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Model name: `home_prod_templ`

Index sets

$$IND = \{\mathrm{H}, \mathrm{M}\}$$

1 CONSUMER

1.1 Optimisation problem

$$\max_{\left(K_t^{\langle i \rangle}\right)_{i\in IND}, \left(C_t^{\langle i \rangle}\right)_{i\in IND}, \left(N_t^{\langle i \rangle}\right)_{i\in IND}, \left(I_t^{\langle i \rangle}\right)_{i\in IND}} U_t = \beta \mathrm{E}_t\left[U_{t+1}\right] + \log\left(1 - \sum_{i\in IND} N_t^{\langle i \rangle}\right)(1-b) + b e^{-1} \log\left(a {C_t^{\langle \mathrm{M} \rangle}}^{e} + (1-a)\, {C_t^{\langle \mathrm{H} \rangle}}^{e}\right) \tag{1.1}$$

s.t. :

$$C_t^{\langle \mathrm{M} \rangle} + \sum_{i\in IND} I_t^{\langle i \rangle} = \pi_t + r_t K_{t-1}^{\langle \mathrm{M} \rangle} + W_t N_t^{\langle \mathrm{M} \rangle} \quad \left(\lambda_t^{\mathrm{CONSUMER}^1}\right) \tag{1.2}$$

$$i \in IND: \quad K_t^{\langle i \rangle} = I_t^{\langle i \rangle} + K_{t-1}^{\langle i \rangle}(1-\delta) \quad \left(\lambda^{\mathrm{CONSUMER}^2}{}_t^{\langle i \rangle}\right) \tag{1.3}$$

$$C_t^{\langle \mathrm{H} \rangle} = \Gamma Z_t^{\langle \mathrm{H} \rangle} {K_{t-1}^{\langle \mathrm{H} \rangle}}^{\theta} {N_t^{\langle \mathrm{H} \rangle}}^{1-\theta} \quad \left(\lambda_t^{\mathrm{CONSUMER}^3}\right) \tag{1.4}$$

1.2 Identities

$$K_t = \sum_{i\in IND} K_t^{\langle i \rangle} \tag{1.5}$$

$$I_t = \sum_{i\in IND} I_t^{\langle i \rangle} \tag{1.6}$$

$$N_t = \sum_{i\in IND} N_t^{\langle i \rangle} \tag{1.7}$$

1.3 First order conditions

$$i \in IND: \quad -\lambda^{\mathrm{CONSUMER}^2}{}_t^{\langle i \rangle} + \beta\left(\delta^{\langle \mathrm{M}, i \rangle} \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{CONSUMER}^1} r_{t+1}\right] + (1-\delta)\, \mathrm{E}_t\left[\lambda^{\mathrm{CONSUMER}^2}{}_{t+1}^{\langle i \rangle}\right] + \delta^{\langle \mathrm{H}, i \rangle} \theta \Gamma {K_t^{\langle \mathrm{H} \rangle}}^{-1+\theta} \mathrm{E}_t\left[\lambda_{t+1}^{\mathrm{CONSUMER}^3} Z_{t+1}^{\langle \mathrm{H} \rangle} {N_{t+1}^{\langle \mathrm{H} \rangle}}^{1-\theta}\right]\right) = 0 \quad \left(K_t^{\langle i \rangle}\right) \tag{1.8}$$

$$i \in IND: \quad -\delta^{\langle \mathrm{M}, i \rangle} \lambda_t^{\mathrm{CONSUMER}^1} - \delta^{\langle \mathrm{H}, i \rangle} \lambda_t^{\mathrm{CONSUMER}^3} + b e^{-1} \left(a {C_t^{\langle \mathrm{M} \rangle}}^{e} + (1-a)\, {C_t^{\langle \mathrm{H} \rangle}}^{e}\right)^{-1} \left(\delta^{\langle \mathrm{M}, i \rangle} a e {C_t^{\langle \mathrm{M} \rangle}}^{-1+e} + \delta^{\langle \mathrm{H}, i \rangle} e (1-a)\, {C_t^{\langle \mathrm{H} \rangle}}^{-1+e}\right) = 0 \quad \left(C_t^{\langle i \rangle}\right) \tag{1.9}$$

$$i \in \mathit{IND}: \quad -\left(1-b\right)\left(1-\sum_{i \in \mathit{IND}} N_t^{\langle i \rangle}\right)^{-1} + \delta^{\langle \mathrm{M},i \rangle}\lambda_t^{\mathrm{CONSUMER}^1} W_t + \delta^{\langle \mathrm{H},i \rangle}\Gamma\lambda_t^{\mathrm{CONSUMER}^3} Z_t^{\langle \mathrm{H} \rangle}\left(1-\theta\right) {K_{t-1}^{\langle \mathrm{H} \rangle}}^{\theta} {N_t^{\langle \mathrm{H} \rangle}}^{-\theta} = 0 \quad \left(N_t^{\langle i \rangle}\right) \tag{1.10}$$

$$i \in \mathit{IND}: \quad -\lambda_t^{\mathrm{CONSUMER}^1} + {\lambda^{\mathrm{CONSUMER}^2}}_t^{\langle i \rangle} = 0 \quad \left(I_t^{\langle i \rangle}\right) \tag{1.11}$$

2 FIRM

2.1 Optimisation problem

$$\max_{K_t^{\mathrm{m^d}}, N_t^{\mathrm{m^d}}, Y_t, \pi_t} \quad \Pi_t = \pi_t \tag{2.1}$$

s.t. :

$$\pi_t = Y_t - N_t^{\mathrm{m^d}} W_t - r_t K_t^{\mathrm{m^d}} \quad \left(\lambda_t^{\mathrm{FIRM}^1}\right) \tag{2.2}$$

$$Y_t = \Gamma Z_t^{\langle \mathrm{M} \rangle} {K_t^{\mathrm{m^d}}}^{\alpha} {N_t^{\mathrm{m^d}}}^{1-\alpha} \quad \left(\lambda_t^{\mathrm{FIRM}^2}\right) \tag{2.3}$$

2.2 First order conditions

$$-\lambda_t^{\mathrm{FIRM}^1} r_t + \alpha\Gamma\lambda_t^{\mathrm{FIRM}^2} Z_t^{\langle \mathrm{M} \rangle} {K_t^{\mathrm{m^d}}}^{-1+\alpha} {N_t^{\mathrm{m^d}}}^{1-\alpha} = 0 \quad \left(K_t^{\mathrm{m^d}}\right) \tag{2.4}$$

$$-\lambda_t^{\mathrm{FIRM}^1} W_t + \Gamma\lambda_t^{\mathrm{FIRM}^2} Z_t^{\langle \mathrm{M} \rangle}\left(1-\alpha\right) {K_t^{\mathrm{m^d}}}^{\alpha} {N_t^{\mathrm{m^d}}}^{-\alpha} = 0 \quad \left(N_t^{\mathrm{m^d}}\right) \tag{2.5}$$

$$\lambda_t^{\mathrm{FIRM}^1} - \lambda_t^{\mathrm{FIRM}^2} = 0 \quad \left(Y_t\right) \tag{2.6}$$

$$1 - \lambda_t^{\mathrm{FIRM}^1} = 0 \quad \left(\pi_t\right) \tag{2.7}$$

2.3 First order conditions after reduction

$$-r_t + \alpha\Gamma Z_t^{\langle \mathrm{M} \rangle} {K_t^{\mathrm{m^d}}}^{-1+\alpha} {N_t^{\mathrm{m^d}}}^{1-\alpha} = 0 \quad \left(K_t^{\mathrm{m^d}}\right) \tag{2.8}$$

$$-W_t + \Gamma Z_t^{\langle \mathrm{M} \rangle}\left(1-\alpha\right) {K_t^{\mathrm{m^d}}}^{\alpha} {N_t^{\mathrm{m^d}}}^{-\alpha} = 0 \quad \left(N_t^{\mathrm{m^d}}\right) \tag{2.9}$$

3 EQUILIBRIUM

3.1 Identities

$$K_t^{\mathrm{m^d}} = K_{t-1}^{\langle \mathrm{M} \rangle} \tag{3.1}$$

$$N_t^{\mathrm{m^d}} = N_t^{\langle \mathrm{M} \rangle} \tag{3.2}$$

4 EXOG

4.1 Identities

$$i \in \mathit{IND}: \quad Z_t^{\langle i \rangle} = e^{\epsilon_t^{\langle i \rangle} + \psi^{\langle i \rangle} \log Z_{t-1}^{\langle i \rangle}} \tag{4.1}$$

5 Equilibrium relationships (before expansion and reduction)

$$-\pi_t + \Pi_t = 0 \tag{5.1}$$

$$-r_t + \alpha \Gamma Z_t^{\langle \mathrm{M} \rangle} {K_t^{\mathrm{m}^{\mathrm{d}}}}^{-1+\alpha} {N_t^{\mathrm{m}^{\mathrm{d}}}}^{1-\alpha} = 0 \tag{5.2}$$

$$I_t - \sum_{i \in \mathit{IND}} I_t^{\langle i \rangle} = 0 \tag{5.3}$$

$$K_t - \sum_{i \in \mathit{IND}} K_t^{\langle i \rangle} = 0 \tag{5.4}$$

$$K_t^{\mathrm{m}^{\mathrm{d}}} - K_{t-1}^{\langle \mathrm{M} \rangle} = 0 \tag{5.5}$$

$$N_t - \sum_{i \in \mathit{IND}} N_t^{\langle i \rangle} = 0 \tag{5.6}$$

$$N_t^{\mathrm{m}^{\mathrm{d}}} - N_t^{\langle \mathrm{M} \rangle} = 0 \tag{5.7}$$

$$-W_t + \Gamma Z_t^{\langle \mathrm{M} \rangle} \left(1 - \alpha\right) {K_t^{\mathrm{m}^{\mathrm{d}}}}^{\alpha} {N_t^{\mathrm{m}^{\mathrm{d}}}}^{-\alpha} = 0 \tag{5.8}$$

$$-Y_t + \Gamma Z_t^{\langle \mathrm{M} \rangle} {K_t^{\mathrm{m}^{\mathrm{d}}}}^{\alpha} {N_t^{\mathrm{m}^{\mathrm{d}}}}^{1-\alpha} = 0 \tag{5.9}$$

$$-C_t^{\langle \mathrm{H} \rangle} + \Gamma Z_t^{\langle \mathrm{H} \rangle} {K_{t-1}^{\langle \mathrm{H} \rangle}}^{\theta} {N_t^{\langle \mathrm{H} \rangle}}^{1-\theta} = 0 \tag{5.10}$$

$$-\pi_t + Y_t - r_t K_t^{\mathrm{m}^{\mathrm{d}}} - N_t^{\mathrm{m}^{\mathrm{d}}} W_t = 0 \tag{5.11}$$

$$U_t - \beta \mathrm{E}_t \left[U_{t+1}\right] - \log \left(1 - \sum_{i \in \mathit{IND}} N_t^{\langle i \rangle}\right) \left(1 - b\right) - b e^{-1} \log \left(a {C_t^{\langle \mathrm{M} \rangle}}^{e} + \left(1 - a\right) {C_t^{\langle \mathrm{H} \rangle}}^{e}\right) = 0 \tag{5.12}$$

$$\pi_t - C_t^{\langle \mathrm{M} \rangle} + r_t K_{t-1}^{\langle \mathrm{M} \rangle} + W_t N_t^{\langle \mathrm{M} \rangle} - \sum_{i \in \mathit{IND}} I_t^{\langle i \rangle} = 0 \tag{5.13}$$

$$i \in \mathit{IND}: \quad -\lambda_t^{\mathrm{CONSUMER}^1} + {\lambda^{\mathrm{CONSUMER}^2}}_t^{\langle i \rangle} = 0 \tag{5.14}$$

$$i \in \mathit{IND}: \quad -{\lambda^{\mathrm{CONSUMER}^2}}_t^{\langle i \rangle} + \beta \left(\delta^{\langle \mathrm{M},i \rangle} \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{CONSUMER}^1} r_{t+1}\right] + \left(1 - \delta\right) \mathrm{E}_t \left[{\lambda^{\mathrm{CONSUMER}^2}}_{t+1}^{\langle i \rangle}\right] + \delta^{\langle \mathrm{H},i \rangle} \theta \Gamma {K_t^{\langle \mathrm{H} \rangle}}^{-1+\theta} \mathrm{E}_t \left[\lambda_{t+1}^{\mathrm{CONSUMER}^3} Z_{t+1}^{\langle \mathrm{H} \rangle} {N_{t+1}^{\langle \mathrm{H} \rangle}}^{1-\theta}\right]\right) = 0 \tag{5.15}$$

$$i \in \mathit{IND}\colon \quad Z_t^{\langle i\rangle} - e^{\epsilon_t^{\langle i\rangle} + \psi^{\langle i\rangle} \log Z_{t-1}^{\langle i\rangle}} = 0 \tag{5.16}$$

$$i \in \mathit{IND}\colon \quad I_t^{\langle i\rangle} - K_t^{\langle i\rangle} + K_{t-1}^{\langle i\rangle} \left(1-\delta\right) = 0 \tag{5.17}$$

$$i \in \mathit{IND}\colon \quad -\delta^{\langle \mathrm{M},i\rangle} \lambda_t^{\mathrm{CONSUMER}^1} - \delta^{\langle \mathrm{H},i\rangle} \lambda_t^{\mathrm{CONSUMER}^3} + b e^{-1} \left(a {C_t^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_t^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} \left(\delta^{\langle \mathrm{M},i\rangle} a e {C_t^{\langle \mathrm{M}\rangle}}^{-1+e} + \delta^{\langle \mathrm{H},i\rangle} e \left(1-a\right) {C_t^{\langle \mathrm{H}\rangle}}^{-1+e}\right) = 0 \tag{5.18}$$

$$i \in \mathit{IND}\colon \quad -\left(1-b\right) \left(1 - \sum_{i \in \mathit{IND}} N_t^{\langle i\rangle}\right)^{-1} + \delta^{\langle \mathrm{M},i\rangle} \lambda_t^{\mathrm{CONSUMER}^1} W_t + \delta^{\langle \mathrm{H},i\rangle} \Gamma \lambda_t^{\mathrm{CONSUMER}^3} Z_t^{\langle \mathrm{H}\rangle} \left(1-\theta\right) {K_{t-1}^{\langle \mathrm{H}\rangle}}^{\theta} {N_t^{\langle \mathrm{H}\rangle}}^{-\theta} = 0 \tag{5.19}$$

6 Equilibrium relationships (after expansion and reduction)

$$-r_t + \alpha \Gamma Z_t^{\langle \mathrm{M}\rangle} {K_{t-1}^{\langle \mathrm{M}\rangle}}^{-1+\alpha} {N_t^{\langle \mathrm{M}\rangle}}^{1-\alpha} = 0 \tag{6.1}$$

$$-W_t + \Gamma Z_t^{\langle \mathrm{M}\rangle} \left(1-\alpha\right) {K_{t-1}^{\langle \mathrm{M}\rangle}}^{\alpha} {N_t^{\langle \mathrm{M}\rangle}}^{-\alpha} = 0 \tag{6.2}$$

$$-Y_t + \Gamma Z_t^{\langle \mathrm{M}\rangle} {K_{t-1}^{\langle \mathrm{M}\rangle}}^{\alpha} {N_t^{\langle \mathrm{M}\rangle}}^{1-\alpha} = 0 \tag{6.3}$$

$$-C_t^{\langle \mathrm{H}\rangle} + \Gamma Z_t^{\langle \mathrm{H}\rangle} {N_t^{\langle \mathrm{H}\rangle}}^{1-\theta} {K_{t-1}^{\langle \mathrm{H}\rangle}}^{\theta} = 0 \tag{6.4}$$

$$Z_t^{\langle \mathrm{H}\rangle} - e^{\epsilon_t^{\langle \mathrm{H}\rangle} + \psi^{\langle \mathrm{H}\rangle} \log Z_{t-1}^{\langle \mathrm{H}\rangle}} = 0 \tag{6.5}$$

$$Z_t^{\langle \mathrm{M}\rangle} - e^{\epsilon_t^{\langle \mathrm{M}\rangle} + \psi^{\langle \mathrm{M}\rangle} \log Z_{t-1}^{\langle \mathrm{M}\rangle}} = 0 \tag{6.6}$$

$$\beta \left(ab \mathrm{E}_t \left[r_{t+1} \left(a {C_{t+1}^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_{t+1}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{t+1}^{\langle \mathrm{M}\rangle}}^{-1+e}\right] + ab \left(1-\delta\right) \mathrm{E}_t \left[\left(a {C_{t+1}^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_{t+1}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{t+1}^{\langle \mathrm{M}\rangle}}^{-1+e}\right]\right) - ab \left(a {C_t^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_t^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_t^{\langle \mathrm{M}\rangle}}^{-1+e} = 0 \tag{6.7}$$

$$\beta \left(ab \left(1-\delta\right) \mathrm{E}_t \left[\left(a {C_{t+1}^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_{t+1}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{t+1}^{\langle \mathrm{M}\rangle}}^{-1+e}\right] + b\theta\Gamma \left(1-a\right) {K_t^{\langle \mathrm{H}\rangle}}^{-1+\theta} \mathrm{E}_t \left[Z_{t+1}^{\langle \mathrm{H}\rangle} \left(a {C_{t+1}^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_{t+1}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{t+1}^{\langle \mathrm{H}\rangle}}^{-1+e} {N_{t+1}^{\langle \mathrm{H}\rangle}}^{1-\theta}\right]\right) - ab \left(a {C_t^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_t^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} C_t^{\langle \mathrm{M}\rangle} \tag{6.8}$$

$$-\left(1-b\right) \left(1 - N_t^{\langle \mathrm{H}\rangle} - N_t^{\langle \mathrm{M}\rangle}\right)^{-1} + ab W_t \left(a {C_t^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_t^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_t^{\langle \mathrm{M}\rangle}}^{-1+e} = 0 \tag{6.9}$$

$$-\left(1-b\right) \left(1 - N_t^{\langle \mathrm{H}\rangle} - N_t^{\langle \mathrm{M}\rangle}\right)^{-1} + b\Gamma Z_t^{\langle \mathrm{H}\rangle} \left(1-a\right) \left(1-\theta\right) \left(a {C_t^{\langle \mathrm{M}\rangle}}^{e} + \left(1-a\right) {C_t^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {K_{t-1}^{\langle \mathrm{H}\rangle}}^{\theta} {C_t^{\langle \mathrm{H}\rangle}}^{-1+e} {N_t^{\langle \mathrm{H}\rangle}}^{-\theta} = 0 \tag{6.10}$$

$$I_t - I_t^{\langle \mathrm{H}\rangle} - I_t^{\langle \mathrm{M}\rangle} = 0 \tag{6.11}$$

$$K_t - K_t^{\langle \mathrm{H}\rangle} - K_t^{\langle \mathrm{M}\rangle} = 0 \tag{6.12}$$

$$N_t - N_t^{\langle \mathrm{H}\rangle} - N_t^{\langle \mathrm{M}\rangle} = 0 \tag{6.13}$$

$$I_t^{\langle \mathrm{H}\rangle} - K_t^{\langle \mathrm{H}\rangle} + K_{t-1}^{\langle \mathrm{H}\rangle} \left(1-\delta\right) = 0 \tag{6.14}$$

$$I_t^{\langle \mathrm{M} \rangle} - K_t^{\langle \mathrm{M} \rangle} + K_{t-1}^{\langle \mathrm{M} \rangle} \left(1 - \delta\right) = 0 \tag{6.15}$$

$$U_t - \beta \mathrm{E}_t \left[U_{t+1}\right] - \log \left(1 - N_t^{\langle \mathrm{H} \rangle} - N_t^{\langle \mathrm{M} \rangle}\right) \left(1 - b\right) - b e^{-1} \log \left(a {C_t^{\langle \mathrm{M} \rangle}}^{e} + \left(1 - a\right) {C_t^{\langle \mathrm{H} \rangle}}^{e}\right) = 0 \tag{6.16}$$

$$Y_t - C_t^{\langle \mathrm{M} \rangle} - I_t^{\langle \mathrm{H} \rangle} - I_t^{\langle \mathrm{M} \rangle} = 0 \tag{6.17}$$

7 Steady state relationships (before expansion and reduction)

$$-\pi_{\mathrm{ss}} + \Pi_{\mathrm{ss}} = 0 \tag{7.1}$$

$$-r_{\mathrm{ss}} + \alpha \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{M} \rangle} {K_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}}}^{-1+\alpha} {N_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}}}^{1-\alpha} = 0 \tag{7.2}$$

$$I_{\mathrm{ss}} - \sum_{i \in \mathit{IND}} I_{\mathrm{ss}}^{\langle i \rangle} = 0 \tag{7.3}$$

$$K_{\mathrm{ss}} - \sum_{i \in \mathit{IND}} K_{\mathrm{ss}}^{\langle i \rangle} = 0 \tag{7.4}$$

$$K_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}} - K_{\mathrm{ss}}^{\langle \mathrm{M} \rangle} = 0 \tag{7.5}$$

$$N_{\mathrm{ss}} - \sum_{i \in \mathit{IND}} N_{\mathrm{ss}}^{\langle i \rangle} = 0 \tag{7.6}$$

$$N_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}} - N_{\mathrm{ss}}^{\langle \mathrm{M} \rangle} = 0 \tag{7.7}$$

$$-W_{\mathrm{ss}} + \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{M} \rangle} \left(1 - \alpha\right) {K_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}}}^{\alpha} {N_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}}}^{-\alpha} = 0 \tag{7.8}$$

$$-Y_{\mathrm{ss}} + \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{M} \rangle} {K_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}}}^{\alpha} {N_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}}}^{1-\alpha} = 0 \tag{7.9}$$

$$-C_{\mathrm{ss}}^{\langle \mathrm{H} \rangle} + \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{H} \rangle} {K_{\mathrm{ss}}^{\langle \mathrm{H} \rangle}}^{\theta} {N_{\mathrm{ss}}^{\langle \mathrm{H} \rangle}}^{1-\theta} = 0 \tag{7.10}$$

$$-\pi_{\mathrm{ss}} + Y_{\mathrm{ss}} - r_{\mathrm{ss}} K_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}} - N_{\mathrm{ss}}^{\mathrm{m}^{\mathrm{d}}} W_{\mathrm{ss}} = 0 \tag{7.11}$$

$$U_{\mathrm{ss}} - \beta U_{\mathrm{ss}} - \log \left(1 - \sum_{i \in \mathit{IND}} N_{\mathrm{ss}}^{\langle i \rangle}\right) \left(1 - b\right) - b e^{-1} \log \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M} \rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H} \rangle}}^{e}\right) = 0 \tag{7.12}$$

$$\pi_{\mathrm{ss}} - C_{\mathrm{ss}}^{\langle \mathrm{M} \rangle} + r_{\mathrm{ss}} K_{\mathrm{ss}}^{\langle \mathrm{M} \rangle} + W_{\mathrm{ss}} N_{\mathrm{ss}}^{\langle \mathrm{M} \rangle} - \sum_{i \in \mathit{IND}} I_{\mathrm{ss}}^{\langle i \rangle} = 0 \tag{7.13}$$

$$i \in \mathit{IND}: \quad -\lambda_{\mathrm{ss}}^{\mathrm{CONSUMER}^1} + {\lambda^{\mathrm{CONSUMER}^2}}_{\mathrm{ss}}^{\langle i \rangle} = 0 \tag{7.14}$$

$$i \in \mathit{IND}: \quad -{\lambda^{\mathrm{CONSUMER}^2}}_{\mathrm{ss}}^{\langle i \rangle} + \beta \left({\lambda^{\mathrm{CONSUMER}^2}}_{\mathrm{ss}}^{\langle i \rangle} \left(1 - \delta\right) + \delta^{\langle \mathrm{M}, i \rangle} \lambda_{\mathrm{ss}}^{\mathrm{CONSUMER}^1} r_{\mathrm{ss}} + \delta^{\langle \mathrm{H}, i \rangle} \theta \Gamma \lambda_{\mathrm{ss}}^{\mathrm{CONSUMER}^3} Z_{\mathrm{ss}}^{\langle \mathrm{H} \rangle} {K_{\mathrm{ss}}^{\langle \mathrm{H} \rangle}}^{-1+\theta} {N_{\mathrm{ss}}^{\langle \mathrm{H} \rangle}}^{1-\theta}\right) = 0 \tag{7.15}$$

$$i \in \mathit{IND}\colon \quad Z_{\mathrm{ss}}^{\langle i\rangle} - e^{\epsilon_{\mathrm{ss}}^{\langle i\rangle} + \psi^{\langle i\rangle} \log Z_{\mathrm{ss}}^{\langle i\rangle}} = 0 \tag{7.16}$$

$$i \in \mathit{IND}\colon \quad I_{\mathrm{ss}}^{\langle i\rangle} - K_{\mathrm{ss}}^{\langle i\rangle} + K_{\mathrm{ss}}^{\langle i\rangle} \left(1 - \delta\right) = 0 \tag{7.17}$$

$$i \in \mathit{IND}\colon \quad -\delta^{\langle \mathrm{M},i\rangle} \lambda_{\mathrm{ss}}^{\mathrm{CONSUMER}^1} - \delta^{\langle \mathrm{H},i\rangle} \lambda_{\mathrm{ss}}^{\mathrm{CONSUMER}^3} + b e^{-1} \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} \left(\delta^{\langle \mathrm{M},i\rangle} a e {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-1+e} + \delta^{\langle \mathrm{H},i\rangle} e \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{-1+e}\right) = 0 \tag{7.18}$$

$$i \in \mathit{IND}\colon \quad -\left(1 - b\right) \left(1 - \sum_{i \in \mathit{IND}} N_{\mathrm{ss}}^{\langle i\rangle}\right)^{-1} + \delta^{\langle \mathrm{M},i\rangle} \lambda_{\mathrm{ss}}^{\mathrm{CONSUMER}^1} W_{\mathrm{ss}} + \delta^{\langle \mathrm{H},i\rangle} \Gamma \lambda_{\mathrm{ss}}^{\mathrm{CONSUMER}^3} Z_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} \left(1 - \theta\right) {K_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{\theta} {N_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{-\theta} = 0 \tag{7.19}$$

8 Steady state relationships (after expansion and reduction)

$$-r_{\mathrm{ss}} + \alpha \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} {K_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-1+\alpha} {N_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{1-\alpha} = 0 \tag{8.1}$$

$$-W_{\mathrm{ss}} + \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} \left(1 - \alpha\right) {K_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{\alpha} {N_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-\alpha} = 0 \tag{8.2}$$

$$-Y_{\mathrm{ss}} + \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} {K_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{\alpha} {N_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{1-\alpha} = 0 \tag{8.3}$$

$$-C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} + \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} {K_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{\theta} {N_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{1-\theta} = 0 \tag{8.4}$$

$$Z_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - e^{\psi^{\langle \mathrm{H}\rangle} \log Z_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}} = 0 \tag{8.5}$$

$$Z_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} - e^{\psi^{\langle \mathrm{M}\rangle} \log Z_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}} = 0 \tag{8.6}$$

$$\beta \left(a b r_{\mathrm{ss}} \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-1+e} + a b \left(1 - \delta\right) \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-1+e}\right) - a b \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-1+e} = 0 \tag{8.7}$$

$$\beta \left(a b \left(1 - \delta\right) \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-1+e} + b \theta \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} \left(1 - a\right) \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{-1+e} {K_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{-1+\theta} {N_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{1-\theta}\right) - a b \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-1+e} = 0 \tag{8.8}$$

$$-\left(1 - b\right) \left(1 - N_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - N_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}\right)^{-1} + a b W_{\mathrm{ss}} \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{-1+e} = 0 \tag{8.9}$$

$$-\left(1 - b\right) \left(1 - N_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - N_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}\right)^{-1} + b \Gamma Z_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} \left(1 - a\right) \left(1 - \theta\right) \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right)^{-1} {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{-1+e} {K_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{\theta} {N_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{-\theta} = 0 \tag{8.10}$$

$$I_{\mathrm{ss}} - I_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - I_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} = 0 \tag{8.11}$$

$$K_{\mathrm{ss}} - K_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - K_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} = 0 \tag{8.12}$$

$$N_{\mathrm{ss}} - N_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - N_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} = 0 \tag{8.13}$$

$$I_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - K_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} + K_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} \left(1 - \delta\right) = 0 \tag{8.14}$$

$$I_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} - K_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} + K_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} \left(1 - \delta\right) = 0 \tag{8.15}$$

$$U_{\mathrm{ss}} - \beta U_{\mathrm{ss}} - \log \left(1 - N_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - N_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}\right) \left(1 - b\right) - b e^{-1} \log \left(a {C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle}}^{e} + \left(1 - a\right) {C_{\mathrm{ss}}^{\langle \mathrm{H}\rangle}}^{e}\right) = 0 \tag{8.16}$$

$$Y_{\mathrm{ss}} - C_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} - I_{\mathrm{ss}}^{\langle \mathrm{H}\rangle} - I_{\mathrm{ss}}^{\langle \mathrm{M}\rangle} = 0 \tag{8.17}$$

9 Parameter settings

$$a = 0.337 \tag{9.1}$$

$$\alpha = 0.36 \tag{9.2}$$

$$b = 0.63 \tag{9.3}$$

$$\beta = 0.99 \tag{9.4}$$

$$\delta = 0.025 \tag{9.5}$$

$$e = 0.8 \tag{9.6}$$

$$\theta = 0.08 \tag{9.7}$$

$$\Gamma = 1 \tag{9.8}$$

$$\psi^{\langle \mathrm{H} \rangle} = 0.95 \tag{9.9}$$

$$\psi^{\langle \mathrm{M} \rangle} = 0.95 \tag{9.10}$$