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Index sets

$$HH = \{1, 2\}$$
$$SEC = \{\mathrm{A}, \mathrm{B}, \mathrm{C}\}$$

1 CONSUMER $h \in HH$

1.1 Optimisation problem

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

s.t. :

$$INC^{\langle h\rangle} + \Pi^{\langle h\rangle} = \sum_{s\in SEC} p^{\langle s\rangle} D^{\langle s,h\rangle} \quad \left(\lambda^{\mathrm{CONSUMER}^{1}\langle h\rangle}\right) \tag{1.2}$$

1.2 Identities

$$INC^{\langle h\rangle} = L^{\langle h\rangle} + p^{\mathrm{k}} K^{\langle h\rangle} \tag{1.3}$$

$$K^{\langle h\rangle} = ks^{\mathrm{data}\langle h\rangle} \tag{1.4}$$

$$L^{\langle h\rangle} = ls^{\mathrm{data}\langle h\rangle} \tag{1.5}$$

1.3 First order conditions

$$s \in SEC: \quad \lambda^{\mathrm{CONSUMER}^{1}\langle h\rangle} p^{\langle s\rangle} + \alpha^{\langle s,h\rangle} {D^{\langle s,h\rangle}}^{-1+\omega^{-1}(-1+\omega)} \left(\sum_{s\in SEC} \alpha^{\langle s,h\rangle} {D^{\langle s,h\rangle}}^{\omega^{-1}(-1+\omega)}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \quad \left(D^{\langle s,h\rangle}\right) \tag{1.6}$$

2 FIRM $s \in SEC$

2.1 Optimisation problem

$$\max_{Y^{\langle s\rangle},K^{\langle s\rangle},L^{\langle s\rangle},Y^{\mathrm{VA}\langle s\rangle},Y^{\mathrm{INT}\langle s\rangle}} \pi^{\langle s\rangle} = -L^{\langle s\rangle} - p^{\mathrm{k}}K^{\langle s\rangle} + p^{\langle s\rangle}Y^{\langle s\rangle} - Y^{\mathrm{INT}\langle s\rangle}\left(\sum_{si\in SEC}\beta^{\mathrm{x}\langle si,s\rangle^{-1}}p^{\langle si\rangle}\right) \tag{2.1}$$

s.t. :

$$Y^{\langle s\rangle} = Y^{\mathrm{VA}\langle s\rangle} \quad \left(\lambda^{\mathrm{FIRM}^1\langle s\rangle}\right) \tag{2.2}$$

$$Y^{\langle s\rangle} = Y^{\mathrm{INT}\langle s\rangle} \quad \left(\lambda^{\mathrm{FIRM}^2\langle s\rangle}\right) \tag{2.3}$$

$$Y^{\mathrm{VA}\langle s\rangle} = \gamma^{\mathrm{yva}\langle s\rangle}K^{\langle s\rangle^{\beta^{\mathrm{k}\langle s\rangle}}}L^{\langle s\rangle^{\beta^{\mathrm{l}\langle s\rangle}}} \quad \left(\lambda^{\mathrm{FIRM}^3\langle s\rangle}\right) \tag{2.4}$$

2.2 Identities

$$si \in SEC: \quad X^{\langle si,s\rangle} = \beta^{\mathrm{x}\langle si,s\rangle^{-1}}Y^{\mathrm{INT}\langle s\rangle} \tag{2.5}$$

2.3 First order conditions

$$-\lambda^{\mathrm{FIRM}^1\langle s\rangle} - \lambda^{\mathrm{FIRM}^2\langle s\rangle} + p^{\langle s\rangle} = 0 \quad \left(Y^{\langle s\rangle}\right) \tag{2.6}$$

$$-p^{\mathrm{k}} + \beta^{\mathrm{k}\langle s\rangle}\gamma^{\mathrm{yva}\langle s\rangle}\lambda^{\mathrm{FIRM}^3\langle s\rangle}K^{\langle s\rangle^{-1+\beta^{\mathrm{k}\langle s\rangle}}}L^{\langle s\rangle^{\beta^{\mathrm{l}\langle s\rangle}}} = 0 \quad \left(K^{\langle s\rangle}\right) \tag{2.7}$$

$$-1 + \beta^{\mathrm{l}\langle s\rangle}\gamma^{\mathrm{yva}\langle s\rangle}\lambda^{\mathrm{FIRM}^3\langle s\rangle}K^{\langle s\rangle^{\beta^{\mathrm{k}\langle s\rangle}}}L^{\langle s\rangle^{-1+\beta^{\mathrm{l}\langle s\rangle}}} = 0 \quad \left(L^{\langle s\rangle}\right) \tag{2.8}$$

$$\lambda^{\mathrm{FIRM}^1\langle s\rangle} - \lambda^{\mathrm{FIRM}^3\langle s\rangle} = 0 \quad \left(Y^{\mathrm{VA}\langle s\rangle}\right) \tag{2.9}$$

$$\lambda^{\mathrm{FIRM}^2\langle s\rangle} - \sum_{si\in SEC}\beta^{\mathrm{x}\langle si,s\rangle^{-1}}p^{\langle si\rangle} = 0 \quad \left(Y^{\mathrm{INT}\langle s\rangle}\right) \tag{2.10}$$

2.4 First order conditions after reduction

$$-p^{\mathrm{k}}+\beta^{\mathrm{k}\langle s\rangle}\gamma^{\mathrm{yva}\langle s\rangle}\left(p^{\langle s\rangle}-\sum_{si\in SEC}\beta^{\mathrm{x}\langle si,s\rangle^{-1}}p^{\langle si\rangle}\right)K^{\langle s\rangle^{-1+\beta^{\mathrm{k}\langle s\rangle}}}L^{\langle s\rangle^{\beta^{\mathrm{l}\langle s\rangle}}}=0\quad\left(K^{\langle s\rangle}\right)\tag{2.11}$$

$$-1+\beta^{\mathrm{l}\langle s\rangle}\gamma^{\mathrm{yva}\langle s\rangle}\left(p^{\langle s\rangle}-\sum_{si\in SEC}\beta^{\mathrm{x}\langle si,s\rangle^{-1}}p^{\langle si\rangle}\right)K^{\langle s\rangle^{\beta^{\mathrm{k}\langle s\rangle}}}L^{\langle s\rangle^{-1+\beta^{\mathrm{l}\langle s\rangle}}}=0\quad\left(L^{\langle s\rangle}\right)\tag{2.12}$$

3 EQUILIBRIUM

3.1 Identities

$$\sum_{h\in HH}K^{\langle h\rangle}=\sum_{s\in SEC}K^{\langle s\rangle}\tag{3.1}$$

$$s\in SEC:\quad p^{\langle s\rangle}=1\tag{3.2}$$

$$h\in HH:\quad \Pi^{\langle h\rangle}=\pi^{\mathrm{h}\langle h\rangle}\left(\sum_{s\in SEC}\pi^{\langle s\rangle}\right)\tag{3.3}$$

4 Equilibrium relationships (before expansion and reduction)

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

$$h\in HH:\quad ks^{\mathrm{data}\langle h\rangle}-K^{\langle h\rangle}=0\tag{4.2}$$

$$h\in HH:\quad ls^{\mathrm{data}\langle h\rangle}-L^{\langle h\rangle}=0\tag{4.3}$$

$$h\in HH:\quad -\Pi^{\langle h\rangle}+\pi^{\mathrm{h}\langle h\rangle}\left(\sum_{s\in SEC}\pi^{\langle s\rangle}\right)=0\tag{4.4}$$

$$h\in HH:\quad U^{\langle h\rangle}-\left(\sum_{s\in SEC}\alpha^{\langle s,h\rangle}D^{\langle s,h\rangle^{\omega^{-1}(-1+\omega)}}\right)^{\omega(-1+\omega)^{-1}}=0\tag{4.5}$$

$$h\in HH:\quad -INC^{\langle h\rangle}+L^{\langle h\rangle}+p^{\mathrm{k}}K^{\langle h\rangle}=0\tag{4.6}$$

$$h \in HH: \quad -INC^{\langle h \rangle} - \Pi^{\langle h \rangle} + \sum_{s \in SEC} p^{\langle s \rangle} D^{\langle s,h \rangle} = 0 \tag{4.7}$$

$$h \in HH: \quad s \in SEC: \quad \lambda^{\text{CONSUMER}^1\langle h \rangle} p^{\langle s \rangle} + \alpha^{\langle s,h \rangle} {D^{\langle s,h \rangle}}^{-1+\omega^{-1}(-1+\omega)} \left(\sum_{s \in SEC} \alpha^{\langle s,h \rangle} {D^{\langle s,h \rangle}}^{\omega^{-1}(-1+\omega)} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{4.8}$$

$$s \in SEC: \quad -1 + \beta^{\text{l}\langle s \rangle} \gamma^{\text{yva}\langle s \rangle} \left(p^{\langle s \rangle} - \sum_{si \in SEC} \beta^{\text{x}\langle si,s \rangle^{-1}} p^{\langle si \rangle} \right) {K^{\langle s \rangle}}^{\beta^{\text{k}\langle s \rangle}} {L^{\langle s \rangle}}^{-1+\beta^{\text{l}\langle s \rangle}} = 0 \tag{4.9}$$

$$s \in SEC: \quad 1 - p^{\langle s \rangle} = 0 \tag{4.10}$$

$$s \in SEC: \quad -p^{\text{k}} + \beta^{\text{k}\langle s \rangle} \gamma^{\text{yva}\langle s \rangle} \left(p^{\langle s \rangle} - \sum_{si \in SEC} \beta^{\text{x}\langle si,s \rangle^{-1}} p^{\langle si \rangle} \right) {K^{\langle s \rangle}}^{-1+\beta^{\text{k}\langle s \rangle}} {L^{\langle s \rangle}}^{\beta^{\text{l}\langle s \rangle}} = 0 \tag{4.11}$$

$$s \in SEC: \quad -Y^{\langle s \rangle} + Y^{\text{VA}\langle s \rangle} = 0 \tag{4.12}$$

$$s \in SEC: \quad -Y^{\langle s \rangle} + Y^{\text{INT}\langle s \rangle} = 0 \tag{4.13}$$

$$s \in SEC: \quad -Y^{\text{VA}\langle s \rangle} + \gamma^{\text{yva}\langle s \rangle} {K^{\langle s \rangle}}^{\beta^{\text{k}\langle s \rangle}} {L^{\langle s \rangle}}^{\beta^{\text{l}\langle s \rangle}} = 0 \tag{4.14}$$

$$s \in SEC: \quad \pi^{\langle s \rangle} + L^{\langle s \rangle} + p^{\text{k}} K^{\langle s \rangle} - p^{\langle s \rangle} Y^{\langle s \rangle} + Y^{\text{INT}\langle s \rangle} \left(\sum_{si \in SEC} \beta^{\text{x}\langle si,s \rangle^{-1}} p^{\langle si \rangle} \right) = 0 \tag{4.15}$$

$$s \in SEC: \quad si \in SEC: \quad -X^{\langle si,s \rangle} + \beta^{\text{x}\langle si,s \rangle^{-1}} Y^{\text{INT}\langle s \rangle} = 0 \tag{4.16}$$

5 Equilibrium relationships (after expansion and reduction)

$$-1 + \beta^{\text{l}\langle \text{A} \rangle} \gamma^{\text{yva}\langle \text{A} \rangle} \left(p^{\langle \text{A} \rangle} - \beta^{\text{x}\langle \text{A,A} \rangle^{-1}} p^{\langle \text{A} \rangle} - \beta^{\text{x}\langle \text{B,A} \rangle^{-1}} p^{\langle \text{B} \rangle} - \beta^{\text{x}\langle \text{C,A} \rangle^{-1}} p^{\langle \text{C} \rangle} \right) {K^{\langle \text{A} \rangle}}^{\beta^{\text{k}\langle \text{A} \rangle}} {L^{\langle \text{A} \rangle}}^{-1+\beta^{\text{l}\langle \text{A} \rangle}} = 0 \tag{5.1}$$

$$-1 + \beta^{\text{l}\langle \text{B} \rangle} \gamma^{\text{yva}\langle \text{B} \rangle} \left(p^{\langle \text{B} \rangle} - \beta^{\text{x}\langle \text{A,B} \rangle^{-1}} p^{\langle \text{A} \rangle} - \beta^{\text{x}\langle \text{B,B} \rangle^{-1}} p^{\langle \text{B} \rangle} - \beta^{\text{x}\langle \text{C,B} \rangle^{-1}} p^{\langle \text{C} \rangle} \right) {K^{\langle \text{B} \rangle}}^{\beta^{\text{k}\langle \text{B} \rangle}} {L^{\langle \text{B} \rangle}}^{-1+\beta^{\text{l}\langle \text{B} \rangle}} = 0 \tag{5.2}$$

$$-1 + \beta^{\text{l}\langle \text{C} \rangle} \gamma^{\text{yva}\langle \text{C} \rangle} \left(p^{\langle \text{C} \rangle} - \beta^{\text{x}\langle \text{A,C} \rangle^{-1}} p^{\langle \text{A} \rangle} - \beta^{\text{x}\langle \text{B,C} \rangle^{-1}} p^{\langle \text{B} \rangle} - \beta^{\text{x}\langle \text{C,C} \rangle^{-1}} p^{\langle \text{C} \rangle} \right) {K^{\langle \text{C} \rangle}}^{\beta^{\text{k}\langle \text{C} \rangle}} {L^{\langle \text{C} \rangle}}^{-1+\beta^{\text{l}\langle \text{C} \rangle}} = 0 \tag{5.3}$$

$$1 - p^{\langle \mathrm{A} \rangle} = 0 \tag{5.4}$$

$$1 - p^{\langle \mathrm{B} \rangle} = 0 \tag{5.5}$$

$$1 - p^{\langle \mathrm{C} \rangle} = 0 \tag{5.6}$$

$$ks^{\mathrm{data}\,\langle 1 \rangle} - K^{\langle 1 \rangle} = 0 \tag{5.7}$$

$$ks^{\mathrm{data}\,\langle 2 \rangle} - K^{\langle 2 \rangle} = 0 \tag{5.8}$$

$$ls^{\mathrm{data}\,\langle 1 \rangle} - L^{\langle 1 \rangle} = 0 \tag{5.9}$$

$$ls^{\mathrm{data}\,\langle 2 \rangle} - L^{\langle 2 \rangle} = 0 \tag{5.10}$$

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

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

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

$$-\Pi^{\langle 1 \rangle} + \pi^{\mathrm{h}\,\langle 1 \rangle} \left(\pi^{\langle \mathrm{A} \rangle} + \pi^{\langle \mathrm{B} \rangle} + \pi^{\langle \mathrm{C} \rangle} \right) = 0 \tag{5.14}$$

$$-\Pi^{\langle 2 \rangle} + \pi^{\mathrm{h}\,\langle 2 \rangle} \left(\pi^{\langle \mathrm{A} \rangle} + \pi^{\langle \mathrm{B} \rangle} + \pi^{\langle \mathrm{C} \rangle} \right) = 0 \tag{5.15}$$

$$U^{\langle 1 \rangle} - \left(\alpha^{\langle \mathrm{A},1 \rangle} D^{\langle \mathrm{A},1 \rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{B},1 \rangle} D^{\langle \mathrm{B},1 \rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{C},1 \rangle} D^{\langle \mathrm{C},1 \rangle^{\omega^{-1}(-1+\omega)}} \right)^{\omega(-1+\omega)^{-1}} = 0 \tag{5.16}$$

$$U^{\langle 2 \rangle} - \left(\alpha^{\langle \mathrm{A},2 \rangle} D^{\langle \mathrm{A},2 \rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{B},2 \rangle} D^{\langle \mathrm{B},2 \rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{C},2 \rangle} D^{\langle \mathrm{C},2 \rangle^{\omega^{-1}(-1+\omega)}} \right)^{\omega(-1+\omega)^{-1}} = 0 \tag{5.17}$$

$$-X^{\langle \mathrm{A,A} \rangle} + \beta^{\mathrm{x}\,\langle \mathrm{A,A} \rangle^{-1}} Y^{\mathrm{INT}\,\langle \mathrm{A} \rangle} = 0 \tag{5.18}$$

$$-X^{\langle \mathrm{A,B} \rangle} + \beta^{\mathrm{x}\langle \mathrm{A,B} \rangle^{-1}} Y^{\mathrm{INT}\langle \mathrm{B} \rangle} = 0 \tag{5.19}$$

$$-X^{\langle \mathrm{A,C} \rangle} + \beta^{\mathrm{x}\langle \mathrm{A,C} \rangle^{-1}} Y^{\mathrm{INT}\langle \mathrm{C} \rangle} = 0 \tag{5.20}$$

$$-X^{\langle \mathrm{B,A} \rangle} + \beta^{\mathrm{x}\langle \mathrm{B,A} \rangle^{-1}} Y^{\mathrm{INT}\langle \mathrm{A} \rangle} = 0 \tag{5.21}$$

$$-X^{\langle \mathrm{B,B} \rangle} + \beta^{\mathrm{x}\langle \mathrm{B,B} \rangle^{-1}} Y^{\mathrm{INT}\langle \mathrm{B} \rangle} = 0 \tag{5.22}$$

$$-X^{\langle \mathrm{B,C} \rangle} + \beta^{\mathrm{x}\langle \mathrm{B,C} \rangle^{-1}} Y^{\mathrm{INT}\langle \mathrm{C} \rangle} = 0 \tag{5.23}$$

$$-X^{\langle \mathrm{C,A} \rangle} + \beta^{\mathrm{x}\langle \mathrm{C,A} \rangle^{-1}} Y^{\mathrm{INT}\langle \mathrm{A} \rangle} = 0 \tag{5.24}$$

$$-X^{\langle \mathrm{C,B} \rangle} + \beta^{\mathrm{x}\langle \mathrm{C,B} \rangle^{-1}} Y^{\mathrm{INT}\langle \mathrm{B} \rangle} = 0 \tag{5.25}$$

$$-X^{\langle \mathrm{C,C} \rangle} + \beta^{\mathrm{x}\langle \mathrm{C,C} \rangle^{-1}} Y^{\mathrm{INT}\langle \mathrm{C} \rangle} = 0 \tag{5.26}$$

$$-Y^{\langle \mathrm{A} \rangle} + Y^{\mathrm{VA}\langle \mathrm{A} \rangle} = 0 \tag{5.27}$$

$$-Y^{\langle \mathrm{A} \rangle} + Y^{\mathrm{INT}\langle \mathrm{A} \rangle} = 0 \tag{5.28}$$

$$-Y^{\langle \mathrm{B} \rangle} + Y^{\mathrm{VA}\langle \mathrm{B} \rangle} = 0 \tag{5.29}$$

$$-Y^{\langle \mathrm{B} \rangle} + Y^{\mathrm{INT}\langle \mathrm{B} \rangle} = 0 \tag{5.30}$$

$$-Y^{\langle \mathrm{C} \rangle} + Y^{\mathrm{VA}\langle \mathrm{C} \rangle} = 0 \tag{5.31}$$

$$-Y^{\langle \mathrm{C} \rangle} + Y^{\mathrm{INT}\langle \mathrm{C} \rangle} = 0 \tag{5.32}$$

$$-Y^{\mathrm{VA}\langle \mathrm{A} \rangle} + \gamma^{\mathrm{yva}\langle \mathrm{A} \rangle} K^{\langle \mathrm{A} \rangle^{\beta^{\mathrm{k}\langle \mathrm{A} \rangle}}} L^{\langle \mathrm{A} \rangle^{\beta^{\mathrm{l}\langle \mathrm{A} \rangle}}} = 0 \tag{5.33}$$

$$-Y^{\mathrm{VA}\langle \mathrm{B} \rangle} + \gamma^{\mathrm{yva}\langle \mathrm{B} \rangle} K^{\langle \mathrm{B} \rangle^{\beta^{\mathrm{k}\langle \mathrm{B} \rangle}}} L^{\langle \mathrm{B} \rangle^{\beta^{\mathrm{l}\langle \mathrm{B} \rangle}}} = 0 \tag{5.34}$$

$$-Y^{\mathrm{VA}\langle \mathrm{C}\rangle} + \gamma^{\mathrm{yva}\langle \mathrm{C}\rangle} K^{\langle \mathrm{C}\rangle^{\beta^{\mathrm{k}\langle \mathrm{C}\rangle}}} L^{\langle \mathrm{C}\rangle^{\beta^{\mathrm{l}\langle \mathrm{C}\rangle}}} = 0 \tag{5.35}$$

$$\lambda^{\mathrm{CONSUMER}^{1}\langle 1\rangle} p^{\langle \mathrm{A}\rangle} + \alpha^{\langle \mathrm{A},1\rangle} D^{\langle \mathrm{A},1\rangle^{-1+\omega^{-1}(-1+\omega)}} \left(\alpha^{\langle \mathrm{A},1\rangle} D^{\langle \mathrm{A},1\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{B},1\rangle} D^{\langle \mathrm{B},1\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{C},1\rangle} D^{\langle \mathrm{C},1\rangle^{\omega^{-1}(-1+\omega)}} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.36}$$

$$\lambda^{\mathrm{CONSUMER}^{1}\langle 1\rangle} p^{\langle \mathrm{B}\rangle} + \alpha^{\langle \mathrm{B},1\rangle} D^{\langle \mathrm{B},1\rangle^{-1+\omega^{-1}(-1+\omega)}} \left(\alpha^{\langle \mathrm{A},1\rangle} D^{\langle \mathrm{A},1\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{B},1\rangle} D^{\langle \mathrm{B},1\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{C},1\rangle} D^{\langle \mathrm{C},1\rangle^{\omega^{-1}(-1+\omega)}} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.37}$$

$$\lambda^{\mathrm{CONSUMER}^{1}\langle 1\rangle} p^{\langle \mathrm{C}\rangle} + \alpha^{\langle \mathrm{C},1\rangle} D^{\langle \mathrm{C},1\rangle^{-1+\omega^{-1}(-1+\omega)}} \left(\alpha^{\langle \mathrm{A},1\rangle} D^{\langle \mathrm{A},1\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{B},1\rangle} D^{\langle \mathrm{B},1\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{C},1\rangle} D^{\langle \mathrm{C},1\rangle^{\omega^{-1}(-1+\omega)}} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.38}$$

$$\lambda^{\mathrm{CONSUMER}^{1}\langle 2\rangle} p^{\langle \mathrm{A}\rangle} + \alpha^{\langle \mathrm{A},2\rangle} D^{\langle \mathrm{A},2\rangle^{-1+\omega^{-1}(-1+\omega)}} \left(\alpha^{\langle \mathrm{A},2\rangle} D^{\langle \mathrm{A},2\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{B},2\rangle} D^{\langle \mathrm{B},2\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{C},2\rangle} D^{\langle \mathrm{C},2\rangle^{\omega^{-1}(-1+\omega)}} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.39}$$

$$\lambda^{\mathrm{CONSUMER}^{1}\langle 2\rangle} p^{\langle \mathrm{B}\rangle} + \alpha^{\langle \mathrm{B},2\rangle} D^{\langle \mathrm{B},2\rangle^{-1+\omega^{-1}(-1+\omega)}} \left(\alpha^{\langle \mathrm{A},2\rangle} D^{\langle \mathrm{A},2\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{B},2\rangle} D^{\langle \mathrm{B},2\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{C},2\rangle} D^{\langle \mathrm{C},2\rangle^{\omega^{-1}(-1+\omega)}} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.40}$$

$$\lambda^{\mathrm{CONSUMER}^{1}\langle 2\rangle} p^{\langle \mathrm{C}\rangle} + \alpha^{\langle \mathrm{C},2\rangle} D^{\langle \mathrm{C},2\rangle^{-1+\omega^{-1}(-1+\omega)}} \left(\alpha^{\langle \mathrm{A},2\rangle} D^{\langle \mathrm{A},2\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{B},2\rangle} D^{\langle \mathrm{B},2\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle \mathrm{C},2\rangle} D^{\langle \mathrm{C},2\rangle^{\omega^{-1}(-1+\omega)}} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{5.41}$$

$$-INC^{\langle 1\rangle} + L^{\langle 1\rangle} + p^{\mathrm{k}} K^{\langle 1\rangle} = 0 \tag{5.42}$$

$$-INC^{\langle 2\rangle} + L^{\langle 2\rangle} + p^{\mathrm{k}} K^{\langle 2\rangle} = 0 \tag{5.43}$$

$$\pi^{\langle \mathrm{A}\rangle} + L^{\langle \mathrm{A}\rangle} + p^{\mathrm{k}} K^{\langle \mathrm{A}\rangle} - p^{\langle \mathrm{A}\rangle} Y^{\langle \mathrm{A}\rangle} + Y^{\mathrm{INT}\langle \mathrm{A}\rangle} \left(\beta^{\mathrm{x}\langle \mathrm{A},\mathrm{A}\rangle^{-1}} p^{\langle \mathrm{A}\rangle} + \beta^{\mathrm{x}\langle \mathrm{B},\mathrm{A}\rangle^{-1}} p^{\langle \mathrm{B}\rangle} + \beta^{\mathrm{x}\langle \mathrm{C},\mathrm{A}\rangle^{-1}} p^{\langle \mathrm{C}\rangle} \right) = 0 \tag{5.44}$$

$$\pi^{\langle \mathrm{B}\rangle} + L^{\langle \mathrm{B}\rangle} + p^{\mathrm{k}} K^{\langle \mathrm{B}\rangle} - p^{\langle \mathrm{B}\rangle} Y^{\langle \mathrm{B}\rangle} + Y^{\mathrm{INT}\langle \mathrm{B}\rangle} \left(\beta^{\mathrm{x}\langle \mathrm{A},\mathrm{B}\rangle^{-1}} p^{\langle \mathrm{A}\rangle} + \beta^{\mathrm{x}\langle \mathrm{B},\mathrm{B}\rangle^{-1}} p^{\langle \mathrm{B}\rangle} + \beta^{\mathrm{x}\langle \mathrm{C},\mathrm{B}\rangle^{-1}} p^{\langle \mathrm{C}\rangle} \right) = 0 \tag{5.45}$$

$$\pi^{\langle \mathrm{C}\rangle} + L^{\langle \mathrm{C}\rangle} + p^{\mathrm{k}} K^{\langle \mathrm{C}\rangle} - p^{\langle \mathrm{C}\rangle} Y^{\langle \mathrm{C}\rangle} + Y^{\mathrm{INT}\langle \mathrm{C}\rangle} \left(\beta^{\mathrm{x}\langle \mathrm{A},\mathrm{C}\rangle^{-1}} p^{\langle \mathrm{A}\rangle} + \beta^{\mathrm{x}\langle \mathrm{B},\mathrm{C}\rangle^{-1}} p^{\langle \mathrm{B}\rangle} + \beta^{\mathrm{x}\langle \mathrm{C},\mathrm{C}\rangle^{-1}} p^{\langle \mathrm{C}\rangle} \right) = 0 \tag{5.46}$$

$$-INC^{\langle 1\rangle} - \Pi^{\langle 1\rangle} + p^{\langle \mathrm{A}\rangle} D^{\langle \mathrm{A},1\rangle} + p^{\langle \mathrm{B}\rangle} D^{\langle \mathrm{B},1\rangle} + p^{\langle \mathrm{C}\rangle} D^{\langle \mathrm{C},1\rangle} = 0 \tag{5.47}$$

$$-INC^{\langle 2\rangle} - \Pi^{\langle 2\rangle} + p^{\langle \mathrm{A}\rangle} D^{\langle \mathrm{A},2\rangle} + p^{\langle \mathrm{B}\rangle} D^{\langle \mathrm{B},2\rangle} + p^{\langle \mathrm{C}\rangle} D^{\langle \mathrm{C},2\rangle} = 0 \tag{5.48}$$

$$-K^{\langle 1\rangle} - K^{\langle 2\rangle} + K^{\langle \mathrm{A}\rangle} + K^{\langle \mathrm{B}\rangle} + K^{\langle \mathrm{C}\rangle} = 0 \tag{5.49}$$

6 Calibrating equations

$$-d^{\text{data}\langle \text{B,1}\rangle} + D^{\langle \text{B,1}\rangle} = 0 \tag{6.1}$$

$$-d^{\text{data}\langle \text{B,2}\rangle} + D^{\langle \text{B,2}\rangle} = 0 \tag{6.2}$$

$$-d^{\text{data}\langle \text{C,1}\rangle} + D^{\langle \text{C,1}\rangle} = 0 \tag{6.3}$$

$$-d^{\text{data}\langle \text{C,2}\rangle} + D^{\langle \text{C,2}\rangle} = 0 \tag{6.4}$$

$$-l^{\text{data}\langle \text{A}\rangle} + L^{\langle \text{A}\rangle} = 0 \tag{6.5}$$

$$-l^{\text{data}\langle \text{B}\rangle} + L^{\langle \text{B}\rangle} = 0 \tag{6.6}$$

$$-l^{\text{data}\langle \text{C}\rangle} + L^{\langle \text{C}\rangle} = 0 \tag{6.7}$$

∞

$$-x^{\text{data}\langle \text{A,A}\rangle} + X^{\langle \text{A,A}\rangle} = 0 \tag{6.8}$$

$$-x^{\text{data}\langle \text{A,B}\rangle} + X^{\langle \text{A,B}\rangle} = 0 \tag{6.9}$$

$$-x^{\text{data}\langle \text{A,C}\rangle} + X^{\langle \text{A,C}\rangle} = 0 \tag{6.10}$$

$$-x^{\text{data}\langle \text{B,A}\rangle} + X^{\langle \text{B,A}\rangle} = 0 \tag{6.11}$$

$$-x^{\text{data}\langle \text{B,B}\rangle} + X^{\langle \text{B,B}\rangle} = 0 \tag{6.12}$$

$$-x^{\text{data}\langle \text{B,C}\rangle} + X^{\langle \text{B,C}\rangle} = 0 \tag{6.13}$$

$$-x^{\text{data}\langle \text{C,A}\rangle} + X^{\langle \text{C,A}\rangle} = 0 \tag{6.14}$$

$$-x^{\text{data}\langle \text{C,B}\rangle} + X^{\langle \text{C,B}\rangle} = 0 \tag{6.15}$$

$$-x^{\text{data}\langle \text{C,C}\rangle} + X^{\langle \text{C,C}\rangle} = 0 \tag{6.16}$$

$$-y^{\mathrm{data}\,\langle \mathrm{A} \rangle} + Y^{\mathrm{VA}\,\langle \mathrm{A} \rangle} = 0 \tag{6.17}$$

$$-y^{\mathrm{data}\,\langle \mathrm{B} \rangle} + Y^{\mathrm{VA}\,\langle \mathrm{B} \rangle} = 0 \tag{6.18}$$

$$-y^{\mathrm{data}\,\langle \mathrm{C} \rangle} + Y^{\mathrm{VA}\,\langle \mathrm{C} \rangle} = 0 \tag{6.19}$$

$$-1 + \beta^{\mathrm{k}\,\langle \mathrm{A} \rangle} + \beta^{\mathrm{l}\,\langle \mathrm{A} \rangle} = 0 \tag{6.20}$$

$$-1 + \beta^{\mathrm{k}\,\langle \mathrm{B} \rangle} + \beta^{\mathrm{l}\,\langle \mathrm{B} \rangle} = 0 \tag{6.21}$$

$$-1 + \beta^{\mathrm{k}\,\langle \mathrm{C} \rangle} + \beta^{\mathrm{l}\,\langle \mathrm{C} \rangle} = 0 \tag{6.22}$$

$$-1 + \pi^{\mathrm{h}\,\langle 1 \rangle} + \pi^{\mathrm{h}\,\langle 2 \rangle} = 0 \tag{6.23}$$

$$-1 + \alpha^{\langle \mathrm{A},1 \rangle^{\omega}} + \alpha^{\langle \mathrm{B},1 \rangle^{\omega}} + \alpha^{\langle \mathrm{C},1 \rangle^{\omega}} = 0 \tag{6.24}$$

$$-1 + \alpha^{\langle \mathrm{A},2 \rangle^{\omega}} + \alpha^{\langle \mathrm{B},2 \rangle^{\omega}} + \alpha^{\langle \mathrm{C},2 \rangle^{\omega}} = 0 \tag{6.25}$$

7 Equilibrium values

	Equilibrium values
p^{k}	1
$\lambda^{\mathrm{CONSUMER}^{1^1}}$	-1
$\lambda^{\mathrm{CONSUMER}^{1^2}}$	-1
p^{A}	1
p^{B}	1
p^{C}	1
π^{A}	0
π^{B}	0
π^{C}	0
D^{A^1}	52.94
D^{A^2}	64.45
D^{B^1}	11.7
D^{B^2}	30.79
D^{C^1}	18.6
D^{C^2}	43.6
INC^1	83.24
INC^2	138.84
K^1	65.07
K^2	68.77
K^{A}	38.1
K^{B}	35.01
K^{C}	60.73
L^1	18.17
L^2	70.07
L^{A}	9.44
L^{B}	31.6
L^{C}	47.2
Π^1	0
Π^2	0
U^1	83.24
U^2	138.84
$X^{\mathrm{A}^{\mathrm{A}}}$	68.4
$X^{\mathrm{A}^{\mathrm{B}}}$	131.01
$X^{\mathrm{A}^{\mathrm{C}}}$	28.28
$X^{\mathrm{B}^{\mathrm{A}}}$	111.91
$X^{\mathrm{B}^{\mathrm{B}}}$	92.3
$X^{\mathrm{B}^{\mathrm{C}}}$	86.92
$X^{\mathrm{C}^{\mathrm{A}}}$	117.23
$X^{\mathrm{C}^{\mathrm{B}}}$	43.7
$X^{\mathrm{C}^{\mathrm{C}}}$	111.65
Y^{A}	345.08
Y^{B}	333.62
Y^{C}	334.78
$Y^{\mathrm{VA}^{\mathrm{A}}}$	345.08
$Y^{\mathrm{VA}^{\mathrm{B}}}$	333.62
$Y^{\mathrm{VA}^{\mathrm{C}}}$	334.78
$Y^{\mathrm{INT}^{\mathrm{A}}}$	345.08
$Y^{\mathrm{INT}^{\mathrm{B}}}$	333.62
$Y^{\mathrm{INT}^{\mathrm{C}}}$	334.78

8 Parameters of the model

	Parameters
ω	2
α^{A^1}	0.7975
α^{A^2}	0.6813
α^{B^1}	0.3749
α^{B^2}	0.4709
α^{C^1}	0.4727
α^{C^2}	0.5604
$\beta^{\mathrm{k}^{\mathrm{A}}}$	0.8014
$\beta^{\mathrm{k}^{\mathrm{B}}}$	0.5256
$\beta^{\mathrm{k}^{\mathrm{C}}}$	0.5627
$\beta^{\mathrm{l}^{\mathrm{A}}}$	0.1986
$\beta^{\mathrm{l}^{\mathrm{B}}}$	0.4744
$\beta^{\mathrm{l}^{\mathrm{C}}}$	0.4373
$\beta^{\mathrm{x}^{\mathrm{A}^{\mathrm{A}}}}$	5.045
$\beta^{\mathrm{x}^{\mathrm{A}^{\mathrm{B}}}}$	2.5465
$\beta^{\mathrm{x}^{\mathrm{A}^{\mathrm{C}}}}$	11.838
$\beta^{\mathrm{x}^{\mathrm{B}^{\mathrm{A}}}}$	3.0835
$\beta^{\mathrm{x}^{\mathrm{B}^{\mathrm{B}}}}$	3.6145
$\beta^{\mathrm{x}^{\mathrm{B}^{\mathrm{C}}}}$	3.8516
$\beta^{\mathrm{x}^{\mathrm{C}^{\mathrm{A}}}}$	2.9436
$\beta^{\mathrm{x}^{\mathrm{C}^{\mathrm{B}}}}$	7.6343
$\beta^{\mathrm{x}^{\mathrm{C}^{\mathrm{C}}}}$	2.9985
$d^{\mathrm{data}^{\mathrm{B}^1}}$	11.7
$d^{\mathrm{data}^{\mathrm{B}^2}}$	30.79
$d^{\mathrm{data}^{\mathrm{C}^1}}$	18.6
$d^{\mathrm{data}^{\mathrm{C}^2}}$	43.6
$\gamma^{\mathrm{yva}^{\mathrm{A}}}$	11.9486
$\gamma^{\mathrm{yva}^{\mathrm{B}}}$	10.004
$\gamma^{\mathrm{yva}^{\mathrm{C}}}$	6.155
ks^{data^1}	65.07
ks^{data^2}	68.77
$l^{\mathrm{data}^{\mathrm{A}}}$	9.44
$l^{\mathrm{data}^{\mathrm{B}}}$	31.6
$l^{\mathrm{data}^{\mathrm{C}}}$	47.2
ls^{data^1}	18.17
ls^{data^2}	70.07
π^{h^1}	0.5
π^{h^2}	0.5
$x^{\mathrm{data}^{\mathrm{A}^{\mathrm{A}}}}$	68.4
$x^{\mathrm{data}^{\mathrm{A}^{\mathrm{B}}}}$	131.01
$x^{\mathrm{data}^{\mathrm{A}^{\mathrm{C}}}}$	28.28
$x^{\mathrm{data}^{\mathrm{B}^{\mathrm{A}}}}$	111.91
$x^{\mathrm{data}^{\mathrm{B}^{\mathrm{B}}}}$	92.3
$x^{\mathrm{data}^{\mathrm{B}^{\mathrm{C}}}}$	86.92
$x^{\mathrm{data}^{\mathrm{C}^{\mathrm{A}}}}$	117.23
$x^{\mathrm{data}^{\mathrm{C}^{\mathrm{B}}}}$	43.7
$x^{\mathrm{data}^{\mathrm{C}^{\mathrm{C}}}}$	111.65
$y^{\mathrm{data}^{\mathrm{A}}}$	345.08
$y^{\mathrm{data}^{\mathrm{B}}}$	333.62
$y^{\mathrm{data}^{\mathrm{C}}}$	334.78