Index sets

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

$$SEC = \{\text{A}, \text{B}, \text{C}\}$$

1 HOUSEHOLD $h \in HH$

1.1 Optimisation problem

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

s.t. :

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

1.2 Identities

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

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

1.3 First order conditions

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

2 FIRM $s \in SEC$

2.1 Optimisation problem

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

s.t. :

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

2.2 First order conditions

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

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

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

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

2.3 First order conditions after reduction

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

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

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

3 EQUILIBRIUM

3.1 Identities

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

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

4 Equilibrium relationships (before expansion and reduction)

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

$$hi \in HH: \quad par^{k\,\langle hi \rangle} - K^{\langle hi \rangle} = 0 \tag{4.2}$$

$$hi \in HH: \quad par^{l\,\langle hi \rangle} - L^{\langle hi \rangle} = 0 \tag{4.3}$$

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

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

$$h \in HH: \quad s \in SEC: \quad -\lambda^{\mathrm{HOUSEHOLD1}\,\langle h \rangle} p^{\langle s \rangle} + \alpha^{\langle h,s \rangle} D^{\langle h,s \rangle^{-1+\omega^{-1}(-1+\omega)}} \left(\sum_{s \in SEC} \alpha^{\langle h,s \rangle} D^{\langle h,s \rangle^{\omega^{-1}(-1+\omega)}} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \tag{4.6}$$

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

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

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

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

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

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

5 Equilibrium relationships (after expansion and reduction)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$-\lambda^{\mathrm{HOUSEHOLD1}\,\langle 1\rangle}p^{\langle \mathrm{C}\rangle} + \alpha^{\langle 1,\mathrm{C}\rangle}D^{\langle 1,\mathrm{C}\rangle^{-1+\omega^{-1}(-1+\omega)}}\left(\alpha^{\langle 1,\mathrm{A}\rangle}D^{\langle 1,\mathrm{A}\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle 1,\mathrm{B}\rangle}D^{\langle 1,\mathrm{B}\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle 1,\mathrm{C}\rangle}D^{\langle 1,\mathrm{C}\rangle^{\omega^{-1}(-1+\omega)}}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \qquad (5.27)$$

$$-\lambda^{\mathrm{HOUSEHOLD1}\,\langle 2\rangle}p^{\langle \mathrm{A}\rangle} + \alpha^{\langle 2,\mathrm{A}\rangle}D^{\langle 2,\mathrm{A}\rangle^{-1+\omega^{-1}(-1+\omega)}}\left(\alpha^{\langle 2,\mathrm{A}\rangle}D^{\langle 2,\mathrm{A}\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle 2,\mathrm{B}\rangle}D^{\langle 2,\mathrm{B}\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle 2,\mathrm{C}\rangle}D^{\langle 2,\mathrm{C}\rangle^{\omega^{-1}(-1+\omega)}}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \qquad (5.28)$$

$$-\lambda^{\mathrm{HOUSEHOLD1}\,\langle 2\rangle}p^{\langle \mathrm{B}\rangle} + \alpha^{\langle 2,\mathrm{B}\rangle}D^{\langle 2,\mathrm{B}\rangle^{-1+\omega^{-1}(-1+\omega)}}\left(\alpha^{\langle 2,\mathrm{A}\rangle}D^{\langle 2,\mathrm{A}\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle 2,\mathrm{B}\rangle}D^{\langle 2,\mathrm{B}\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle 2,\mathrm{C}\rangle}D^{\langle 2,\mathrm{C}\rangle^{\omega^{-1}(-1+\omega)}}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \qquad (5.29)$$

$$-\lambda^{\mathrm{HOUSEHOLD1}\,\langle 2\rangle}p^{\langle \mathrm{C}\rangle} + \alpha^{\langle 2,\mathrm{C}\rangle}D^{\langle 2,\mathrm{C}\rangle^{-1+\omega^{-1}(-1+\omega)}}\left(\alpha^{\langle 2,\mathrm{A}\rangle}D^{\langle 2,\mathrm{A}\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle 2,\mathrm{B}\rangle}D^{\langle 2,\mathrm{B}\rangle^{\omega^{-1}(-1+\omega)}} + \alpha^{\langle 2,\mathrm{C}\rangle}D^{\langle 2,\mathrm{C}\rangle^{\omega^{-1}(-1+\omega)}}\right)^{-1+\omega(-1+\omega)^{-1}} = 0 \qquad (5.30)$$

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

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

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

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

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

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

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

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

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

6 Equilibrium values

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