Generated on 2023-01-18 17:27:24 by `gEcon` version 1.2.1 (2023-01-18)
Model name: `cge_templ`

Index sets

$$HH = \{1, 2\}$$

$$\mathit{SEC} = \{\mathrm{A}, \mathrm{B}, \mathrm{C}\}$$

1 HOUSEHOLD $h \in HH$

1.1 Optimisation problem

$$\max_{\left(D^{\langle h,s\rangle}\right)_{s\in \mathit{SEC}}} U^{\langle h\rangle} = \left(\sum_{s\in \mathit{SEC}} \alpha^{\langle h,s\rangle} {D^{\langle h,s\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{\omega(-1+\omega)^{-1}} \tag{1.1}$$

s.t. :

$$\sum_{s\in \mathit{SEC}} p^{\langle s\rangle} D^{\langle h,s\rangle} = L^{\langle h\rangle} + \phi^{\langle h\rangle}\left(\sum_{s\in \mathit{SEC}} \pi^{\langle s\rangle}\right) + p^{\mathrm{k}} K^{\langle h\rangle} \quad \left(\lambda^{\mathrm{HOUSEHOLD}^{1}\langle h\rangle}\right) \tag{1.2}$$

1.2 Identities

$$\mathit{hi} \in HH: \quad K^{\langle \mathit{hi}\rangle} = \mathit{par}^{\mathrm{k}\langle \mathit{hi}\rangle} \tag{1.3}$$

$$\mathit{hi} \in HH: \quad L^{\langle \mathit{hi}\rangle} = \mathit{par}^{\mathrm{l}\langle \mathit{hi}\rangle} \tag{1.4}$$

1.3 First order conditions

$$s \in \mathit{SEC}: \quad -\lambda^{\mathrm{HOUSEHOLD}^{1}\langle h\rangle} p^{\langle s\rangle} + \alpha^{\langle h,s\rangle} {D^{\langle h,s\rangle}}^{-1+\omega^{-1}(-1+\omega)} \left(\sum_{s\in \mathit{SEC}} \alpha^{\langle h,s\rangle} {D^{\langle h,s\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \quad \left(D^{\langle h,s\rangle}\right) \tag{1.5}$$

2 FIRM $s \in \mathit{SEC}$

2.1 Optimisation problem

$$\max_{Y^{\langle s\rangle},K^{\langle s\rangle},L^{\langle s\rangle},\left(X^{\langle s,\mathit{si}\rangle}\right)_{\mathit{si}\in\mathit{SEC}}} \pi^{\langle s\rangle} = -L^{\langle s\rangle} - p^{\mathrm{k}}K^{\langle s\rangle} + p^{\langle s\rangle}Y^{\langle s\rangle} - \sum_{\mathit{si}\in\mathit{SEC}} p^{\langle \mathit{si}\rangle}X^{\langle s,\mathit{si}\rangle} \tag{2.1}$$

s.t. :

$$Y^{\langle s\rangle} = \gamma^{\langle s\rangle}{K^{\langle s\rangle}}^{\beta^{\mathrm{k}\langle s\rangle}}{L^{\langle s\rangle}}^{\beta^{\mathrm{l}\langle s\rangle}}\left(\prod_{\mathit{si}\in\mathit{SEC}}{X^{\langle s,\mathit{si}\rangle}}^{\beta^{\mathrm{x}\langle s,\mathit{si}\rangle}}\right) \quad \left(\lambda^{\mathrm{FIRM}^1\langle s\rangle}\right) \tag{2.2}$$

2.2 First order conditions

$$-\lambda^{\mathrm{FIRM}^1\langle s\rangle} + p^{\langle s\rangle} = 0 \quad \left(Y^{\langle s\rangle}\right) \tag{2.3}$$

$$-p^{\mathrm{k}} + \beta^{\mathrm{k}\langle s\rangle}\gamma^{\langle s\rangle}\lambda^{\mathrm{FIRM}^1\langle s\rangle}{K^{\langle s\rangle}}^{-1+\beta^{\mathrm{k}\langle s\rangle}}{L^{\langle s\rangle}}^{\beta^{\mathrm{l}\langle s\rangle}}\left(\prod_{\mathit{si}\in\mathit{SEC}}{X^{\langle s,\mathit{si}\rangle}}^{\beta^{\mathrm{x}\langle s,\mathit{si}\rangle}}\right) = 0 \quad \left(K^{\langle s\rangle}\right) \tag{2.4}$$

$$-1 + \beta^{\mathrm{l}\langle s\rangle}\gamma^{\langle s\rangle}\lambda^{\mathrm{FIRM}^1\langle s\rangle}{K^{\langle s\rangle}}^{\beta^{\mathrm{k}\langle s\rangle}}{L^{\langle s\rangle}}^{-1+\beta^{\mathrm{l}\langle s\rangle}}\left(\prod_{\mathit{si}\in\mathit{SEC}}{X^{\langle s,\mathit{si}\rangle}}^{\beta^{\mathrm{x}\langle s,\mathit{si}\rangle}}\right) = 0 \quad \left(L^{\langle s\rangle}\right) \tag{2.5}$$

$$\mathit{si}\in\mathit{SEC}: \quad -p^{\langle \mathit{si}\rangle} + \beta^{\mathrm{x}\langle s,\mathit{si}\rangle}\gamma^{\langle s\rangle}\lambda^{\mathrm{FIRM}^1\langle s\rangle}{X^{\langle s,\mathit{si}\rangle}}^{-1}{K^{\langle s\rangle}}^{\beta^{\mathrm{k}\langle s\rangle}}{L^{\langle s\rangle}}^{\beta^{\mathrm{l}\langle s\rangle}}\left(\prod_{\mathit{si}'\in\mathit{SEC}}{X^{\langle s,\mathit{si}'\rangle}}^{\beta^{\mathrm{x}\langle s,\mathit{si}'\rangle}}\right) = 0 \quad \left(X^{\langle s,\mathit{si}\rangle}\right) \tag{2.6}$$

2.3 First order conditions after reduction

$$-p^{\mathrm{k}} + \beta^{\mathrm{k}\langle s\rangle}\gamma^{\langle s\rangle}p^{\langle s\rangle}{K^{\langle s\rangle}}^{-1+\beta^{\mathrm{k}\langle s\rangle}}{L^{\langle s\rangle}}^{\beta^{\mathrm{l}\langle s\rangle}}\left(\prod_{\mathit{si}\in\mathit{SEC}}{X^{\langle s,\mathit{si}\rangle}}^{\beta^{\mathrm{x}\langle s,\mathit{si}\rangle}}\right) = 0 \quad \left(K^{\langle s\rangle}\right) \tag{2.7}$$

$$-1 + \beta^{\mathrm{l}\langle s\rangle}\gamma^{\langle s\rangle}p^{\langle s\rangle}{K^{\langle s\rangle}}^{\beta^{\mathrm{k}\langle s\rangle}}{L^{\langle s\rangle}}^{-1+\beta^{\mathrm{l}\langle s\rangle}}\left(\prod_{\mathit{si}\in\mathit{SEC}}{X^{\langle s,\mathit{si}\rangle}}^{\beta^{\mathrm{x}\langle s,\mathit{si}\rangle}}\right) = 0 \quad \left(L^{\langle s\rangle}\right) \tag{2.8}$$

$$\mathit{si}\in\mathit{SEC}: \quad -p^{\langle \mathit{si}\rangle} + \beta^{\mathrm{x}\langle s,\mathit{si}\rangle}\gamma^{\langle s\rangle}p^{\langle s\rangle}{X^{\langle s,\mathit{si}\rangle}}^{-1}{K^{\langle s\rangle}}^{\beta^{\mathrm{k}\langle s\rangle}}{L^{\langle s\rangle}}^{\beta^{\mathrm{l}\langle s\rangle}}\left(\prod_{\mathit{si}'\in\mathit{SEC}}{X^{\langle s,\mathit{si}'\rangle}}^{\beta^{\mathrm{x}\langle s,\mathit{si}'\rangle}}\right) = 0 \quad \left(\left(X^{\langle s,\mathit{si}\rangle}\right)_{\mathit{si}\in\mathit{SEC}}\right) \tag{2.9}$$

3 EQUILIBRIUM

3.1 Identities

$$s \in \mathit{SEC}: \quad Y^{\langle s\rangle} = \sum_{h\in \mathit{HH}} D^{\langle h,s\rangle} + \sum_{\mathit{si}\in \mathit{SEC}} X^{\langle \mathit{si},s\rangle} \tag{3.1}$$

$$\sum_{h\in \mathit{HH}} L^{\langle h\rangle} = \sum_{s\in \mathit{SEC}} L^{\langle s\rangle} \tag{3.2}$$

4 Equilibrium relationships (before expansion and reduction)

$$-\sum_{h\in \mathit{HH}} L^{\langle h\rangle} + \sum_{s\in \mathit{SEC}} L^{\langle s\rangle} = 0 \tag{4.1}$$

$$\mathit{hi} \in \mathit{HH}: \quad \mathit{por}^{\mathrm{k}\langle \mathit{hi}\rangle} - K^{\langle \mathit{hi}\rangle} = 0 \tag{4.2}$$

$$\mathit{hi} \in \mathit{HH}: \quad \mathit{por}^{\mathrm{l}\langle \mathit{hi}\rangle} - L^{\langle \mathit{hi}\rangle} = 0 \tag{4.3}$$

$$h \in \mathit{HH}: \quad U^{\langle h\rangle} - \left(\sum_{s\in \mathit{SEC}} \alpha^{\langle h,s\rangle} D^{\langle h,s\rangle^{\omega^{-1}(-1+\omega)}}\right)^{\omega(-1+\omega)^{-1}} = 0 \tag{4.4}$$

$$h \in \mathit{HH}: \quad L^{\langle h\rangle} + \phi^{\langle h\rangle}\left(\sum_{s\in \mathit{SEC}} \pi^{\langle s\rangle}\right) + p^{\mathrm{k}} K^{\langle h\rangle} - \sum_{s\in \mathit{SEC}} p^{\langle s\rangle} D^{\langle h,s\rangle} = 0 \tag{4.5}$$

$$h \in \mathit{HH}: \quad s \in \mathit{SEC}: \quad -\lambda^{\mathrm{HOUSEHOLD}^{1}\langle h\rangle} p^{\langle s\rangle} + \alpha^{\langle h,s\rangle} D^{\langle h,s\rangle^{-1+\omega^{-1}(-1+\omega)}} \left(\sum_{s\in \mathit{SEC}} \alpha^{\langle h,s\rangle} D^{\langle h,s\rangle^{\omega^{-1}(-1+\omega)}}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{4.6}$$

$$s \in \mathit{SEC}: \quad -1 + \beta^{\mathrm{l}\langle s\rangle} \gamma^{\langle s\rangle} p^{\langle s\rangle} K^{\langle s\rangle^{\beta^{\mathrm{k}\langle s\rangle}}} L^{\langle s\rangle^{-1+\beta^{\mathrm{l}\langle s\rangle}}} \left(\prod_{\mathit{si}\in \mathit{SEC}} X^{\langle s,\mathit{si}\rangle^{\beta^{\mathrm{x}\langle s,\mathit{si}\rangle}}}\right) = 0 \tag{4.7}$$

$$s \in \mathit{SEC}: \quad -p^{\mathrm{k}} + \beta^{\mathrm{k}\langle s\rangle} \gamma^{\langle s\rangle} p^{\langle s\rangle} K^{\langle s\rangle^{-1+\beta^{\mathrm{k}\langle s\rangle}}} L^{\langle s\rangle^{\beta^{\mathrm{l}\langle s\rangle}}} \left(\prod_{\mathit{si}\in \mathit{SEC}} X^{\langle s,\mathit{si}\rangle^{\beta^{\mathrm{x}\langle s,\mathit{si}\rangle}}}\right) = 0 \tag{4.8}$$

$$s \in \mathit{SEC}: \quad -Y^{\langle s\rangle} + \gamma^{\langle s\rangle} K^{\langle s\rangle^{\beta^{\mathrm{k}\langle s\rangle}}} L^{\langle s\rangle^{\beta^{\mathrm{l}\langle s\rangle}}} \left(\prod_{\mathit{si}\in \mathit{SEC}} X^{\langle s,\mathit{si}\rangle^{\beta^{\mathrm{x}\langle s,\mathit{si}\rangle}}}\right) = 0 \tag{4.9}$$

$$s \in \mathit{SEC}: \quad -Y^{\langle s\rangle} + \sum_{h\in \mathit{HH}} D^{\langle h,s\rangle} + \sum_{\mathit{si}\in \mathit{SEC}} X^{\langle \mathit{si},s\rangle} = 0 \tag{4.10}$$

$$s \in SEC: \quad \pi^{\langle s\rangle} + L^{\langle s\rangle} + p^{\mathrm{k}} K^{\langle s\rangle} - p^{\langle s\rangle} Y^{\langle s\rangle} + \sum_{si \in SEC} p^{\langle si\rangle} X^{\langle s,si\rangle} = 0 \tag{4.11}$$

$$s \in SEC: \quad si \in SEC: \quad -p^{\langle si\rangle} + \beta^{\mathrm{x}\langle s,si\rangle} \gamma^{\langle s\rangle} p^{\langle s\rangle} {X^{\langle s,si\rangle}}^{-1} {K^{\langle s\rangle}}^{\beta^{\mathrm{k}\langle s\rangle}} {L^{\langle s\rangle}}^{\beta^{\mathrm{l}\langle s\rangle}} \left(\prod_{si' \in SEC} {X^{\langle s,si'\rangle}}^{\beta^{\mathrm{x}\langle s,si'\rangle}} \right) = 0 \tag{4.12}$$

5 Equilibrium relationships (after expansion and reduction)

$$-1 + \beta^{\mathrm{l}\langle \mathrm{A}\rangle} \gamma^{\langle \mathrm{A}\rangle} p^{\langle \mathrm{A}\rangle} {K^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{A}\rangle}} {L^{\langle \mathrm{A}\rangle}}^{-1+\beta^{\mathrm{l}\langle \mathrm{A}\rangle}} {X^{\langle \mathrm{A,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,A}\rangle}} {X^{\langle \mathrm{A,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,B}\rangle}} {X^{\langle \mathrm{A,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,C}\rangle}} = 0 \tag{5.1}$$

$$-1 + \beta^{\mathrm{l}\langle \mathrm{B}\rangle} \gamma^{\langle \mathrm{B}\rangle} p^{\langle \mathrm{B}\rangle} {K^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{B}\rangle}} {L^{\langle \mathrm{B}\rangle}}^{-1+\beta^{\mathrm{l}\langle \mathrm{B}\rangle}} {X^{\langle \mathrm{B,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,A}\rangle}} {X^{\langle \mathrm{B,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,B}\rangle}} {X^{\langle \mathrm{B,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,C}\rangle}} = 0 \tag{5.2}$$

$$-1 + \beta^{\mathrm{l}\langle \mathrm{C}\rangle} \gamma^{\langle \mathrm{C}\rangle} p^{\langle \mathrm{C}\rangle} {K^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{C}\rangle}} {L^{\langle \mathrm{C}\rangle}}^{-1+\beta^{\mathrm{l}\langle \mathrm{C}\rangle}} {X^{\langle \mathrm{C,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,A}\rangle}} {X^{\langle \mathrm{C,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,B}\rangle}} {X^{\langle \mathrm{C,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,C}\rangle}} = 0 \tag{5.3}$$

$$par^{\mathrm{k}\langle 1\rangle} - K^{\langle 1\rangle} = 0 \tag{5.4}$$

$$par^{\mathrm{k}\langle 2\rangle} - K^{\langle 2\rangle} = 0 \tag{5.5}$$

$$par^{\mathrm{l}\langle 1\rangle} - L^{\langle 1\rangle} = 0 \tag{5.6}$$

$$par^{\mathrm{l}\langle 2\rangle} - L^{\langle 2\rangle} = 0 \tag{5.7}$$

$$-p^{\mathrm{k}} + \beta^{\mathrm{k}\langle \mathrm{A}\rangle} \gamma^{\langle \mathrm{A}\rangle} p^{\langle \mathrm{A}\rangle} {K^{\langle \mathrm{A}\rangle}}^{-1+\beta^{\mathrm{k}\langle \mathrm{A}\rangle}} {L^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{A}\rangle}} {X^{\langle \mathrm{A,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,A}\rangle}} {X^{\langle \mathrm{A,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,B}\rangle}} {X^{\langle \mathrm{A,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,C}\rangle}} = 0 \tag{5.8}$$

$$-p^{\mathrm{k}} + \beta^{\mathrm{k}\langle \mathrm{B}\rangle} \gamma^{\langle \mathrm{B}\rangle} p^{\langle \mathrm{B}\rangle} {K^{\langle \mathrm{B}\rangle}}^{-1+\beta^{\mathrm{k}\langle \mathrm{B}\rangle}} {L^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{B}\rangle}} {X^{\langle \mathrm{B,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,A}\rangle}} {X^{\langle \mathrm{B,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,B}\rangle}} {X^{\langle \mathrm{B,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,C}\rangle}} = 0 \tag{5.9}$$

$$-p^{\mathrm{k}} + \beta^{\mathrm{k}\langle \mathrm{C}\rangle} \gamma^{\langle \mathrm{C}\rangle} p^{\langle \mathrm{C}\rangle} {K^{\langle \mathrm{C}\rangle}}^{-1+\beta^{\mathrm{k}\langle \mathrm{C}\rangle}} {L^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{C}\rangle}} {X^{\langle \mathrm{C,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,A}\rangle}} {X^{\langle \mathrm{C,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,B}\rangle}} {X^{\langle \mathrm{C,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,C}\rangle}} = 0 \tag{5.10}$$

$$-p^{\langle \mathrm{A}\rangle} + \beta^{\mathrm{x}\langle \mathrm{A,A}\rangle} \gamma^{\langle \mathrm{A}\rangle} p^{\langle \mathrm{A}\rangle} {X^{\langle \mathrm{A,A}\rangle}}^{-1} {K^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{A}\rangle}} {L^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{A}\rangle}} {X^{\langle \mathrm{A,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,A}\rangle}} {X^{\langle \mathrm{A,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,B}\rangle}} {X^{\langle \mathrm{A,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,C}\rangle}} = 0 \tag{5.11}$$

$$-p^{\langle \mathrm{A}\rangle} + \beta^{\mathrm{x}\langle \mathrm{B,A}\rangle} \gamma^{\langle \mathrm{B}\rangle} p^{\langle \mathrm{B}\rangle} {X^{\langle \mathrm{B,A}\rangle}}^{-1} {K^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{B}\rangle}} {L^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{B}\rangle}} {X^{\langle \mathrm{B,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,A}\rangle}} {X^{\langle \mathrm{B,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,B}\rangle}} {X^{\langle \mathrm{B,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,C}\rangle}} = 0 \tag{5.12}$$

$$-p^{\langle \mathrm{A}\rangle} + \beta^{\mathrm{x}\langle \mathrm{C,A}\rangle} \gamma^{\langle \mathrm{C}\rangle} p^{\langle \mathrm{C}\rangle} {X^{\langle \mathrm{C,A}\rangle}}^{-1} {K^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{C}\rangle}} {L^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{C}\rangle}} {X^{\langle \mathrm{C,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,A}\rangle}} {X^{\langle \mathrm{C,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,B}\rangle}} {X^{\langle \mathrm{C,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,C}\rangle}} = 0 \tag{5.13}$$

$$-p^{\langle \mathrm{B}\rangle} + \beta^{\mathrm{x}\langle \mathrm{A,B}\rangle} \gamma^{\langle \mathrm{A}\rangle} p^{\langle \mathrm{A}\rangle} {X^{\langle \mathrm{A,B}\rangle}}^{-1} {K^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{A}\rangle}} {L^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{A}\rangle}} {X^{\langle \mathrm{A,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,A}\rangle}} {X^{\langle \mathrm{A,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,B}\rangle}} {X^{\langle \mathrm{A,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,C}\rangle}} = 0 \tag{5.14}$$

$$-p^{\langle \mathrm{B}\rangle} + \beta^{\mathrm{x}\langle \mathrm{B,B}\rangle} \gamma^{\langle \mathrm{B}\rangle} p^{\langle \mathrm{B}\rangle} {X^{\langle \mathrm{B,B}\rangle}}^{-1} {K^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{B}\rangle}} {L^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{B}\rangle}} {X^{\langle \mathrm{B,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,A}\rangle}} {X^{\langle \mathrm{B,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,B}\rangle}} {X^{\langle \mathrm{B,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,C}\rangle}} = 0 \tag{5.15}$$

$$-p^{\langle \mathrm{B}\rangle} + \beta^{\mathrm{x}\langle \mathrm{C,B}\rangle} \gamma^{\langle \mathrm{C}\rangle} p^{\langle \mathrm{C}\rangle} {X^{\langle \mathrm{C,B}\rangle}}^{-1} {K^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{C}\rangle}} {L^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{C}\rangle}} {X^{\langle \mathrm{C,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,A}\rangle}} {X^{\langle \mathrm{C,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,B}\rangle}} {X^{\langle \mathrm{C,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,C}\rangle}} = 0 \tag{5.16}$$

$$-p^{\langle \mathrm{C}\rangle} + \beta^{\mathrm{x}\langle \mathrm{A,C}\rangle}\gamma^{\langle \mathrm{A}\rangle}p^{\langle \mathrm{A}\rangle}{X^{\langle \mathrm{A,C}\rangle}}^{-1}{K^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{A}\rangle}}{L^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{A}\rangle}}{X^{\langle \mathrm{A,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,A}\rangle}}{X^{\langle \mathrm{A,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,B}\rangle}}{X^{\langle \mathrm{A,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,C}\rangle}} = 0 \tag{5.17}$$

$$-p^{\langle \mathrm{C}\rangle} + \beta^{\mathrm{x}\langle \mathrm{B,C}\rangle}\gamma^{\langle \mathrm{B}\rangle}p^{\langle \mathrm{B}\rangle}{X^{\langle \mathrm{B,C}\rangle}}^{-1}{K^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{B}\rangle}}{L^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{B}\rangle}}{X^{\langle \mathrm{B,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,A}\rangle}}{X^{\langle \mathrm{B,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,B}\rangle}}{X^{\langle \mathrm{B,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,C}\rangle}} = 0 \tag{5.18}$$

$$-p^{\langle \mathrm{C}\rangle} + \beta^{\mathrm{x}\langle \mathrm{C,C}\rangle}\gamma^{\langle \mathrm{C}\rangle}p^{\langle \mathrm{C}\rangle}{X^{\langle \mathrm{C,C}\rangle}}^{-1}{K^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{C}\rangle}}{L^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{C}\rangle}}{X^{\langle \mathrm{C,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,A}\rangle}}{X^{\langle \mathrm{C,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,B}\rangle}}{X^{\langle \mathrm{C,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,C}\rangle}} = 0 \tag{5.19}$$

$$U^{\langle 1\rangle} - \left(\alpha^{\langle 1,\mathrm{A}\rangle}{D^{\langle 1,\mathrm{A}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 1,\mathrm{B}\rangle}{D^{\langle 1,\mathrm{B}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 1,\mathrm{C}\rangle}{D^{\langle 1,\mathrm{C}\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{\omega(-1+\omega)^{-1}} = 0 \tag{5.20}$$

$$U^{\langle 2\rangle} - \left(\alpha^{\langle 2,\mathrm{A}\rangle}{D^{\langle 2,\mathrm{A}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 2,\mathrm{B}\rangle}{D^{\langle 2,\mathrm{B}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 2,\mathrm{C}\rangle}{D^{\langle 2,\mathrm{C}\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{\omega(-1+\omega)^{-1}} = 0 \tag{5.21}$$

$$-Y^{\langle \mathrm{A}\rangle} + \gamma^{\langle \mathrm{A}\rangle}{K^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{A}\rangle}}{L^{\langle \mathrm{A}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{A}\rangle}}{X^{\langle \mathrm{A,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,A}\rangle}}{X^{\langle \mathrm{A,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,B}\rangle}}{X^{\langle \mathrm{A,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{A,C}\rangle}} = 0 \tag{5.22}$$

$$-Y^{\langle \mathrm{B}\rangle} + \gamma^{\langle \mathrm{B}\rangle}{K^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{B}\rangle}}{L^{\langle \mathrm{B}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{B}\rangle}}{X^{\langle \mathrm{B,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,A}\rangle}}{X^{\langle \mathrm{B,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,B}\rangle}}{X^{\langle \mathrm{B,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{B,C}\rangle}} = 0 \tag{5.23}$$

$$-Y^{\langle \mathrm{C}\rangle} + \gamma^{\langle \mathrm{C}\rangle}{K^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{k}\langle \mathrm{C}\rangle}}{L^{\langle \mathrm{C}\rangle}}^{\beta^{\mathrm{l}\langle \mathrm{C}\rangle}}{X^{\langle \mathrm{C,A}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,A}\rangle}}{X^{\langle \mathrm{C,B}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,B}\rangle}}{X^{\langle \mathrm{C,C}\rangle}}^{\beta^{\mathrm{x}\langle \mathrm{C,C}\rangle}} = 0 \tag{5.24}$$

$$-{\lambda^{\mathrm{HOUSEHOLD}^{1}}}^{\langle 1\rangle}p^{\langle \mathrm{A}\rangle} + \alpha^{\langle 1,\mathrm{A}\rangle}{D^{\langle 1,\mathrm{A}\rangle}}^{-1+\omega^{-1}(-1+\omega)}\left(\alpha^{\langle 1,\mathrm{A}\rangle}{D^{\langle 1,\mathrm{A}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 1,\mathrm{B}\rangle}{D^{\langle 1,\mathrm{B}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 1,\mathrm{C}\rangle}{D^{\langle 1,\mathrm{C}\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.25}$$

$$-{\lambda^{\mathrm{HOUSEHOLD}^{1}}}^{\langle 1\rangle}p^{\langle \mathrm{B}\rangle} + \alpha^{\langle 1,\mathrm{B}\rangle}{D^{\langle 1,\mathrm{B}\rangle}}^{-1+\omega^{-1}(-1+\omega)}\left(\alpha^{\langle 1,\mathrm{A}\rangle}{D^{\langle 1,\mathrm{A}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 1,\mathrm{B}\rangle}{D^{\langle 1,\mathrm{B}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 1,\mathrm{C}\rangle}{D^{\langle 1,\mathrm{C}\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.26}$$

$$-{\lambda^{\mathrm{HOUSEHOLD}^{1}}}^{\langle 1\rangle}p^{\langle \mathrm{C}\rangle} + \alpha^{\langle 1,\mathrm{C}\rangle}{D^{\langle 1,\mathrm{C}\rangle}}^{-1+\omega^{-1}(-1+\omega)}\left(\alpha^{\langle 1,\mathrm{A}\rangle}{D^{\langle 1,\mathrm{A}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 1,\mathrm{B}\rangle}{D^{\langle 1,\mathrm{B}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 1,\mathrm{C}\rangle}{D^{\langle 1,\mathrm{C}\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.27}$$

$$-{\lambda^{\mathrm{HOUSEHOLD}^{1}}}^{\langle 2\rangle}p^{\langle \mathrm{A}\rangle} + \alpha^{\langle 2,\mathrm{A}\rangle}{D^{\langle 2,\mathrm{A}\rangle}}^{-1+\omega^{-1}(-1+\omega)}\left(\alpha^{\langle 2,\mathrm{A}\rangle}{D^{\langle 2,\mathrm{A}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 2,\mathrm{B}\rangle}{D^{\langle 2,\mathrm{B}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 2,\mathrm{C}\rangle}{D^{\langle 2,\mathrm{C}\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.28}$$

$$-{\lambda^{\mathrm{HOUSEHOLD}^{1}}}^{\langle 2\rangle}p^{\langle \mathrm{B}\rangle} + \alpha^{\langle 2,\mathrm{B}\rangle}{D^{\langle 2,\mathrm{B}\rangle}}^{-1+\omega^{-1}(-1+\omega)}\left(\alpha^{\langle 2,\mathrm{A}\rangle}{D^{\langle 2,\mathrm{A}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 2,\mathrm{B}\rangle}{D^{\langle 2,\mathrm{B}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 2,\mathrm{C}\rangle}{D^{\langle 2,\mathrm{C}\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.29}$$

$$-{\lambda^{\mathrm{HOUSEHOLD}^{1}}}^{\langle 2\rangle}p^{\langle \mathrm{C}\rangle} + \alpha^{\langle 2,\mathrm{C}\rangle}{D^{\langle 2,\mathrm{C}\rangle}}^{-1+\omega^{-1}(-1+\omega)}\left(\alpha^{\langle 2,\mathrm{A}\rangle}{D^{\langle 2,\mathrm{A}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 2,\mathrm{B}\rangle}{D^{\langle 2,\mathrm{B}\rangle}}^{\omega^{-1}(-1+\omega)} + \alpha^{\langle 2,\mathrm{C}\rangle}{D^{\langle 2,\mathrm{C}\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.30}$$

$$-L^{\langle 1\rangle} - L^{\langle 2\rangle} + L^{\langle \mathrm{A}\rangle} + L^{\langle \mathrm{B}\rangle} + L^{\langle \mathrm{C}\rangle} = 0 \tag{5.31}$$

$$D^{\langle 1,\mathrm{A}\rangle} + D^{\langle 2,\mathrm{A}\rangle} + X^{\langle \mathrm{A,A}\rangle} + X^{\langle \mathrm{B,A}\rangle} + X^{\langle \mathrm{C,A}\rangle} - Y^{\langle \mathrm{A}\rangle} = 0 \tag{5.32}$$

$$D^{\langle 1,\mathrm{B}\rangle} + D^{\langle 2,\mathrm{B}\rangle} + X^{\langle \mathrm{A,B}\rangle} + X^{\langle \mathrm{B,B}\rangle} + X^{\langle \mathrm{C,B}\rangle} - Y^{\langle \mathrm{B}\rangle} = 0 \tag{5.33}$$

$$D^{\langle 1,\mathrm{C}\rangle} + D^{\langle 2,\mathrm{C}\rangle} + X^{\langle \mathrm{A,C}\rangle} + X^{\langle \mathrm{B,C}\rangle} + X^{\langle \mathrm{C,C}\rangle} - Y^{\langle \mathrm{C}\rangle} = 0 \tag{5.34}$$

$$L^{\langle 1\rangle} + \phi^{\langle 1\rangle}\left(\pi^{\langle \mathrm{A}\rangle} + \pi^{\langle \mathrm{B}\rangle} + \pi^{\langle \mathrm{C}\rangle}\right) + p^{\mathrm{k}} K^{\langle 1\rangle} - p^{\langle \mathrm{A}\rangle} D^{\langle 1,\mathrm{A}\rangle} - p^{\langle \mathrm{B}\rangle} D^{\langle 1,\mathrm{B}\rangle} - p^{\langle \mathrm{C}\rangle} D^{\langle 1,\mathrm{C}\rangle} = 0 \tag{5.35}$$

$$L^{\langle 2\rangle} + \phi^{\langle 2\rangle}\left(\pi^{\langle \mathrm{A}\rangle} + \pi^{\langle \mathrm{B}\rangle} + \pi^{\langle \mathrm{C}\rangle}\right) + p^{\mathrm{k}} K^{\langle 2\rangle} - p^{\langle \mathrm{A}\rangle} D^{\langle 2,\mathrm{A}\rangle} - p^{\langle \mathrm{B}\rangle} D^{\langle 2,\mathrm{B}\rangle} - p^{\langle \mathrm{C}\rangle} D^{\langle 2,\mathrm{C}\rangle} = 0 \tag{5.36}$$

$$\pi^{\langle \mathrm{A}\rangle} + L^{\langle \mathrm{A}\rangle} + p^{\mathrm{k}} K^{\langle \mathrm{A}\rangle} + p^{\langle \mathrm{A}\rangle} X^{\langle \mathrm{A},\mathrm{A}\rangle} - p^{\langle \mathrm{A}\rangle} Y^{\langle \mathrm{A}\rangle} + p^{\langle \mathrm{B}\rangle} X^{\langle \mathrm{A},\mathrm{B}\rangle} + p^{\langle \mathrm{C}\rangle} X^{\langle \mathrm{A},\mathrm{C}\rangle} = 0 \tag{5.37}$$

$$\pi^{\langle \mathrm{B}\rangle} + L^{\langle \mathrm{B}\rangle} + p^{\mathrm{k}} K^{\langle \mathrm{B}\rangle} + p^{\langle \mathrm{A}\rangle} X^{\langle \mathrm{B},\mathrm{A}\rangle} + p^{\langle \mathrm{B}\rangle} X^{\langle \mathrm{B},\mathrm{B}\rangle} - p^{\langle \mathrm{B}\rangle} Y^{\langle \mathrm{B}\rangle} + p^{\langle \mathrm{C}\rangle} X^{\langle \mathrm{B},\mathrm{C}\rangle} = 0 \tag{5.38}$$

$$\pi^{\langle \mathrm{C}\rangle} + L^{\langle \mathrm{C}\rangle} + p^{\mathrm{k}} K^{\langle \mathrm{C}\rangle} + p^{\langle \mathrm{A}\rangle} X^{\langle \mathrm{C},\mathrm{A}\rangle} + p^{\langle \mathrm{B}\rangle} X^{\langle \mathrm{C},\mathrm{B}\rangle} + p^{\langle \mathrm{C}\rangle} X^{\langle \mathrm{C},\mathrm{C}\rangle} - p^{\langle \mathrm{C}\rangle} Y^{\langle \mathrm{C}\rangle} = 0 \tag{5.39}$$

6 Equilibrium values

	Equilibrium value
p^{k}	1.0008
$\lambda^{\mathrm{HOUSEHOLD^1}\langle 1\rangle}$	0.2524
$\lambda^{\mathrm{HOUSEHOLD^1}\langle 2\rangle}$	0.2524
$p^{\langle \mathrm{A}\rangle}$	0.992
$p^{\langle \mathrm{B}\rangle}$	0.9931
$p^{\langle \mathrm{C}\rangle}$	0.9908
$\pi^{\langle \mathrm{A}\rangle}$	-0.0699
$\pi^{\langle \mathrm{B}\rangle}$	-0.06
$\pi^{\langle \mathrm{C}\rangle}$	-0.07
$D^{\langle 1,\mathrm{A}\rangle}$	11.2953
$D^{\langle 1,\mathrm{B}\rangle}$	3.7712
$D^{\langle 1,\mathrm{C}\rangle}$	15.155
$D^{\langle 2,\mathrm{A}\rangle}$	18.7964
$D^{\langle 2,\mathrm{B}\rangle}$	6.2757
$D^{\langle 2,\mathrm{C}\rangle}$	25.2192
$K^{\langle 1\rangle}$	20
$K^{\langle 2\rangle}$	20
$K^{\langle \mathrm{A}\rangle}$	19.9764
$K^{\langle \mathrm{B}\rangle}$	10.0161
$K^{\langle \mathrm{C}\rangle}$	10.0075
$L^{\langle 1\rangle}$	10
$L^{\langle 2\rangle}$	30
$L^{\langle \mathrm{A}\rangle}$	9.9962
$L^{\langle \mathrm{B}\rangle}$	19.9883
$L^{\langle \mathrm{C}\rangle}$	10.0155
$U^{\langle 1\rangle}$	7.5639
$U^{\langle 2\rangle}$	12.5869
$X^{\langle \mathrm{A},\mathrm{A}\rangle}$	10.0764
$X^{\langle \mathrm{A},\mathrm{B}\rangle}$	20.1315
$X^{\langle \mathrm{A},\mathrm{C}\rangle}$	10.0891
$X^{\langle \mathrm{B},\mathrm{A}\rangle}$	10.1046
$X^{\langle \mathrm{B},\mathrm{B}\rangle}$	10.0939
$X^{\langle \mathrm{B},\mathrm{C}\rangle}$	10.1173
$X^{\langle \mathrm{C},\mathrm{A}\rangle}$	20.1917
$X^{\langle \mathrm{C},\mathrm{B}\rangle}$	20.1703
$X^{\langle \mathrm{C},\mathrm{C}\rangle}$	10.1086
$Y^{\langle \mathrm{A}\rangle}$	70.4644
$Y^{\langle \mathrm{B}\rangle}$	60.4427
$Y^{\langle \mathrm{C}\rangle}$	70.6892