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1 CONSUMER

1.1 Optimisation problem

$$\max_{C_t, K_t^{\mathrm{s}}, I_t, B_t, L_t^{\mathrm{s}}} U_t = \beta \mathrm{E}_t\left[U_{t+1}\right] + (1-\eta)^{-1}\left(C_t{}^{\mu}(1-L_t^{\mathrm{s}})^{1-\mu}\right)^{1-\eta} \tag{1.1}$$

s.t. :

$$C_t + I_t + B_t R_t{}^{-1} = Dw_t - T_t + B_{t-1}\pi_t{}^{-1} + K_{t-1}^{\mathrm{s}} r_t + L_t^{\mathrm{s}} W_t \quad (\lambda_t) \tag{1.2}$$

$$K_t^{\mathrm{s}} = I_t + K_{t-1}^{\mathrm{s}}(1-\delta) \quad (q_t) \tag{1.3}$$

1.2 Identities

$$Q_t = \lambda_t{}^{-1} q_t \tag{1.4}$$

1.3 First order conditions

$$-\lambda_t + \mu C_t{}^{-1+\mu}(1-L_t^{\mathrm{s}})^{1-\mu}\left(C_t{}^{\mu}(1-L_t^{\mathrm{s}})^{1-\mu}\right)^{-\eta} = 0 \quad (C_t) \tag{1.5}$$

$$-q_t + \beta\left((1-\delta)\,\mathrm{E}_t\left[q_{t+1}\right] + \mathrm{E}_t\left[\lambda_{t+1} r_{t+1}\right]\right) = 0 \quad (K_t^{\mathrm{s}}) \tag{1.6}$$

$$-\lambda_t + q_t = 0 \quad (I_t) \tag{1.7}$$

$$\beta \mathrm{E}_t\left[\lambda_{t+1}\pi_{t+1}{}^{-1}\right] - \lambda_t R_t{}^{-1} = 0 \quad (B_t) \tag{1.8}$$

$$\lambda_t W_t + (-1+\mu)\, C_t{}^{\mu}(1-L_t^{\mathrm{s}})^{-\mu}\left(C_t{}^{\mu}(1-L_t^{\mathrm{s}})^{1-\mu}\right)^{-\eta} = 0 \quad (L_t^{\mathrm{s}}) \tag{1.9}$$

2 FIRM

2.1 Optimisation problem

$$\max_{K_t^{\mathrm{d}}, L_t^{\mathrm{d}}} tc_t^{\mathrm{j}} = -r_t K_t^{\mathrm{d}} - L_t^{\mathrm{d}} W_t \tag{2.1}$$

s.t. :

$$Y_t^{\mathrm{j}} = Z_t K_t^{\mathrm{d}\alpha} L_t^{\mathrm{d}\,1-\alpha} \quad (mc_t) \tag{2.2}$$

2.2 First order conditions

$$-r_t + \alpha mc_t Z_t {K_t^{\mathrm{d}}}^{-1+\alpha} {L_t^{\mathrm{d}}}^{1-\alpha} = 0 \quad \left(K_t^{\mathrm{d}}\right) \tag{2.3}$$

$$-W_t + mc_t Z_t \left(1-\alpha\right) {K_t^{\mathrm{d}}}^{\alpha} {L_t^{\mathrm{d}}}^{-\alpha} = 0 \quad \left(L_t^{\mathrm{d}}\right) \tag{2.4}$$

3 PRICE SETTING PROBLEM

3.1 Identities

$$g_t^1 = \eta_t^{\mathrm{p}} + g_t^2 \left(1+\lambda^{\mathrm{p}}\right) \tag{3.1}$$

$$g_t^1 = \lambda_t \pi_t^{\star} Y_t + \beta \xi^{\mathrm{p}} \pi_t^{\star} \mathrm{E}_t \left[g_{t+1}^1 {\pi_{t+1}^{\star}}^{-1} \left({\pi_{t+1}}^{-1} {\pi_t}^{\gamma^{\mathrm{p}}} \right)^{-\lambda^{\mathrm{p}-1}} \right] \tag{3.2}$$

$$g_t^2 = \beta \xi^{\mathrm{p}} \mathrm{E}_t \left[g_{t+1}^2 \left({\pi_{t+1}}^{-1} {\pi_t}^{\gamma^{\mathrm{p}}} \right)^{-\lambda^{\mathrm{p}-1}\left(1+\lambda^{\mathrm{p}}\right)} \right] + \lambda_t mc_t Y_t \tag{3.3}$$

4 PRICE EVOLUTION

4.1 Identities

$$1 = \xi^{\mathrm{p}} \left({\pi_t}^{-1} {\pi_{t-1}}^{\gamma^{\mathrm{p}}} \right)^{-\lambda^{\mathrm{p}-1}} + \left(1-\xi^{\mathrm{p}}\right) {\pi_t^{\star}}^{-\lambda^{\mathrm{p}-1}} \tag{4.1}$$

5 PRODUCT AGGREGATION

5.1 Identities

$$Y_t^{\mathrm{s}} = Y_t^{\mathrm{j}} \tag{5.1}$$

$$\nu_t^{\mathrm{p}} = \left(1-\xi^{\mathrm{p}}\right) {\pi_t^{\star}}^{-\lambda^{\mathrm{p}-1}\left(1+\lambda^{\mathrm{p}}\right)} + \xi^{\mathrm{p}} \nu_{t-1}^{\mathrm{p}} \left({\pi_t}^{-1} {\pi_{t-1}}^{\gamma^{\mathrm{p}}} \right)^{-\lambda^{\mathrm{p}-1}\left(1+\lambda^{\mathrm{p}}\right)} \tag{5.2}$$

$$\nu_t^{\mathrm{p}} Y_t = Y_t^{\mathrm{s}} \tag{5.3}$$

6 EQUILIBRIUM

6.1 Identities

$$K_t^{\mathrm{d}} = K_{t-1}^{\mathrm{s}} \tag{6.1}$$

$$L_t^{\mathrm{d}} = L_t^{\mathrm{s}} \tag{6.2}$$

$$B_t = 0 \tag{6.3}$$

$$Div_t = Y_t - L_t^{\mathrm{d}} W_t - r_t K_t^{\mathrm{d}} \tag{6.4}$$

7 MONETARY POLICY AUTHORITY

7.1 Identities

$$addr^{\pi} + \log\left({R_{\mathrm{ss}}}^{-1} R_t\right) = \eta_t^{\mathrm{R}} + \rho \log\left({R_{\mathrm{ss}}}^{-1} R_{t-1}\right) + (1-\rho)\left(\log \pi_t^{\mathrm{obj}} + r^{\pi}\left(-\log \pi_t^{\mathrm{obj}} + \log\left({\pi_{\mathrm{ss}}}^{-1}\pi_{t-1}\right)\right) + r^{\mathrm{Y}} \log\left({Y_{\mathrm{ss}}}^{-1} Y_t\right)\right) \tag{7.1}$$

$$\log \pi_t^{\mathrm{obj}} = \eta_t^{\pi} + {\rho^{\pi}}^{\mathrm{bar}} \log \pi_{t-1}^{\mathrm{obj}} + \log addr^{\pi^{\mathrm{obj}}}\left(1 - {\rho^{\pi}}^{\mathrm{bar}}\right) \tag{7.2}$$

8 GOVERNMENT

8.1 Identities

$$G_t = {G}^{\mathrm{bar}} \epsilon_t^{\mathrm{G}} \tag{8.1}$$

$$G_t + B_{t-1}{\pi_t}^{-1} = T_t + B_t {R_t}^{-1} \tag{8.2}$$

9 GOVERNMENT SPENDING SHOCK

9.1 Identities

$$\log \epsilon_t^{\mathrm{G}} = \eta_t^{\mathrm{G}} + \rho^{\mathrm{G}} \log \epsilon_{t-1}^{\mathrm{G}} \tag{9.1}$$

10 TECHNOLOGY

10.1 Identities

$$Z_t = e^{\epsilon_t^{\mathrm{Z}} + \rho^{\mathrm{a}} \log Z_{t-1}} \tag{10.1}$$

11 Equilibrium relationships (after reduction)

$$-B_t = 0 \tag{11.1}$$

$$-\lambda_t + q_t = 0 \tag{11.2}$$

$$-\lambda_t + \mu {C_t}^{-1+\mu} (1 - L_t^{\mathrm{s}})^{1-\mu} \left({C_t}^{\mu} (1 - L_t^{\mathrm{s}})^{1-\mu} \right)^{-\eta} = 0 \tag{11.3}$$

$$-q_t + \beta \left((1-\delta) \, \mathrm{E}_t \left[q_{t+1} \right] + \mathrm{E}_t \left[\lambda_{t+1} r_{t+1} \right] \right) = 0 \tag{11.4}$$

$$-r_t + \alpha mc_t Z_t {K_{t-1}^{\mathrm{s}}}^{-1+\alpha} L_t^{\mathrm{s}\,1-\alpha} = 0 \tag{11.5}$$

$$-G_t + G^{\mathrm{bar}} \epsilon_t^{\mathrm{G}} = 0 \tag{11.6}$$

$$-Q_t + {\lambda_t}^{-1} q_t = 0 \tag{11.7}$$

$$-W_t + mc_t Z_t \left(1 - \alpha \right) {K_{t-1}^{\mathrm{s}}}^{\alpha} L_t^{\mathrm{s}\,-\alpha} = 0 \tag{11.8}$$

$$-Y_t^{\mathrm{j}} + Z_t {K_{t-1}^{\mathrm{s}}}^{\alpha} L_t^{\mathrm{s}\,1-\alpha} = 0 \tag{11.9}$$

$$Y_t^{\mathrm{j}} - Y_t^{\mathrm{s}} = 0 \tag{11.10}$$

$$Y_t^{\mathrm{s}} - \nu_t^{\mathrm{p}} Y_t = 0 \tag{11.11}$$

$$-Z_t + e^{\epsilon_t^{\mathrm{Z}} + \rho^{\mathrm{a}} \log Z_{t-1}} = 0 \tag{11.12}$$

$$\beta \mathrm{E}_t \left[\lambda_{t+1} {\pi_{t+1}}^{-1} \right] - \lambda_t {R_t}^{-1} = 0 \tag{11.13}$$

$$\lambda_t W_t + \left(-1 + \mu \right) {C_t}^{\mu} (1 - L_t^{\mathrm{s}})^{-\mu} \left({C_t}^{\mu} (1 - L_t^{\mathrm{s}})^{1-\mu} \right)^{-\eta} = 0 \tag{11.14}$$

$$-1 + \xi^{\mathrm{p}} \left({\pi_t}^{-1} {\pi_{t-1}}^{\gamma^{\mathrm{p}}} \right)^{-\lambda^{\mathrm{p}}-1} + \left(1 - \xi^{\mathrm{p}} \right) {\pi_t^{\star}}^{-\lambda^{\mathrm{p}}-1} = 0 \tag{11.15}$$

$$\eta_t^{\mathrm{p}} - g_t^1 + g_t^2 \left(1 + \lambda^{\mathrm{p}} \right) = 0 \tag{11.16}$$

$$\eta_t^{\mathrm{G}} - \log \epsilon_t^{\mathrm{G}} + \rho^{\mathrm{G}} \log \epsilon_{t-1}^{\mathrm{G}} = 0 \tag{11.17}$$

$$-g_t^1 + \lambda_t \pi_t^{\star} Y_t + \beta \xi^{\mathrm{p}} \pi_t^{\star} \mathrm{E}_t \left[g_{t+1}^1 {\pi_{t+1}^{\star}}^{-1} \left({\pi_{t+1}}^{-1} {\pi_t}^{\gamma^{\mathrm{p}}} \right)^{-\lambda^{\mathrm{p}}-1} \right] = 0 \tag{11.18}$$

$$-g_t^2 + \beta \xi^{\mathrm{p}} \mathrm{E}_t \left[g_{t+1}^2 \left({\pi_{t+1}}^{-1} {\pi_t}^{\gamma^{\mathrm{p}}} \right)^{-\lambda^{\mathrm{p}}-1(1+\lambda^{\mathrm{p}})} \right] + \lambda_t mc_t Y_t = 0 \tag{11.19}$$

$$-\nu_t^{\mathrm{p}} + \left(1 - \xi^{\mathrm{p}} \right) {\pi_t^{\star}}^{-\lambda^{\mathrm{p}}-1(1+\lambda^{\mathrm{p}})} + \xi^{\mathrm{p}} \nu_{t-1}^{\mathrm{p}} \left({\pi_t}^{-1} {\pi_{t-1}}^{\gamma^{\mathrm{p}}} \right)^{-\lambda^{\mathrm{p}}-1(1+\lambda^{\mathrm{p}})} = 0 \tag{11.20}$$

$$I_t - K_t^{\mathrm{s}} + K_{t-1}^{\mathrm{s}} \left(1 - \delta \right) = 0 \tag{11.21}$$

$$U_t - \beta \mathrm{E}_t \left[U_{t+1} \right] - \left(1 - \eta \right)^{-1} \left({C_t}^{\mu} (1 - L_t^{\mathrm{s}})^{1-\mu} \right)^{1-\eta} = 0 \tag{11.22}$$

$$\eta_t^{\pi} - \log \pi_t^{\mathrm{obj}} + \rho^{\pi^{\mathrm{bar}}} \log \pi_{t-1}^{\mathrm{obj}} + \log \mathit{add}r^{\pi^{\mathrm{obj}}} \left(1 - \rho^{\pi^{\mathrm{bar}}}\right) = 0 \tag{11.23}$$

$$-\mathit{Div}_t + Y_t - K_{t-1}^{\mathrm{s}} r_t - L_t^{\mathrm{s}} W_t = 0 \tag{11.24}$$

$$-G_t + T_t - B_{t-1} {\pi_t}^{-1} + B_t {R_t}^{-1} = 0 \tag{11.25}$$

$$-\mathit{add}r^{\pi} + \eta_t^{\mathrm{R}} - \log\left({R_{\mathrm{ss}}}^{-1} R_t\right) + \rho \log\left({R_{\mathrm{ss}}}^{-1} R_{t-1}\right) + (1-\rho)\left(\log \pi_t^{\mathrm{obj}} + r^{\pi}\left(-\log \pi_t^{\mathrm{obj}} + \log\left({\pi_{\mathrm{ss}}}^{-1}\pi_{t-1}\right)\right) + r^{\mathrm{Y}} \log\left({Y_{\mathrm{ss}}}^{-1} Y_t\right)\right) = 0 \tag{11.26}$$

$$-C_t + \mathit{Div}_t - I_t - T_t + B_{t-1} {\pi_t}^{-1} + K_{t-1}^{\mathrm{s}} r_t - B_t {R_t}^{-1} + L_t^{\mathrm{s}} W_t = 0 \tag{11.27}$$

12 Steady state relationships (after reduction)

$$-B_{\mathrm{ss}} = 0 \tag{12.1}$$

$$-\lambda_{\mathrm{ss}} + q_{\mathrm{ss}} = 0 \tag{12.2}$$

$$-\lambda_{\mathrm{ss}} + \mu {C_{\mathrm{ss}}}^{-1+\mu} (1 - L_{\mathrm{ss}}^{\mathrm{s}})^{1-\mu} \left({C_{\mathrm{ss}}}^{\mu} (1 - L_{\mathrm{ss}}^{\mathrm{s}})^{1-\mu}\right)^{-\eta} = 0 \tag{12.3}$$

$$-q_{\mathrm{ss}} + \beta\left(\lambda_{\mathrm{ss}} r_{\mathrm{ss}} + q_{\mathrm{ss}}\left(1-\delta\right)\right) = 0 \tag{12.4}$$

$$-r_{\mathrm{ss}} + \alpha \mathit{mc}_{\mathrm{ss}} Z_{\mathrm{ss}} {K_{\mathrm{ss}}^{\mathrm{s}}}^{-1+\alpha} {L_{\mathrm{ss}}^{\mathrm{s}}}^{1-\alpha} = 0 \tag{12.5}$$

$$-G_{\mathrm{ss}} + G^{\mathrm{bar}} \epsilon_{\mathrm{ss}}^{\mathrm{G}} = 0 \tag{12.6}$$

$$-Q_{\mathrm{ss}} + {\lambda_{\mathrm{ss}}}^{-1} q_{\mathrm{ss}} = 0 \tag{12.7}$$

$$-W_{\mathrm{ss}} + \mathit{mc}_{\mathrm{ss}} Z_{\mathrm{ss}} \left(1-\alpha\right) {K_{\mathrm{ss}}^{\mathrm{s}}}^{\alpha} {L_{\mathrm{ss}}^{\mathrm{s}}}^{-\alpha} = 0 \tag{12.8}$$

$$-Y_{\mathrm{ss}}^{\mathrm{j}} + Z_{\mathrm{ss}} {K_{\mathrm{ss}}^{\mathrm{s}}}^{\alpha} {L_{\mathrm{ss}}^{\mathrm{s}}}^{1-\alpha} = 0 \tag{12.9}$$

$$Y_{\mathrm{ss}}^{\mathrm{j}} - Y_{\mathrm{ss}}^{\mathrm{s}} = 0 \tag{12.10}$$

$$Y_{\mathrm{ss}}^{\mathrm{s}} - \nu_{\mathrm{ss}}^{\mathrm{p}} Y_{\mathrm{ss}} = 0 \tag{12.11}$$

$$-Z_{\mathrm{ss}} + e^{\rho^{\mathrm{a}} \log Z_{\mathrm{ss}}} = 0 \tag{12.12}$$

$$-\lambda_{\mathrm{ss}} {R_{\mathrm{ss}}}^{-1} + \beta \lambda_{\mathrm{ss}} {\pi_{\mathrm{ss}}}^{-1} = 0 \tag{12.13}$$

$$\lambda_{\mathrm{ss}} W_{\mathrm{ss}} + \left(-1+\mu\right) {C_{\mathrm{ss}}}^{\mu} (1 - L_{\mathrm{ss}}^{\mathrm{s}})^{-\mu} \left({C_{\mathrm{ss}}}^{\mu} (1 - L_{\mathrm{ss}}^{\mathrm{s}})^{1-\mu}\right)^{-\eta} = 0 \tag{12.14}$$

$$-1 + \xi^{\mathrm{p}} \left({\pi_{\mathrm{ss}}}^{-1} {\pi_{\mathrm{ss}}}^{\gamma^{\mathrm{p}}}\right)^{-\lambda^{\mathrm{p}-1}} + \left(1-\xi^{\mathrm{p}}\right) {\pi_{\mathrm{ss}}^{\star}}^{-\lambda^{\mathrm{p}-1}} = 0 \tag{12.15}$$

$$-g_{\mathrm{ss}}^{1} + g_{\mathrm{ss}}^{2} \left(1 + \lambda^{\mathrm{p}}\right) = 0 \tag{12.16}$$

$$-\log \epsilon_{\mathrm{ss}}^{\mathrm{G}} + \rho^{\mathrm{G}} \log \epsilon_{\mathrm{ss}}^{\mathrm{G}} = 0 \tag{12.17}$$

$$-g_{\mathrm{ss}}^{1} + \lambda_{\mathrm{ss}} \pi_{\mathrm{ss}}^{\star} Y_{\mathrm{ss}} + \beta \xi^{\mathrm{p}} g_{\mathrm{ss}}^{1} \left({\pi_{\mathrm{ss}}}^{-1} {\pi_{\mathrm{ss}}}^{\gamma^{\mathrm{p}}}\right)^{-\lambda^{\mathrm{p}-1}} = 0 \tag{12.18}$$

$$-g_{\mathrm{ss}}^{2}+\lambda_{\mathrm{ss}} mc_{\mathrm{ss}} Y_{\mathrm{ss}}+\beta\xi^{\mathrm{p}} g_{\mathrm{ss}}^{2}\left(\pi_{\mathrm{ss}}{}^{-1}\pi_{\mathrm{ss}}{}^{\gamma^{\mathrm{p}}}\right)^{-\lambda^{\mathrm{p}-1}(1+\lambda^{\mathrm{p}})}=0 \tag{12.19}$$

$$-\nu_{\mathrm{ss}}^{\mathrm{p}}+\left(1-\xi^{\mathrm{p}}\right)\pi_{\mathrm{ss}}^{\star}{}^{-\lambda^{\mathrm{p}-1}(1+\lambda^{\mathrm{p}})}+\xi^{\mathrm{p}}\nu_{\mathrm{ss}}^{\mathrm{p}}\left(\pi_{\mathrm{ss}}{}^{-1}\pi_{\mathrm{ss}}{}^{\gamma^{\mathrm{p}}}\right)^{-\lambda^{\mathrm{p}-1}(1+\lambda^{\mathrm{p}})}=0 \tag{12.20}$$

$$I_{\mathrm{ss}}-K_{\mathrm{ss}}^{\mathrm{s}}+K_{\mathrm{ss}}^{\mathrm{s}}\left(1-\delta\right)=0 \tag{12.21}$$

$$U_{\mathrm{ss}}-\beta U_{\mathrm{ss}}-\left(1-\eta\right)^{-1}\left(C_{\mathrm{ss}}{}^{\mu}(1-L_{\mathrm{ss}}^{\mathrm{s}})^{1-\mu}\right)^{1-\eta}=0 \tag{12.22}$$

$$-\log\pi_{\mathrm{ss}}^{\mathrm{obj}}+\rho^{\pi^{\mathrm{bar}}}\log\pi_{\mathrm{ss}}^{\mathrm{obj}}+\log addr^{\pi^{\mathrm{obj}}}\left(1-\rho^{\pi^{\mathrm{bar}}}\right)=0 \tag{12.23}$$

$$-Div_{\mathrm{ss}}+Y_{\mathrm{ss}}-r_{\mathrm{ss}}K_{\mathrm{ss}}^{\mathrm{s}}-L_{\mathrm{ss}}^{\mathrm{s}}W_{\mathrm{ss}}=0 \tag{12.24}$$

$$-G_{\mathrm{ss}}+T_{\mathrm{ss}}-\pi_{\mathrm{ss}}{}^{-1}B_{\mathrm{ss}}+B_{\mathrm{ss}}R_{\mathrm{ss}}{}^{-1}=0 \tag{12.25}$$

$$-addr^{\pi}+\left(1-\rho\right)\left(\log\pi_{\mathrm{ss}}^{\mathrm{obj}}-r^{\pi}\log\pi_{\mathrm{ss}}^{\mathrm{obj}}\right)=0 \tag{12.26}$$

$$-C_{\mathrm{ss}}+Div_{\mathrm{ss}}-I_{\mathrm{ss}}-T_{\mathrm{ss}}+\pi_{\mathrm{ss}}{}^{-1}B_{\mathrm{ss}}+r_{\mathrm{ss}}K_{\mathrm{ss}}^{\mathrm{s}}-B_{\mathrm{ss}}R_{\mathrm{ss}}{}^{-1}+L_{\mathrm{ss}}^{\mathrm{s}}W_{\mathrm{ss}}=0 \tag{12.27}$$

13 Calibrating equations

$$-1+\pi_{\mathrm{ss}}^{\mathrm{obj}}=0 \tag{13.1}$$

$$-0.18+G_{\mathrm{ss}}Y_{\mathrm{ss}}{}^{-1}=0 \tag{13.2}$$

$$\pi_{\mathrm{ss}}-\pi_{\mathrm{ss}}^{\mathrm{obj}}=0 \tag{13.3}$$

14 Parameter settings

$$\alpha=0.3 \tag{14.1}$$

$$\beta=0.99 \tag{14.2}$$

$$\delta=0.025 \tag{14.3}$$

$$\eta=2 \tag{14.4}$$

$$\gamma^{\mathrm{p}}=0.469 \tag{14.5}$$

$$\lambda^{\mathrm{p}}=0.5 \tag{14.6}$$

$$\mu=0.3 \tag{14.7}$$

$$r^{\pi}=1.684 \tag{14.8}$$

$$r^{\mathrm{Y}}=0.099 \tag{14.9}$$

$$\rho = 0.961 \tag{14.10}$$

$$\rho^{\pi^{\text{bar}}} = 0.9999 \tag{14.11}$$

$$\rho^{\text{G}} = 0.949 \tag{14.12}$$

$$\rho^{\text{a}} = 0.823 \tag{14.13}$$

$$\xi^{\text{p}} = 0.908 \tag{14.14}$$

15 Steady-state values

	Steady-state value
ϵ^{G}	1
g^1	7.3514
g^2	4.9009
λ	1.5467
mc	0.6667
ν^{p}	1
π	1
$\pi^\star$	1
π^{obj}	1
q	1.5467
r	0.0351
B	0
C	0.3255
Dw	0.1601
G	0.0865
I	0.0684
K^{s}	2.7374
L^{s}	0.2279
Q	1
R	1.0101
T	0.0865
U	-167.8256
W	0.9837
Y	0.4804
Y^{j}	0.4804
Y^{s}	0.4804
Z	1

16 The solution of the 1st order perturbation

Matrix P

	$\epsilon^{\mathrm{G}}_{t-1}$	ν^{p}_{t-1}	π_{t-1}	π^{obj}_{t-1}	B_{t-1}	K^{s}_{t-1}	R_{t-1}	Z_{t-1}
ϵ^{G}_t	0.949	0	0	0	0	0	0	0
ν^{p}_t	0	0.908	0	0	0	0	0	0
π_t	−0.0001	0.0549	0.3347	1.6743	0	−0.0399	−1.1151	−0.0644
π^{obj}_t	0	0	0	0.9999	0	0	0	0
B_t	0	0	0	0	0	0	0	0
K^{s}_t	0.0052	0.5527	−1.2493	15.5759	0	0.4384	−15.1013	−0.4031
R_t	0.0006	0.0147	0.0313	0.4011	0	−0.0135	0.5465	−0.011
Z_t	0	0	0	0	0	0	0	0.823

Matrix Q

	ϵ^{Z}	η^{p}	η^{R}	η^{π}	η^{G}
ϵ^{G}	0	0	0	0	1
ν^{p}	0	0	0	0	0
π	−0.0783	0.0121	−1.1604	1.6744	−0.0001
π^{obj}	0	0	0	1	0
B	0	0	0	0	0
K^{s}	−0.4898	−0.0064	−15.7141	15.5774	0.0055
R	−0.0133	−0.0002	0.5687	0.4011	0.0007
Z	1	0	0	0	0

Matrix R

	$\epsilon^{\mathrm{G}}_{t-1}$	ν^{p}_{t-1}	π_{t-1}	π^{obj}_{t-1}	B_{t-1}	K^{s}_{t-1}	R_{t-1}	Z_{t-1}
g^1_t	0.1474	0.9164	−1.9772	30.4192	0	−0.8826	−15.6826	−0.8627
g^2_t	0.1474	0.9164	−1.9772	30.4192	0	−0.8826	−15.6826	−0.8627
λ_t	0.1179	0.1359	0.8044	−9.5956	0	−0.2745	9.2056	−0.0385
mc_t	0.0862	4.9707	−10.2156	126.743	0	−4.181	−122.7414	−4.7402
$\pi^\star_t$	−0.0012	0.5419	−1.3251	16.5244	0	−0.3941	−11.0059	−0.636
q_t	0.1179	0.1359	0.8044	−9.5956	0	−0.2745	9.2056	−0.0385
r_t	0.2504	9.6818	−19.1237	237.5383	0	−8.6795	−230.1009	−7.5809
C_t	−0.0534	0.9651	−2.6415	32.5385	0	−0.6513	−31.4584	−0.8022
Dw_t	−0.0082	−7.9544	11.5232	−142.6906	0	4.8635	138.1234	6.6399
G_t	0.949	0	0	0	0	0	0	0
I_t	0.2078	22.1074	−49.9721	623.034	0	−21.4622	−604.0515	−16.1258
L^{s}_t	0.2346	6.7301	−12.7258	158.2791	0	−5.4264	−153.3707	−5.2337
Q_t	0	0	0	0	0	0	0	0
T_t	0.949	0	0	0	11.5637	0	0	0
U_t	−0.0107	−0.0272	−0.0234	0.2831	0	0.0226	−0.1954	0.0162
W_t	0.0158	2.9517	−6.3979	79.2593	0	−2.2531	−76.7302	−2.3471
Y_t	0.1642	3.803	−8.9081	110.7953	0	−3.4985	−107.3595	−2.8406
Y^{j}_t	0.1642	4.711	−8.9081	110.7953	0	−3.4985	−107.3595	−2.8406
Y^{s}_t	0.1642	4.711	−8.9081	110.7953	0	−3.4985	−107.3595	−2.8406

Matrix S

	ϵ^{Z}	η^{p}	η^{R}	η^{π}	η^{G}
g^1	−1.0482	0.1094	−16.319	30.4222	0.1553
g^2	−1.0482	−0.0266	−16.319	30.4222	0.1553
λ	−0.0468	0.0052	9.5791	−9.5965	0.1243
mc	−5.7597	−0.0537	−127.7226	126.7557	0.0908
$\pi^\star$	−0.7728	0.1192	−11.4526	16.5261	−0.0012
q	−0.0468	0.0052	9.5791	−9.5965	0.1243
r	−9.2112	−0.0999	−239.439	237.5621	0.2638
C	−0.9748	−0.0144	−32.735	32.5418	−0.0563
Dw	8.0679	0.0612	143.7288	−142.7049	−0.0086
G	0	0	0	0	1
I	−19.5939	−0.2554	−628.5656	623.0963	0.2189
L^{s}	−6.3593	−0.066	−159.5949	158.2949	0.2472
Q	0	0	0	0	0
T	0	0	0	0	1
U	0.0197	−0.0003	−0.2033	0.2831	−0.0113
W	−2.8519	−0.0339	−79.8442	79.2672	0.0167
Y	−3.4515	−0.0462	−111.7164	110.8064	0.173
Y^{j}	−3.4515	−0.0462	−111.7164	110.8064	0.173
Y^{s}	−3.4515	−0.0462	−111.7164	110.8064	0.173

17 Model statistics

17.1 Basic statistics

	Steady-state value	Std. dev.	Variance	Loglin
ϵ^{G}	1	1.3033	1.6986	Y
g^1	7.3514	33.2677	1106.7424	Y
g^2	4.9009	33.2676	1106.7321	Y
λ	1.5467	16.9701	287.9841	Y
mc	0.6667	174.7416	30534.6343	Y
ν^{p}	1	0	0	Y
π	1	2.0482	4.1953	Y
$\pi^\star$	1	18.6163	346.566	Y
π^{obj}	1	1.2917	1.6684	Y
q	1.5467	16.9701	287.9841	Y
r	0.0351	336.2645	113073.7905	Y
B	0	0	0	N
C	0.3255	42.2113	1781.7967	Y
Dw	0.1601	198.2805	39315.1724	Y
G	0.0865	1.3033	1.6986	Y
I	0.0684	868.202	753774.7611	Y
K^{s}	2.7374	27.5515	759.0867	Y
L^{s}	0.2279	220.2727	48520.0799	Y
Q	1	0	0	Y
R	1.0101	0.8977	0.8059	Y
T	0.0865	1.3033	1.6986	Y
U	-167.8256	0.8178	0.6688	Y
W	0.9837	106.1997	11278.3793	Y
Y	0.4804	151.3198	22897.6721	Y
Y^{j}	0.4804	151.3198	22897.6721	Y
Y^{s}	0.4804	151.3198	22897.6721	Y
Z	1	1.227	1.5056	Y

17.2 Correlation matrix

	ϵ^{G}	g^1	g^2	λ	mc	π	$\pi^\star$	π^{obj}	q	r	C	Diw	G	I
ϵ^{G}	1	0.006	0.006	0.01	0	-0.001	-0.001	0	0.01	0	-0.002	0	1	0
g^1		1	1	-0.463	0.92	0.844	0.983	0.545	-0.463	0.914	0.905	-0.919	0.006	0.918
g^2			1	-0.463	0.92	0.844	0.983	0.545	-0.463	0.914	0.905	-0.919	0.006	0.918
λ				1	-0.443	-0.799	-0.579	-0.701	1	-0.384	-0.659	0.425	0.01	-0.419
mc					1	0.758	0.953	0.25	-0.443	0.998	0.966	-1	0	1
π						1	0.884	0.752	-0.799	0.723	0.866	-0.748	-0.001	0.744
$\pi^\star$							1	0.528	-0.579	0.94	0.966	-0.949	-0.001	0.948
π^{obj}								1	-0.701	0.207	0.411	-0.237	0	0.232
q									1	-0.384	-0.659	0.425	0.01	-0.419
r										1	0.948	-0.999	0	0.999
C											1	-0.961	-0.002	0.959
Diw												1	0	-1
G													1	0
I														1
K^{s}														
L^{s}														
R														
T														
U														
W														
Y														
Y^{j}														
Y^{s}														
Z														

17.3 Cross correlations with the reference variable (π)

	$\sigma[\cdot]$ rel. to $\sigma[\pi]$	π_{t-5}	π_{t-4}	π_{t-3}	π_{t-2}	π_{t-1}	π_t	π_{t+1}	π_{t+2}	π_{t+3}	π_{t+4}	π_{t+5}
ϵ_t^{G}	0.636	0	0	-0.001	-0.001	-0.001	-0.001	0	0	0	0	0
g_t^1	16.242	-0.018	0.017	0.073	0.173	0.376	0.844	-0.13	-0.085	-0.074	-0.073	-0.073
g_t^2	16.242	-0.018	0.017	0.073	0.173	0.376	0.844	-0.13	-0.085	-0.074	-0.073	-0.073
λ_t	8.285	0.155	0.14	0.102	0.008	-0.221	-0.799	-0.568	-0.392	-0.251	-0.139	-0.05
mc_t	85.313	-0.007	0.009	0.041	0.115	0.294	0.758	-0.254	-0.193	-0.156	-0.128	-0.105
π_t	1	-0.084	-0.047	0.017	0.139	0.396	1	0.396	0.139	0.017	-0.047	-0.084
$\pi_t^\star$	9.089	-0.038	-0.008	0.043	0.142	0.36	0.884	-0.079	-0.051	-0.052	-0.06	-0.068
π_t^{obj}	0.631	-0.114	-0.067	0.005	0.121	0.329	0.752	0.566	0.406	0.269	0.155	0.063
q_t	8.285	0.155	0.14	0.102	0.008	-0.221	-0.799	-0.568	-0.392	-0.251	-0.139	-0.05
r_t	164.172	0.004	0.019	0.05	0.118	0.287	0.723	-0.303	-0.227	-0.179	-0.142	-0.112
C_t	20.609	-0.05	-0.033	0.005	0.094	0.31	0.866	-0.05	-0.05	-0.059	-0.068	-0.074
Diw_t	96.805	0.004	-0.012	-0.044	-0.116	-0.292	-0.748	0.27	0.204	0.163	0.132	0.107
G_t	0.636	0	0	-0.001	-0.001	-0.001	-0.001	0	0	0	0	0
I_t	423.876	-0.003	0.013	0.045	0.116	0.291	0.744	-0.275	-0.208	-0.166	-0.134	-0.108
K_t^{s}	13.451	-0.154	-0.14	-0.101	-0.007	0.222	0.802	0.566	0.388	0.248	0.136	0.048
L_t^{s}	107.542	-0.003	0.013	0.044	0.116	0.292	0.745	-0.273	-0.206	-0.164	-0.133	-0.107
R_t	0.438	0.005	0.054	0.111	0.169	0.206	0.158	0.185	0.161	0.122	0.082	0.045
T_t	0.636	0	0	-0.001	-0.001	-0.001	-0.001	0	0	0	0	0
U_t	0.399	-0.169	-0.156	-0.123	-0.046	0.132	0.565	0.758	0.537	0.362	0.221	0.108
W_t	51.849	-0.022	-0.005	0.029	0.108	0.302	0.8	-0.187	-0.146	-0.124	-0.109	-0.095
Y_t	73.878	-0.012	0.004	0.038	0.113	0.297	0.771	-0.234	-0.179	-0.146	-0.122	-0.102
Y_t^{j}	73.878	-0.012	0.004	0.038	0.113	0.297	0.771	-0.234	-0.179	-0.146	-0.122	-0.102
Y_t^{s}	73.878	-0.012	0.004	0.038	0.113	0.297	0.771	-0.234	-0.179	-0.146	-0.122	-0.102
Z_t	0.599	0.005	0.002	-0.004	-0.012	-0.024	-0.043	-0.028	-0.016	-0.008	-0.001	0.003

17.4 Autocorrelations

	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
ϵ^{G}	0.713	0.471	0.271	0.109	-0.017
g^1	-0.035	-0.013	-0.016	-0.025	-0.034
g^2	-0.035	-0.013	-0.016	-0.025	-0.034
λ	0.686	0.443	0.25	0.097	-0.022
mc	-0.114	-0.079	-0.063	-0.053	-0.046
π	0.396	0.139	0.017	-0.047	-0.084
$\pi^\star$	-0.06	-0.029	-0.026	-0.031	-0.037
π^{obj}	0.721	0.484	0.286	0.125	-0.002
q	0.686	0.443	0.25	0.097	-0.022
r	-0.117	-0.081	-0.064	-0.054	-0.046
C	-0.026	-0.021	-0.028	-0.037	-0.044
Dw	-0.116	-0.08	-0.063	-0.054	-0.046
G	0.713	0.471	0.271	0.109	-0.017
I	-0.116	-0.08	-0.064	-0.054	-0.046
K^{s}	0.682	0.438	0.246	0.095	-0.023
L^{s}	-0.116	-0.08	-0.063	-0.054	-0.046
R	0.71	0.475	0.283	0.127	0.004
T	0.713	0.471	0.271	0.109	-0.017
U	0.835	0.544	0.312	0.128	-0.015
W	-0.098	-0.068	-0.056	-0.05	-0.046
Y	-0.111	-0.076	-0.061	-0.053	-0.046
Y^{j}	-0.111	-0.076	-0.061	-0.053	-0.046
Y^{s}	-0.111	-0.076	-0.061	-0.053	-0.046
Z	0.644	0.368	0.159	0.006	-0.102

17.5 Variance decomposition

	ϵ^{Z}	η^{p}	η^{R}	η^{π}	η^{G}
ϵ^{G}	0	0	0	0	1
g^1	0.001	0	0.347	0.652	0
g^2	0.001	0	0.347	0.652	0
λ	0	0	0.492	0.508	0
mc	0.001	0	0.506	0.493	0
π	0.002	0	0.323	0.675	0
$\pi^\star$	0.002	0	0.373	0.625	0
π^{obj}	0	0	0	1	0
q	0	0	0.492	0.508	0
r	0.001	0	0.506	0.493	0
C	0.001	0	0.504	0.495	0
Dw	0.001	0	0.506	0.493	0
G	0	0	0	0	1
I	0.001	0	0.506	0.493	0
K^{s}	0.001	0	0.496	0.503	0
L^{s}	0.001	0	0.506	0.493	0
R	0	0	0.573	0.426	0
T	0	0	0	0	1
U	0.001	0	0.415	0.584	0
W	0.001	0	0.506	0.494	0
Y	0.001	0	0.506	0.493	0
Y^{j}	0.001	0	0.506	0.493	0
Y^{s}	0.001	0	0.506	0.493	0
Z	1	0	0	0	0

18 Impulse response functions

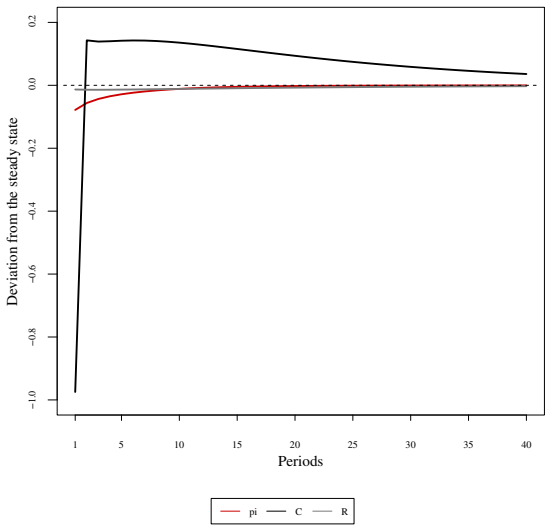

Figure 1: Impulse responses (π, C, R) to ϵ^{Z} shock

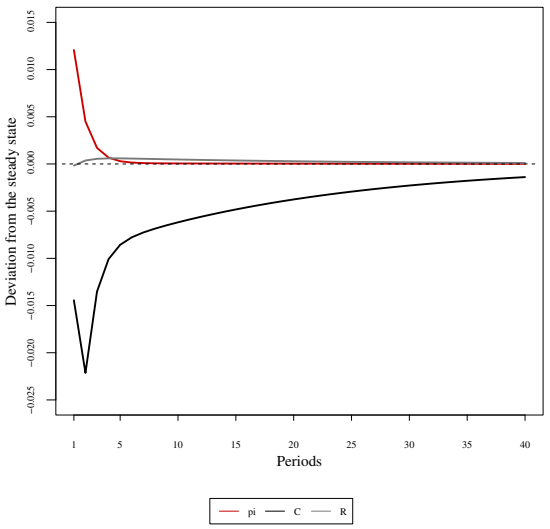

Figure 2: Impulse responses (π, C, R) to η^{p} shock

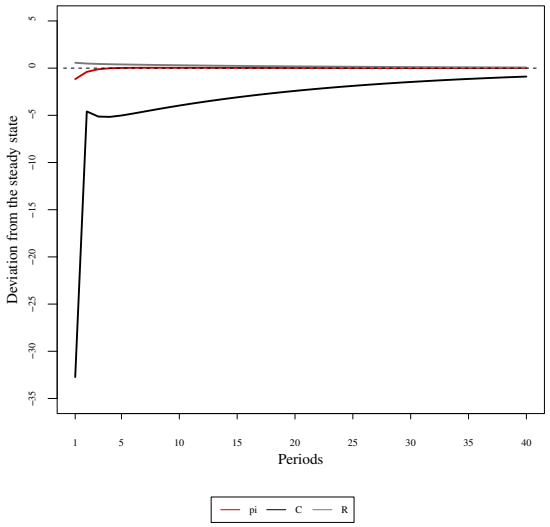

Figure 3: Impulse responses (π, C, R) to η^{R} shock

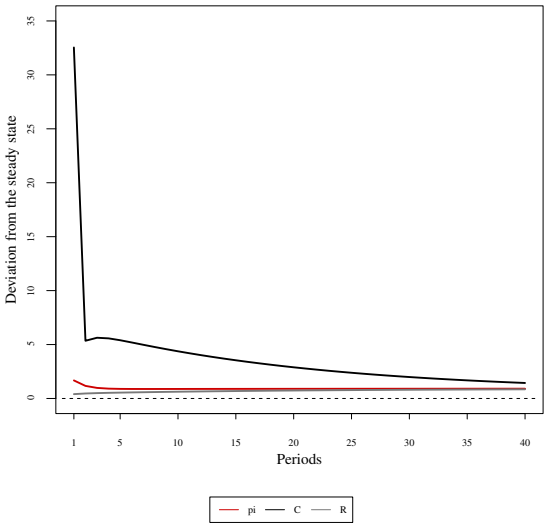

Figure 4: Impulse responses (π, C, R) to η^{π} shock

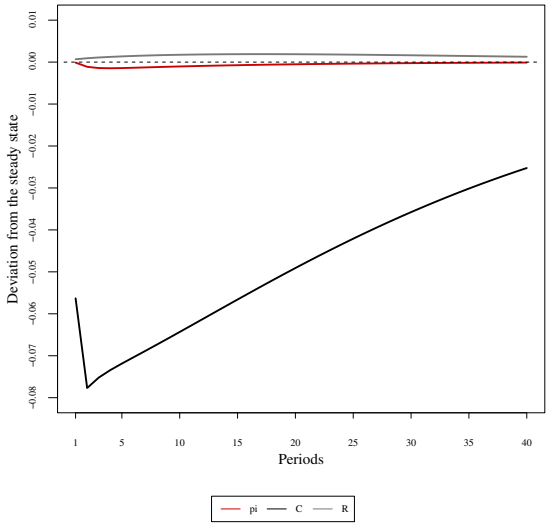

Figure 5: Impulse responses (π, C, R) to η^{G} shock