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1 CONSUMER

1.1 Optimisation problem

$$\max_{C_t, N_t, a_t, L_t} U_t = \beta \mathrm{E}_t \left[U_{t+1} \right] + \gamma^{-1} \left({L_t}^{1-\mu} {C_t}^{\mu} \right)^{\gamma} \tag{1.1}$$

s.t. :

$$C_t = \pi_t + N_t W_t \quad (\lambda_t^{\mathrm{c}}) \tag{1.2}$$

$$L_t = 1 - \alpha N_t - \eta a_{t-1} (1 - \alpha) \quad \left(\lambda_t^{\mathrm{CONSUMER}^2} \right) \tag{1.3}$$

$$a_t = N_t + a_{t-1} (1 - \eta) \quad \left(\lambda_t^{\mathrm{CONSUMER}^3} \right) \tag{1.4}$$

1.2 First order conditions

$$\beta - \lambda_t^{\mathrm{U}} = 0 \quad (U_t) \tag{1.5}$$

$$-\lambda_t^{\mathrm{c}} + \mu {C_t}^{-1+\mu} {L_t}^{1-\mu} \left({L_t}^{1-\mu} {C_t}^{\mu} \right)^{-1+\gamma} = 0 \quad (C_t) \tag{1.6}$$

$$\lambda_t^{\mathrm{CONSUMER}^3} + \lambda_t^{\mathrm{c}} W_t - \alpha \lambda_t^{\mathrm{CONSUMER}^2} = 0 \quad (N_t) \tag{1.7}$$

$$-\lambda_t^{\mathrm{CONSUMER}^3} + \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{U}} \left(\lambda_{t+1}^{\mathrm{CONSUMER}^3} (1 - \eta) - \eta \lambda_{t+1}^{\mathrm{CONSUMER}^2} (1 - \alpha) \right) \right] = 0 \quad (a_t) \tag{1.8}$$

$$-\lambda_t^{\mathrm{CONSUMER}^2} + (1 - \mu) {L_t}^{-\mu} \left({L_t}^{1-\mu} {C_t}^{\mu} \right)^{-1+\gamma} {C_t}^{\mu} = 0 \quad (L_t) \tag{1.9}$$

2 FIRM

2.1 Optimisation problem

$$\max_{K_t, N_t^{\mathrm{d}}, Z_t, Y_t, S_t, X_t, \pi_t, S_t^{\mathrm{lag}^1}, S_t^{\mathrm{lag}^2}} \Pi_t = \pi_t + {\lambda_t^{\mathrm{c}}}^{-1} \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{c}} \lambda_{t+1}^{\mathrm{U}} \Pi_{t+1} \right] \tag{2.1}$$

s.t. :

$$Y_t = \left(\sigma {Z_{t-1}}^{-\nu} + \left(\Lambda_t {K_{t-1}}^{\theta} {N_t^{\mathrm{d}}}^{1-\theta} \right)^{-\nu} \right)^{-\nu^{-1}} \quad \left(\lambda_t^{\mathrm{FIRM}^1} \right) \tag{2.2}$$

$$K_t = S_{t-3} + K_{t-1} (1 - \delta) \quad \left(\lambda_t^{\mathrm{FIRM}^2} \right) \tag{2.3}$$

$$X_t = \psi \left(S_{t-3} + S_{t-2} + S_{t-1} + S_t \right) \quad \left(\lambda_t^{\mathrm{FIRM}^3} \right) \tag{2.4}$$

$$\pi_t = Z_{t-1} - X_t + Y_t - Z_t - N_t^{\mathrm{d}} W_t \quad \left(\lambda_t^{\mathrm{FIRM}^4} \right) \tag{2.5}$$

2.2 First order conditions

$$-\lambda_t^{\mathrm{FIRM}^{\Pi}} + {\lambda_{t-1}^{\mathrm{c}}}^{-1} \lambda_t^{\mathrm{c}} \lambda_t^{\mathrm{U}} = 0 \quad (\Pi_t) \tag{2.6}$$

$$-\lambda_t^{\mathrm{FIRM}^2} + \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}} \left(\lambda_{t+1}^{\mathrm{FIRM}^2} (1 - \delta) + \theta \lambda_{t+1}^{\mathrm{FIRM}^1} \Lambda_{t+1} {K_t}^{-1+\theta} {N_{t+1}^{\mathrm{d}}}^{1-\theta} \left(\sigma {Z_t}^{-\nu} + \left(\Lambda_{t+1} {K_t}^{\theta} {N_{t+1}^{\mathrm{d}}}^{1-\theta} \right)^{-\nu} \right)^{-1-\nu^{-1}} \left(\Lambda_{t+1} {K_t}^{\theta} {N_{t+1}^{\mathrm{d}}}^{1-\theta} \right)^{-1-\nu} \right) \right] = 0 \quad (K_t) \tag{2.7}$$

$$-\lambda_t^{\mathrm{FIRM}^4} W_t + \lambda_t^{\mathrm{FIRM}^1} \Lambda_t (1 - \theta) {K_{t-1}}^{\theta} {N_t^{\mathrm{d}}}^{-\theta} \left(\sigma {Z_{t-1}}^{-\nu} + \left(\Lambda_t {K_{t-1}}^{\theta} {N_t^{\mathrm{d}}}^{1-\theta} \right)^{-\nu} \right)^{-1-\nu^{-1}} \left(\Lambda_t {K_{t-1}}^{\theta} {N_t^{\mathrm{d}}}^{1-\theta} \right)^{-1-\nu} = 0 \quad \left(N_t^{\mathrm{d}} \right) \tag{2.8}$$

$$-\lambda_t^{\mathrm{FIRM}^4} + \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}} \left(\lambda_{t+1}^{\mathrm{FIRM}^4} + \sigma \lambda_{t+1}^{\mathrm{FIRM}^1} {Z_t}^{-1-\nu} \left(\sigma {Z_t}^{-\nu} + \left(\Lambda_{t+1} {K_t}^{\theta} {N_{t+1}^{\mathrm{d}}}^{1-\theta} \right)^{-\nu} \right)^{-1-\nu^{-1}} \right) \right] = 0 \quad (Z_t) \tag{2.9}$$

$$-\lambda_t^{\mathrm{FIRM}^1} + \lambda_t^{\mathrm{FIRM}^4} = 0 \quad (Y_t) \tag{2.10}$$

$$\psi \lambda_t^{\mathrm{FIRM}^3} + \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}} \left(\lambda_{t+1}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^1}}} + \psi \lambda_{t+1}^{\mathrm{FIRM}^3} \right) \right] = 0 \quad (S_t) \tag{2.11}$$

$$-\lambda_t^{\mathrm{FIRM}^3} - \lambda_t^{\mathrm{FIRM}^4} = 0 \quad (X_t) \tag{2.12}$$

$$1 - \lambda_t^{\mathrm{FIRM}^4} = 0 \quad (\pi_t) \tag{2.13}$$

$$-\lambda_t^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^1}}} + \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}} \left(\lambda_{t+1}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^2}}} + \psi \lambda_{t+1}^{\mathrm{FIRM}^3} \right) \right] = 0 \quad \left(S_t^{\mathrm{lag}^1} \right) \tag{2.14}$$

$$-\lambda_t^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^2}}} + \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}} \left(\lambda_{t+1}^{\mathrm{FIRM}^2} + \psi \lambda_{t+1}^{\mathrm{FIRM}^3} \right) \right] = 0 \quad \left(S_t^{\mathrm{lag}^2} \right) \tag{2.15}$$

2.3 First order conditions after reduction

$$-\lambda_t^{\mathrm{FIRM}^{\Pi}} + {\lambda_{t-1}^{\mathrm{c}}}^{-1}\lambda_t^{\mathrm{c}}\lambda_t^{\mathrm{U}} = 0 \quad (\Pi_t) \tag{2.16}$$

$$-\lambda_t^{\mathrm{FIRM}^2} + \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}}\left(\lambda_{t+1}^{\mathrm{FIRM}^2}(1-\delta) + \theta\Lambda_{t+1}{K_t}^{-1+\theta}{N_{t+1}^{\mathrm{d}}}^{1-\theta}\left(\sigma {Z_t}^{-\nu} + \left(\Lambda_{t+1}{K_t}^{\theta}{N_{t+1}^{\mathrm{d}}}^{1-\theta}\right)^{-\nu}\right)^{-1-\nu^{-1}}\left(\Lambda_{t+1}{K_t}^{\theta}{N_{t+1}^{\mathrm{d}}}^{1-\theta}\right)^{-1-\nu}\right)\right] = 0 \quad (K_t) \tag{2.17}$$

$$-W_t + \Lambda_t(1-\theta){K_{t-1}}^{\theta}{N_t^{\mathrm{d}}}^{-\theta}\left(\sigma {Z_{t-1}}^{-\nu} + \left(\Lambda_t{K_{t-1}}^{\theta}{N_t^{\mathrm{d}}}^{1-\theta}\right)^{-\nu}\right)^{-1-\nu^{-1}}\left(\Lambda_t{K_{t-1}}^{\theta}{N_t^{\mathrm{d}}}^{1-\theta}\right)^{-1-\nu} = 0 \quad \left(N_t^{\mathrm{d}}\right) \tag{2.18}$$

$$-1 + \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}}\left(1 + \sigma {Z_t}^{-1-\nu}\left(\sigma {Z_t}^{-\nu} + \left(\Lambda_{t+1}{K_t}^{\theta}{N_{t+1}^{\mathrm{d}}}^{1-\theta}\right)^{-\nu}\right)^{-1-\nu^{-1}}\right)\right] = 0 \quad (Z_t) \tag{2.19}$$

$$-\psi + \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}}\left(-\psi + \lambda_{t+1}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^1}}}\right)\right] = 0 \quad (S_t) \tag{2.20}$$

$$-\lambda_t^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^1}}} + \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}}\left(-\psi + \lambda_{t+1}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^2}}}\right)\right] = 0 \quad \left(S_t^{\mathrm{lag}^1}\right) \tag{2.21}$$

$$-\lambda_t^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^2}}} + \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{FIRM}^{\Pi}}\left(-\psi + \lambda_{t+1}^{\mathrm{FIRM}^2}\right)\right] = 0 \quad \left(S_t^{\mathrm{lag}^2}\right) \tag{2.22}$$

3 EQUILIBRIUM

3.1 Identities

$$N_t^{\mathrm{d}} = N_t \tag{3.1}$$

4 EXOG

4.1 Identities

$$-1 + \Lambda_t = \epsilon_t^{\Lambda} + \phi^{\mathrm{a}}(-1 + \Lambda_{t-1}) + \phi^{\mathrm{b}}(-1 + \Lambda_{t-1}) \tag{4.1}$$

5 Equilibrium relationships (after reduction)

$$-1 + \beta {C_t}^{1-\mu}{L_t}^{-1+\mu}\left({C_t}^{\mu}{L_t}^{1-\mu}\right)^{1-\gamma}\mathrm{E}_t\left[\left(1 + \sigma {Z_t}^{-1-\nu}\left(\sigma {Z_t}^{-\nu} + \left(\Lambda_{t+1}{K_t}^{\theta}{N_{t+1}}^{1-\theta}\right)^{-\nu}\right)^{-1-\nu^{-1}}\right){C_{t+1}}^{-1+\mu}{L_{t+1}}^{1-\mu}\left({C_{t+1}}^{\mu}{L_{t+1}}^{1-\mu}\right)^{-1+\gamma}\right] = 0 \tag{5.1}$$

$$-\psi + \beta {C_t}^{1-\mu}{L_t}^{-1+\mu}\left({C_t}^{\mu}{L_t}^{1-\mu}\right)^{1-\gamma}\mathrm{E}_t\left[\left(-\psi + \lambda_{t+1}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^1}}}\right){C_{t+1}}^{-1+\mu}{L_{t+1}}^{1-\mu}\left({L_{t+1}}^{1-\mu}{C_{t+1}}^{\mu}\right)^{-1+\gamma}\right] = 0 \tag{5.2}$$

$$S_{t-1} - S_t^{\text{lag}^1} = 0 \tag{5.3}$$

$$S_{t-1}^{\text{lag}^1} - S_t^{\text{lag}^2} = 0 \tag{5.4}$$

$$-\lambda_t^{\text{FIRM}^2} + \beta {C_t}^{1-\mu} {L_t}^{-1+\mu} \left({C_t}^{\mu} {L_t}^{1-\mu}\right)^{1-\gamma} \mathrm{E}_t \left[\left(\lambda_{t+1}^{\text{FIRM}^2} (1-\delta) + \theta \Lambda_{t+1} {K_t}^{-1+\theta} {N_{t+1}}^{1-\theta} \left(\sigma {Z_t}^{-\nu} + \left(\Lambda_{t+1} {K_t}^{\theta} {N_{t+1}}^{1-\theta} \right)^{-\nu} \right)^{-1-\nu^{-1}} \left(\Lambda_{t+1} {K_t}^{\theta} {N_{t+1}}^{1-\theta} \right)^{-1-\nu} \right) {C_{t+1}}^{-1+\mu} {L_{t+1}}^{1-\mu} \left(C_{t+1}\right.$$

(5.5)

$$-\lambda_t^{\text{FIRM}^{\text{S}^{\text{lag}^1}}} + \beta {C_t}^{1-\mu} {L_t}^{-1+\mu} \left({C_t}^{\mu} {L_t}^{1-\mu}\right)^{1-\gamma} \mathrm{E}_t \left[\left(-\psi + \lambda_{t+1}^{\text{FIRM}^{\text{S}^{\text{lag}^2}}} \right) {C_{t+1}}^{-1+\mu} {L_{t+1}}^{1-\mu} \left({C_{t+1}}^{\mu} {L_{t+1}}^{1-\mu}\right)^{-1+\gamma} \right] = 0 \tag{5.6}$$

$$-\lambda_t^{\text{FIRM}^{\text{S}^{\text{lag}^2}}} + \beta {C_t}^{1-\mu} {L_t}^{-1+\mu} \left({C_t}^{\mu} {L_t}^{1-\mu}\right)^{1-\gamma} \mathrm{E}_t \left[\left(-\psi + \lambda_{t+1}^{\text{FIRM}^2} \right) {C_{t+1}}^{-1+\mu} {L_{t+1}}^{1-\mu} \left({C_{t+1}}^{\mu} {L_{t+1}}^{1-\mu}\right)^{-1+\gamma} \right] = 0 \tag{5.7}$$

$$-W_t + \Lambda_t (1-\theta) {K_{t-1}}^{\theta} {N_t}^{-\theta} \left(\sigma {Z_{t-1}}^{-\nu} + \left(\Lambda_t {K_{t-1}}^{\theta} {N_t}^{1-\theta} \right)^{-\nu} \right)^{-1-\nu^{-1}} \left(\Lambda_t {K_{t-1}}^{\theta} {N_t}^{1-\theta} \right)^{-1-\nu} = 0 \tag{5.8}$$

$$-Y_t + \left(\sigma {Z_{t-1}}^{-\nu} + \left(\Lambda_t {K_{t-1}}^{\theta} {N_t}^{1-\theta} \right)^{-\nu} \right)^{-\nu^{-1}} = 0 \tag{5.9}$$

$$S_{t-1}^{\text{lag}^2} - K_t + K_{t-1} (1-\delta) = 0 \tag{5.10}$$

$$-a_t + N_t + a_{t-1} (1-\eta) = 0 \tag{5.11}$$

$$-\pi_t + \Pi_t - \beta \left({C_t}^{-1+\mu} \right)^{-1} \left({L_t}^{1-\mu} \right)^{-1} \left(\left({C_t}^{\mu} {L_t}^{1-\mu} \right)^{-1+\gamma} \right)^{-1} \mathrm{E}_t \left[\Pi_{t+1} {C_{t+1}}^{-1+\mu} {L_{t+1}}^{1-\mu} \left({C_{t+1}}^{\mu} {L_{t+1}}^{1-\mu} \right)^{-1+\gamma} \right] = 0 \tag{5.12}$$

$$\pi_t - C_t + N_t W_t = 0 \tag{5.13}$$

$$U_t - \beta \mathrm{E}_t \left[U_{t+1} \right] - \gamma^{-1} \left({C_t}^{\mu} {L_t}^{1-\mu} \right)^{\gamma} = 0 \tag{5.14}$$

$$\beta \left((1-\eta) \left(-\mu \mathrm{E}_t \left[W_{t+1} {C_{t+1}}^{-1+\mu} {L_{t+1}}^{1-\mu} \left({C_{t+1}}^{\mu} {L_{t+1}}^{1-\mu} \right)^{-1+\gamma} \right] + \alpha (1-\mu) \mathrm{E}_t \left[{C_{t+1}}^{\mu} \left({C_{t+1}}^{\mu} {L_{t+1}}^{1-\mu} \right)^{-1+\gamma} {L_{t+1}}^{-\mu} \right] \right) - \eta (1-\alpha)(1-\mu) \mathrm{E}_t \left[{C_{t+1}}^{\mu} {L_{t+1}}^{-\mu} \left({C_{t+1}}^{\mu} {L_{t+1}}^{1-\mu} \right)^{-1+\gamma} \right] \right)$$

(5.15)

$$1 - L_t - \alpha N_t - \eta a_{t-1} (1-\alpha) = 0 \tag{5.16}$$

$$-1 - \epsilon_t^{\Lambda} + \Lambda_t - \phi^{\text{a}} \left(-1 + \Lambda_{t-1} \right) - \phi^{\text{b}} \left(-1 + \Lambda_{t-1} \right) = 0 \tag{5.17}$$

$$Z_{t-1} - \pi_t + Y_t - Z_t - \psi \left(S_{t-1} + S_{t-1}^{\text{lag}^1} + S_{t-1}^{\text{lag}^2} + S_t \right) - N_t W_t = 0 \tag{5.18}$$

6 Steady state relationships (after reduction)

$$-1+\beta\left(1+\sigma {Z_{\mathrm{ss}}}^{-1-\nu}\left(\sigma {Z_{\mathrm{ss}}}^{-\nu}+\left(\Lambda_{\mathrm{ss}}{K_{\mathrm{ss}}}^{\theta}{N_{\mathrm{ss}}}^{1-\theta}\right)^{-\nu}\right)^{-1-\nu^{-1}}\right){C_{\mathrm{ss}}}^{-1+\mu}{C_{\mathrm{ss}}}^{1-\mu}{L_{\mathrm{ss}}}^{-1+\mu}{L_{\mathrm{ss}}}^{1-\mu}=0 \tag{6.1}$$

$$-\psi+\beta\left(-\psi+\lambda_{\mathrm{ss}}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^{1}}}}\right){C_{\mathrm{ss}}}^{-1+\mu}{C_{\mathrm{ss}}}^{1-\mu}{L_{\mathrm{ss}}}^{-1+\mu}{L_{\mathrm{ss}}}^{1-\mu}=0 \tag{6.2}$$

$$S_{\mathrm{ss}}-S_{\mathrm{ss}}^{\mathrm{lag}^{1}}=0 \tag{6.3}$$

$$S_{\mathrm{ss}}^{\mathrm{lag}^{1}}-S_{\mathrm{ss}}^{\mathrm{lag}^{2}}=0 \tag{6.4}$$

$$-\lambda_{\mathrm{ss}}^{\mathrm{FIRM}^{2}}+\beta\left(\lambda_{\mathrm{ss}}^{\mathrm{FIRM}^{2}}\left(1-\delta\right)+\theta\Lambda_{\mathrm{ss}}{K_{\mathrm{ss}}}^{-1+\theta}{N_{\mathrm{ss}}}^{1-\theta}\left(\sigma {Z_{\mathrm{ss}}}^{-\nu}+\left(\Lambda_{\mathrm{ss}}{K_{\mathrm{ss}}}^{\theta}{N_{\mathrm{ss}}}^{1-\theta}\right)^{-\nu}\right)^{-1-\nu^{-1}}\left(\Lambda_{\mathrm{ss}}{K_{\mathrm{ss}}}^{\theta}{N_{\mathrm{ss}}}^{1-\theta}\right)^{-1-\nu}\right){C_{\mathrm{ss}}}^{-1+\mu}{C_{\mathrm{ss}}}^{1-\mu}{L_{\mathrm{ss}}}^{-1+\mu}{L_{\mathrm{ss}}}^{1-\mu}=0 \tag{6.5}$$

$$-\lambda_{\mathrm{ss}}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^{1}}}}+\beta\left(-\psi+\lambda_{\mathrm{ss}}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^{2}}}}\right){C_{\mathrm{ss}}}^{-1+\mu}{C_{\mathrm{ss}}}^{1-\mu}{L_{\mathrm{ss}}}^{-1+\mu}{L_{\mathrm{ss}}}^{1-\mu}=0 \tag{6.6}$$

$$-\lambda_{\mathrm{ss}}^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^{2}}}}+\beta\left(-\psi+\lambda_{\mathrm{ss}}^{\mathrm{FIRM}^{2}}\right){C_{\mathrm{ss}}}^{-1+\mu}{C_{\mathrm{ss}}}^{1-\mu}{L_{\mathrm{ss}}}^{-1+\mu}{L_{\mathrm{ss}}}^{1-\mu}=0 \tag{6.7}$$

$$-W_{\mathrm{ss}}+\Lambda_{\mathrm{ss}}\left(1-\theta\right){K_{\mathrm{ss}}}^{\theta}{N_{\mathrm{ss}}}^{-\theta}\left(\sigma {Z_{\mathrm{ss}}}^{-\nu}+\left(\Lambda_{\mathrm{ss}}{K_{\mathrm{ss}}}^{\theta}{N_{\mathrm{ss}}}^{1-\theta}\right)^{-\nu}\right)^{-1-\nu^{-1}}\left(\Lambda_{\mathrm{ss}}{K_{\mathrm{ss}}}^{\theta}{N_{\mathrm{ss}}}^{1-\theta}\right)^{-1-\nu}=0 \tag{6.8}$$

$$-Y_{\mathrm{ss}}+\left(\sigma {Z_{\mathrm{ss}}}^{-\nu}+\left(\Lambda_{\mathrm{ss}}{K_{\mathrm{ss}}}^{\theta}{N_{\mathrm{ss}}}^{1-\theta}\right)^{-\nu}\right)^{-\nu^{-1}}=0 \tag{6.9}$$

$$-K_{\mathrm{ss}}+S_{\mathrm{ss}}^{\mathrm{lag}^{2}}+K_{\mathrm{ss}}\left(1-\delta\right)=0 \tag{6.10}$$

$$-a_{\mathrm{ss}}+N_{\mathrm{ss}}+a_{\mathrm{ss}}\left(1-\eta\right)=0 \tag{6.11}$$

$$-\pi_{\mathrm{ss}}+\Pi_{\mathrm{ss}}-\beta\Pi_{\mathrm{ss}}1{L_{\mathrm{ss}}}^{-1+\mu}{L_{\mathrm{ss}}}^{1-\mu}=0 \tag{6.12}$$

$$\pi_{\mathrm{ss}}-C_{\mathrm{ss}}+N_{\mathrm{ss}}W_{\mathrm{ss}}=0 \tag{6.13}$$

$$U_{\mathrm{ss}}-\beta U_{\mathrm{ss}}-\gamma^{-1}\left({C_{\mathrm{ss}}}^{\mu}{L_{\mathrm{ss}}}^{1-\mu}\right)^{\gamma}=0 \tag{6.14}$$

$$\beta\left(\left(1-\eta\right)\left(\alpha\left(1-\mu\right){C_{\mathrm{ss}}}^{\mu}{L_{\mathrm{ss}}}^{-\mu}\left({C_{\mathrm{ss}}}^{\mu}{L_{\mathrm{ss}}}^{1-\mu}\right)^{-1+\gamma}-\mu W_{\mathrm{ss}}{C_{\mathrm{ss}}}^{-1+\mu}{L_{\mathrm{ss}}}^{1-\mu}\left({C_{\mathrm{ss}}}^{\mu}{L_{\mathrm{ss}}}^{1-\mu}\right)^{-1+\gamma}\right)-\eta\left(1-\alpha\right)\left(1-\mu\right){C_{\mathrm{ss}}}^{\mu}{L_{\mathrm{ss}}}^{-\mu}\left({C_{\mathrm{ss}}}^{\mu}{L_{\mathrm{ss}}}^{1-\mu}\right)^{-1+\gamma}\right)-\alpha\left(1-\mu\right){C_{\mathrm{ss}}}^{\mu}{L_{\mathrm{ss}}}^{-\mu}\left({C_{\mathrm{ss}}}^{\mu}{L_{\mathrm{ss}}}^{1-\mu}\right)^{-} \tag{6.15}$$

$$1-L_{\mathrm{ss}}-\alpha N_{\mathrm{ss}}-\eta a_{\mathrm{ss}}\left(1-\alpha\right)=0 \tag{6.16}$$

$$-1+\Lambda_{\mathrm{ss}}-\phi^{\mathrm{a}}\left(-1+\Lambda_{\mathrm{ss}}\right)-\phi^{\mathrm{b}}\left(-1+\Lambda_{\mathrm{ss}}\right)=0 \tag{6.17}$$

$$-\pi_{\mathrm{ss}}+Y_{\mathrm{ss}}-\psi\left(2S_{\mathrm{ss}}+S_{\mathrm{ss}}^{\mathrm{lag}^{1}}+S_{\mathrm{ss}}^{\mathrm{lag}^{2}}\right)-N_{\mathrm{ss}}W_{\mathrm{ss}}=0 \tag{6.18}$$

7 Parameter settings

$$\alpha = 1 \tag{7.1}$$

$$\beta = 0.99 \tag{7.2}$$

$$\delta = 0.025 \tag{7.3}$$

$$\eta = 0.5 \tag{7.4}$$

$$\gamma = -1 \tag{7.5}$$

$$\mu = 0.34 \tag{7.6}$$

$$\nu = 3 \tag{7.7}$$

$$\phi^{\mathrm{a}} = 0.906 \tag{7.8}$$

$$\phi^{\mathrm{b}} = 0.088 \tag{7.9}$$

$$\psi = 0.25 \tag{7.10}$$

$$\sigma = 0.01 \tag{7.11}$$

$$\theta = 0.36 \tag{7.12}$$

8 Steady-state values

	Steady-state values
a	0.6064
π	0.1283
C	0.8261
K	11.0149
L	0.6968
Λ	1
N	0.3032
Π	12.8257
S	0.2754
S^{lag^1}	0.2754
S^{lag^2}	0.2754
U	-135.4461
W	2.3014
Y	1.1015
Z	1.0987

9 The solution of the perturbation

9.1 P

$$\begin{array}{c} \\ a \\ K \\ \Lambda \\ S \\ S^{\text{lag}^1} \\ S^{\text{lag}^2} \\ Z \end{array} \begin{array}{c} \begin{array}{ccccccc} a_{t-1} & K_{t-1} & \Lambda_{t-1} & S_{t-1} & S_{t-1}^{\text{lag}^1} & S_{t-1}^{\text{lag}^2} & Z_{t-1} \end{array} \\ \begin{pmatrix} 0.5 & -0.0601 & 0.1549 & -0.0012 & -0.0024 & -0.0037 & -0.0086 \\ 0 & 0.975 & 0 & 0 & 0 & 0.025 & 0 \\ 0 & 0 & 0.994 & 0 & 0 & 0 & 0 \\ 0 & -8.077 & 6.257 & -1.0496 & -1.0055 & -0.8423 & 8.6102 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0.453 & 0.2652 & 0.0002 & -0.0056 & -0.0193 & 0.4187 \end{pmatrix} \end{array}$$

9.2 Q

$$\begin{array}{c} \\ a \\ K \\ \Lambda \\ S \\ S^{\text{lag}^1} \\ S^{\text{lag}^2} \\ Z \end{array} \begin{array}{c} \begin{array}{c} \epsilon^{\Lambda} \end{array} \\ \begin{pmatrix} 0.1558 \\ 0 \\ 1 \\ 6.2947 \\ 0 \\ 0 \\ 0.2668 \end{pmatrix} \end{array}$$

9.3 R

$$\begin{array}{c} \\ \lambda^{\text{FIRM}^2} \\ \lambda^{\text{FIRM}^{S^{\text{lag}^1}}} \\ \lambda^{\text{FIRM}^{S^{\text{lag}^2}}} \\ \pi \\ C \\ L \\ N \\ \Pi \\ U \\ W \\ Y \end{array} \begin{array}{c} \begin{array}{ccccccc} a_{t-1} & K_{t-1} & \Lambda_{t-1} & S_{t-1} & S_{t-1}^{\text{lag}^1} & S_{t-1}^{\text{lag}^2} & Z_{t-1} \end{array} \\ \begin{pmatrix} 0 & -0.0493 & 0.0617 & -0.0009 & -0.0019 & -0.0025 & 0.0167 \\ 0 & -0.0227 & 0.025 & -0.0016 & -0.0017 & -0.0015 & 0.0126 \\ 0 & -0.0376 & 0.044 & -0.0012 & -0.0024 & -0.0022 & 0.0165 \\ 0 & 1.3828 & -1.7195 & 0.0202 & 0.041 & 0.0647 & 0.1891 \\ 0 & 0.4442 & 0.6996 & 0.0019 & 0.0039 & 0.0062 & 0.0545 \\ 0 & 0.0523 & -0.1348 & 0.001 & 0.0021 & 0.0033 & 0.0075 \\ 0 & -0.1202 & 0.3098 & -0.0023 & -0.0048 & -0.0075 & -0.0172 \\ 0 & 0.8155 & 0.0939 & 0.0046 & 0.0091 & 0.014 & 0.0989 \\ 0 & -0.0465 & -0.2798 & -0.0003 & -0.0006 & -0.0009 & -0.0046 \\ 0 & 0.3919 & 0.8344 & 0.0009 & 0.0018 & 0.0029 & 0.047 \\ 0 & 0.2802 & 1.1803 & -0.0015 & -0.003 & -0.0047 & -0.0008 \end{pmatrix} \end{array}$$

9.4 S

$$\begin{array}{l} \\ \lambda^{\mathrm{FIRM}^2} \\ \lambda^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^1}}} \\ \lambda^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^2}}} \\ \pi \\ C \\ L \\ N \\ \Pi \\ U \\ W \\ Y \end{array} \begin{array}{c} \epsilon^{\Lambda} \\ \left(\begin{array}{c} 0.0621 \\ 0.0252 \\ 0.0443 \\ -1.7299 \\ 0.7038 \\ -0.1356 \\ 0.3117 \\ 0.0945 \\ -0.2815 \\ 0.8395 \\ 1.1874 \end{array} \right) \end{array}$$

10 Statistics of the model

10.1 Moments

	Steady-state value	Std. dev.	Variance	Loglinear
C	0.8261	0.2883	0.0831	Y
K	11.0149	0.093	0.0087	Y
L	0.6968	0.0533	0.0028	Y
Λ	1	0.4096	0.1678	Y
N	0.3032	0.1225	0.015	Y
U	-135.4461	0.1153	0.0133	Y
W	2.3014	0.3399	0.1155	Y
Y	1.1015	0.4723	0.2231	Y

10.2 Correlation matrix

	C	K	L	Λ	N	U	W	Y
a	0.9543	-0.1427	-0.9156	0.9519	0.9156	-0.9551	0.9532	0.9469
$\lambda^{\mathrm{FIRM}^2}$	0.9535	-0.3445	-0.999	0.9851	0.999	-0.9786	0.9655	0.9808
$\lambda^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^1}}}$	0.9189	-0.3123	-0.9813	0.9538	0.9813	-0.9461	0.9334	0.9536
$\lambda^{\mathrm{FIRM}^{\mathrm{S}^{\mathrm{lag}^2}}}$	0.9415	-0.3346	-0.9959	0.9746	0.9959	-0.9675	0.9548	0.9726
π	-0.9228	0.4079	0.9932	-0.9663	-0.9932	0.9566	-0.9386	-0.9601
C	1	-0.0689	-0.9613	0.989	0.9613	-0.994	0.9991	0.9937
K	-0.0689	1	0.3125	-0.2068	-0.3125	0.171	-0.1075	-0.1669
L	-0.9613	0.3125	1	-0.9891	-1	0.9836	-0.9723	-0.9861
Λ	0.989	-0.2068	-0.9891	1	0.9891	-0.9992	0.9941	0.9983
N	0.9613	-0.3125	-1	0.9891	1	-0.9836	0.9723	0.9861
Π	0.5469	0.7454	-0.3036	0.4173	0.3036	-0.4523	0.5115	0.4537
S	0.6373	-0.1735	-0.7313	0.6684	0.7313	-0.66	0.6554	0.684
S^{lag^1}	0.5043	-0.2471	-0.5156	0.5098	0.5156	-0.5088	0.5086	0.5115
S^{lag^2}	0.3796	-0.2113	-0.316	0.3713	0.316	-0.3758	0.3715	0.3551
U	-0.994	0.171	0.9836	-0.9992	-0.9836	1	-0.9974	-0.9991
W	0.9991	-0.1075	-0.9723	0.9941	0.9723	-0.9974	1	0.9976
Y	0.9937	-0.1669	-0.9861	0.9983	0.9861	-0.9991	0.9976	1
Z	0.8794	0.2007	-0.766	0.8151	0.766	-0.833	0.8661	0.8414

10.3 Autocorrelations

	$t-1$	$t-2$	$t-3$	$t-4$	$t-5$
C	0.7305	0.4987	0.3069	0.1534	0.0236
K	0.8674	0.72	0.6137	0.5297	0.3681
L	0.6809	0.4258	0.2416	0.1333	-0.0011
Λ	0.7212	0.4838	0.2859	0.1249	-0.0024
N	0.6809	0.4258	0.2416	0.1333	-0.0011
U	0.7238	0.4879	0.2907	0.1298	0.0022
W	0.721	0.4848	0.2936	0.1466	0.0162
Y	0.7051	0.4634	0.2752	0.1393	0.0069

11 Statistics of the model

11.1 Moments relative to moments of the reference variable

	Steady-state value relative to Y	Std. dev. relative to Y	Variance relative to Y	Loglinear
C	0.75	0.6104	0.3726	Y
K	10.0002	0.197	0.0388	Y
L	0.6326	0.1129	0.0127	Y
Λ	0.9079	0.8672	0.752	Y
N	0.2753	0.2594	0.0673	Y
U	-122.969	0.2441	0.0596	Y
W	2.0894	0.7196	0.5178	Y
Y	1	1	1	Y

11.2 Correlations with the reference variable

	Y_{t-5}	Y_{t-4}	Y_{t-3}	Y_{t-2}	Y_{t-1}	Y_t	Y_{t+1}	Y_{t+2}	Y_{t+3}	Y_{t+4}	Y_{t+5}
C	-0.0457	0.0881	0.2302	0.427	0.681	0.9937	0.7438	0.5265	0.3448	0.1984	0.0719
K	-0.4647	-0.472	-0.4503	-0.3907	-0.2912	-0.1669	0.018	0.2779	0.6192	0.6097	0.5685
L	-0.0857	-0.213	-0.3367	-0.5075	-0.7249	-0.9861	-0.6361	-0.3607	-0.1629	-0.0451	0.0902
Λ	0.0291	0.1602	0.295	0.4793	0.7138	0.9983	0.7105	0.4668	0.265	0.1019	-0.0259
N	0.0857	0.213	0.3367	0.5075	0.7249	0.9861	0.6361	0.3607	0.1629	0.0451	-0.0902
U	-0.0096	-0.1417	-0.2788	-0.4668	-0.7068	-0.9991	-0.7218	-0.4853	-0.2877	-0.1267	0.0009
W	-0.0253	0.1081	0.2481	0.4418	0.6914	0.9976	0.7308	0.5032	0.3181	0.1753	0.0468
Y	0.0069	0.1393	0.2752	0.4634	0.7051	1	0.7051	0.4634	0.2752	0.1393	0.0069

12 Impulse response functions

12.1 Shock ϵ^{Λ}

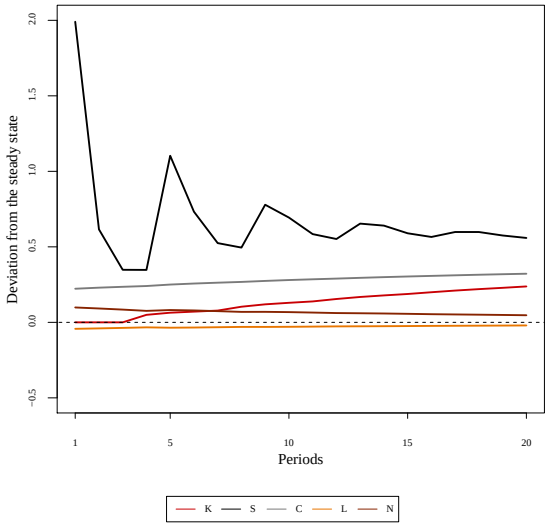

Figure 1: Impulse response function for ϵ^{Λ} shock

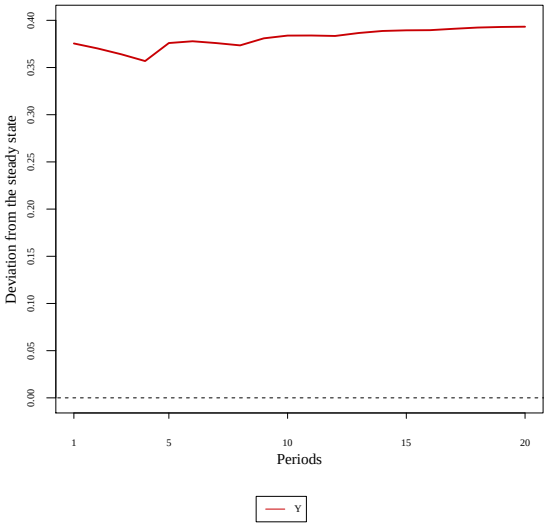

Figure 2: Impulse response function for ϵ^{Λ} shock