1283	0	0.127	0.0469	0.075	0.0437	0.0016
r_t^{kf}	0.0136	-0.0056	-0.0184	-0.0051	0.0811	0	0	0	0	0	0.0285
w_t^*	0.0289	0.1212	0.0786	-0.0349	-0.0841	0	0.3193	0.1656	0.9456	0.0466	0.0018
z_t	0.1178	0.0862	-0.0248	-0.0333	-0.7591	0	0.7515	0.2776	0.444	0.2587	0.0092
z_t^f	0.0804	-0.0331	-0.1089	-0.0304	0.4799	0	0	0	0	0	0.1685
G_t	0.949	0	0	0	0	0	0	0	0	0	0
G_t^f	0.949	0	0	0	0	0	0	0	0	0	0
L_t	0.1319	0.0743	-0.0467	-0.0346	-0.8942	0	0.8113	0.0832	0.3915	0.2916	0.0101
L_t^s	0.1319	0.0743	-0.0467	-0.0346	-0.8942	0.737	0.8113	0.0832	0.3915	0.2916	0.0101
L_t^{sf}	0.0999	-0.0411	-0.1351	-0.0377	-0.5799	0	0	0	0	0	0.2091
L_t^f	0.0999	-0.0411	-0.1351	-0.0377	-0.5799	0	0	0	0	0	0.2091
P_t^j	0	0	0	0	0	0	0	0	0	0	0
Π_t^{wsf}	0.094	-0.0387	-0.1272	-0.0355	0.561	0	0	0	0	0	0.1969
Π_t^{psf}	0.1324	-0.0545	-0.1792	-0.05	0.7899	0	0	0	0	0	0.2773
Q_t	-0.0378	-0.1746	-0.1096	0.1337	0.5059	0	0.0261	0.4521	0.9367	-0.1103	0.0532
Q_t^f	-0.171	-0.6175	-0.476	0.0768	2.307	0	0	0	0	0	-0.5009
R_t^f	0.0733	0.1721	0.2023	0.0509	-1.0618	0	0	0	0	0	0.3294
T_t	0.949	0	0	0	0	0	0	0	0	0	0
T_t^f	0.949	0	0	0	0	0	0	0	0	0	0
U_t	-0.0147	-0.0561	-0.0122	-0.0026	0.0335	-0.0151	-0.0454	0.0017	0.0154	-0.004	0
U_t^f	-0.0149	-0.0568	-0.0126	-0.0019	0.0364	0	0	0	0	0	-0.0041
$W_t^{\text{disutil}^f}$	-0.0058	0.0024	0.0079	0.0022	1.141	0	0	0	0	0	-0.0122
W_t^i	-0.0058	0.0024	0.0079	0.0022	1.141	0	0	0	0	0	-0.0122
W_t^f	-0.0058	0.0024	0.0079	0.0022	1.141	0	0	0	0	0	-0.0122
Y_t^s	0.1797	0.1096	-0.0565	-0.0481	-0.0432	0	1.117	0.1993	0.5734	0.3967	0.0139
Y_t^f	0.1324	-0.0545	-0.1792	-0.05	0.7899	0	0	0	0	0	0.2773

Matrix S

	η^b	η^L	η^I	η^w	η^a	η^p	η^G	η^R	η^π
f^1	0.2409	-0.0051	-0.2456	-0.0239	-0.9199	-0.001	0.1734	3.2101	-0.6639
f^2	0.2409	-0.0051	-0.2456	-0.1379	-0.9199	-0.001	0.1734	3.2101	-0.6639
g^1	0.4258	-0.1185	-0.4361	0.0029	-0.8863	0.0163	0.2274	-14.0411	5.3127
g^2	0.4258	-0.1185	-0.4361	0.0029	-0.8863	-0.0042	0.2274	-14.0411	5.3127
mc	0.0268	-0.0125	-0.0051	0.0031	-1.0409	-0.0015	0.0106	-0.5488	0.1209
mc^f	0	0	0	0	0	0	0	0	0
π^*	0.084	-0.0452	-0.0708	0.0016	-0.472	0.0189	0.0249	-4.9118	1.757
q	0.1117	-0.0654	0.0079	0.0003	-0.2013	0.0004	0.0682	1.8211	-0.5478
q^f	0.1596	-0.0909	-0.0172	0	-0.2743	0	0.0785	0	0
r^k	0.017	0.0047	-0.0061	0.0005	-0.1559	-0.0003	0.021	-0.375	0.0812
r^{kf}	-0.0065	0.0207	-0.0055	0	0.0985	0	0.0143	0	0
w^*	0.1418	-0.0884	-0.0377	0.0165	-0.1022	-0.0023	0.0304	-3.7644	1.0233
z	0.1008	0.0279	-0.0359	0.0032	-0.9223	-0.0017	0.1241	-2.2189	0.4805
z^f	-0.0387	0.1224	-0.0328	0	0.5831	0	0.0848	0	0
G	0	0	0	0	0	0	1	0	0
G^f	0	0	0	0	0	0	1	0	0
L	0.0869	0.0525	-0.0373	-0.0004	-1.0865	0	0.1389	-1.9706	0.4237
L^s	0.0869	0.0525	-0.0373	-0.0004	-1.0865	0	0.1389	-1.9706	0.4237
L^{sf}	-0.048	0.152	-0.0407	0	-0.7047	0	0.1052	0	0
L^f	-0.048	0.152	-0.0407	0	-0.7047	0	0.1052	0	0
P^{jf}	0	0	0	0	0	0	0	0	0
Π^{wsf}	-0.0452	0.1431	-0.0383	0	0.6817	0	0.0991	0	0
Π^{psf}	-0.0637	0.2015	-0.054	0	0.9598	0	0.1395	0	0
Q	-0.2042	0.1233	0.1442	0.0002	0.6147	0	-0.0399	-5.6394	1.0138
Q^f	-0.7223	0.5354	0.0829	0	2.8032	0	-0.1802	0	0
R^f	0.2013	-0.2275	0.0549	0	-1.2901	0	0.0773	0	0
T	0	0	0	0	0	0	1	0	0
T^f	0	0	0	0	0	0	1	0	0
U	-0.0656	0.0137	-0.0028	0	0.0407	0	-0.0155	-0.0476	0.0167
U^f	-0.0664	0.0142	-0.0021	0	0.0442	0	-0.0157	0	0
$W^{disutilf}$	0.0028	-0.0089	0.0024	0	1.3863	0	-0.0061	0	0
W^{if}	0.0028	-0.0089	0.0024	0	1.3863	0	-0.0061	0	0
W^f	0.0028	-0.0089	0.0024	0	1.3863	0	-0.0061	0	0
Y^s	0.1282	0.0635	-0.0519	0.001	-0.0525	-0.0007	0.1894	-2.8795	0.6206
Y^{sf}	-0.0637	0.2015	-0.054	0	0.9598	0	0.1395	0	0

33 Model statistics

33.1 Basic statistics

	Steady-state value	Std. dev.	Variance	Loglin
q	2.4577	0.3662	0.1341	Y
π	1	0.1145	0.0131	Y
r^k	0.0351	0.152	0.0231	Y
z	1	0.8992	0.8086	Y
C	1.2049	0.7154	0.5118	Y
G	0.3615	0.4236	0.1794	Y
I	0.4418	1.8279	3.3412	Y
K	17.6712	0.2275	0.0518	Y
L	1.2891	0.9894	0.9788	Y
Q	1	0.9374	0.8786	Y
R	1.0101	0.2153	0.0464	Y
W	1.1227	0.3847	0.148	Y
T	0.3615	0.4236	0.1794	Y
Y	2.0081	0.9158	0.8387	Y

33.2 Correlation matrix

	π	q	r^k	z	C	G	I	K	L	Q	R	T	W	Y
π	1	0.067	0.676	0.676	0.021	0.015	0.173	0.099	0.466	-0.047	0.594	0.015	0.688	0.292
q		1	-0.205	-0.205	-0.842	0.077	-0.591	0.229	-0.226	-0.91	0.771	0.077	0.23	-0.71
r^k			1	1	0.329	0.05	0.461	-0.058	0.93	0.056	0.33	0.05	0.249	0.664
z				1	0.329	0.05	0.461	-0.058	0.93	0.056	0.33	0.05	0.249	0.664
C					1	-0.032	0.663	-0.325	0.3	0.797	-0.666	-0.032	-0.151	0.857
G						1	-0.013	0.014	0.052	-0.018	0.021	1	0.015	0.078
I							1	0.223	0.465	0.326	-0.23	-0.013	0.078	0.889
K								1	0.048	-0.493	0.426	0.014	0.297	-0.071
L									1	0.002	0.263	0.052	-0.058	0.631
Q										1	-0.822	-0.018	-0.192	0.532
R											1	0.021	0.51	-0.311
T												1	0.015	0.078
W													1	0.04
Y														1

33.3 Autocorrelations

	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
π	0.881	0.675	0.452	0.245	0.067
q	0.67	0.408	0.204	0.049	-0.064
r^k	0.741	0.516	0.326	0.167	0.037
z	0.741	0.516	0.326	0.167	0.037
C	0.871	0.637	0.384	0.155	-0.034
G	0.713	0.471	0.271	0.109	-0.017
I	0.945	0.818	0.65	0.463	0.276
K	0.98	0.921	0.829	0.71	0.573
L	0.705	0.457	0.253	0.092	-0.032
Q	0.672	0.395	0.179	0.019	-0.096
R	0.771	0.496	0.253	0.062	-0.079
T	0.713	0.471	0.271	0.109	-0.017
W	0.95	0.831	0.669	0.485	0.298
Y	0.905	0.726	0.519	0.314	0.129

33.4 Variance decomposition

	η^b	η^L	η^I	η^w	η^a	η^p	η^G	η^R	η^π
π	0.003	0.109	0	0	0.214	0	0	0.669	0.004
q	0.016	0.599	0	0	0.149	0	0.006	0.229	0.001
r^k	0.005	0.109	0	0	0.463	0	0.003	0.419	0.001
z	0.005	0.109	0	0	0.463	0	0.003	0.419	0.001
C	0.046	0.427	0	0	0.214	0	0.001	0.31	0.001
G	0	0	0	0	0	0	1	0	0
I	0.012	0.431	0.003	0	0.178	0	0.001	0.374	0.001
K	0.011	0.44	0.003	0	0.164	0	0.001	0.379	0.001
L	0.003	0.256	0	0	0.569	0	0.003	0.167	0
Q	0.01	0.371	0	0	0.254	0	0	0.363	0.001
R	0.011	0.398	0	0	0.491	0	0	0.099	0
T	0	0	0	0	0	0	1	0	0
W	0.011	0.401	0	0	0.012	0	0	0.573	0.002
Y	0.009	0.408	0	0	0.112	0	0.006	0.462	0.001

34 Impulse response functions

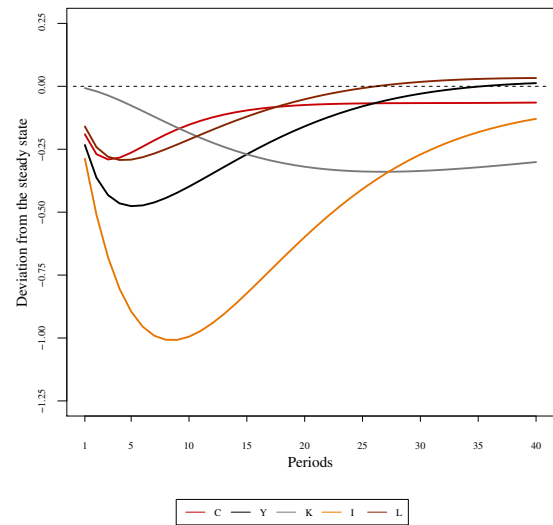
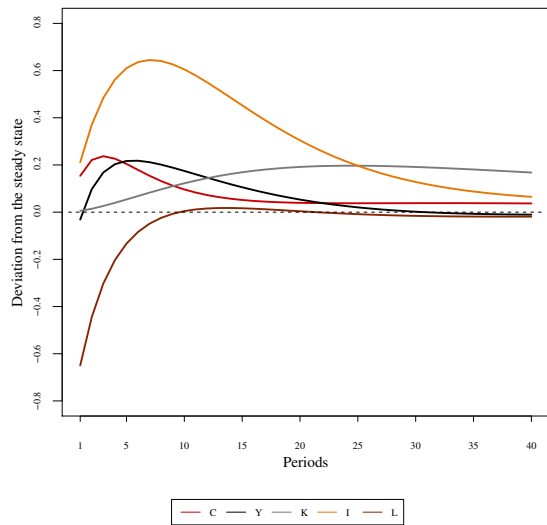


Figure 1: Impulse responses (C, Y, K, I, L) to η^a shock Figure 2: Impulse responses (C, Y, K, I, L) to η^R shock