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Index sets

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

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

1 HOUSEHOLD $h \in HH$

1.1 Optimisation problem

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

s.t. :

$$\sum_{s\in SEC} p^{\langle s\rangle} D^{\langle h,s\rangle} = L^{\langle h\rangle} + p^{\mathrm{k}} K^{\langle h\rangle} + \sum_{s\in SEC} \pi^{\langle s\rangle} \left(\delta^{\langle 1,h\rangle}\left(1 - \sum_{h2\in HH\setminus\{1\}} \phi^{\langle h2\rangle}\right) + \phi^{\langle h\rangle}\left(1 - \delta^{\langle 1,h\rangle}\right)\right) \quad \left(\lambda^{\mathrm{HOUSEHOLD}^{1}\,\langle h\rangle}\right) \tag{1.2}$$

1.2 Identities

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

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

1.3 First order conditions

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

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

2.1 Optimisation problem

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

s.t. :

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

2.2 First order conditions

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

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

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

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

2.3 First order conditions after reduction

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

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

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

3 EQUILIBRIUM

3.1 Identities

$$s \in \mathit{SEC}\colon \quad Y_t^{\langle s\rangle} = \sum_{h\in \mathit{HH}} D_t^{\langle h,s\rangle} + \sum_{\mathit{si}\in \mathit{SEC}} X_t^{\langle \mathit{si},s\rangle} \tag{3.1}$$

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

4 Equilibrium relationships (before expansion and reduction)

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

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

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

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

$$h \in \mathit{HH}\colon \quad L^{\langle h\rangle} + p^{\mathrm{k}} K^{\langle h\rangle} - \sum_{s\in \mathit{SEC}} p^{\langle s\rangle} D^{\langle h,s\rangle} + \sum_{s\in \mathit{SEC}} \pi^{\langle s\rangle} \left(\delta^{\langle 1,h\rangle}\left(1 - \sum_{\mathit{h2}\in \mathit{HH}\setminus\{1\}} \phi^{\langle \mathit{h2}\rangle}\right) + \phi^{\langle h\rangle}\left(1-\delta^{\langle 1,h\rangle}\right)\right) = 0 \tag{4.5}$$

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

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

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

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

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

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

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

5 Equilibrium relationships (after expansion and reduction)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\pi^{\langle \mathrm{A}\rangle} + L^{\langle \mathrm{A}\rangle} + p^{\mathrm{k}}K^{\langle \mathrm{A}\rangle} + p^{\langle \mathrm{A}\rangle}X^{\langle \mathrm{A},\mathrm{A}\rangle} - p^{\langle \mathrm{A}\rangle}Y^{\langle \mathrm{A}\rangle} + p^{\langle \mathrm{B}\rangle}X^{\langle \mathrm{A},\mathrm{B}\rangle} + p^{\langle \mathrm{C}\rangle}X^{\langle \mathrm{A},\mathrm{C}\rangle} = 0 \tag{5.35}$$

$$\pi^{\langle \mathrm{B}\rangle} + L^{\langle \mathrm{B}\rangle} + p^{\mathrm{k}}K^{\langle \mathrm{B}\rangle} + p^{\langle \mathrm{A}\rangle}X^{\langle \mathrm{B},\mathrm{A}\rangle} + p^{\langle \mathrm{B}\rangle}X^{\langle \mathrm{B},\mathrm{B}\rangle} - p^{\langle \mathrm{B}\rangle}Y^{\langle \mathrm{B}\rangle} + p^{\langle \mathrm{C}\rangle}X^{\langle \mathrm{B},\mathrm{C}\rangle} = 0 \tag{5.36}$$

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

$$L^{\langle 1\rangle} + p^{\mathrm{k}}K^{\langle 1\rangle} - p^{\langle \mathrm{A}\rangle}D^{\langle 1,\mathrm{A}\rangle} - p^{\langle \mathrm{B}\rangle}D^{\langle 1,\mathrm{B}\rangle} - p^{\langle \mathrm{C}\rangle}D^{\langle 1,\mathrm{C}\rangle} + \pi^{\langle \mathrm{A}\rangle}\left(1-\phi^{\langle 2\rangle}\right) + \pi^{\langle \mathrm{B}\rangle}\left(1-\phi^{\langle 2\rangle}\right) + \pi^{\langle \mathrm{C}\rangle}\left(1-\phi^{\langle 2\rangle}\right) = 0 \tag{5.38}$$

$$L^{\langle 2\rangle} + \phi^{\langle 2\rangle}\pi^{\langle \mathrm{A}\rangle} + \phi^{\langle 2\rangle}\pi^{\langle \mathrm{B}\rangle} + \phi^{\langle 2\rangle}\pi^{\langle \mathrm{C}\rangle} + p^{\mathrm{k}}K^{\langle 2\rangle} - p^{\langle \mathrm{A}\rangle}D^{\langle 2,\mathrm{A}\rangle} - p^{\langle \mathrm{B}\rangle}D^{\langle 2,\mathrm{B}\rangle} - p^{\langle \mathrm{C}\rangle}D^{\langle 2,\mathrm{C}\rangle} = 0 \tag{5.39}$$