

Index sets

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

1 CONSUMER

1.1 Optimisation problem

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

s.t. :

$$H^{inc} (1 - \tau^h) = - \sum_{s \in SEC} \pi^{(s)} + \sum_{s \in SEC} p^{(s)} D^{(s)} \quad (\lambda^{CONSUMER^1}) \quad (1.2)$$

1.2 Identities

$$H^{inc} = L + TR + p^k K \quad (1.3)$$

$$K = p w^k \quad (1.4)$$

$$L = p w^l \quad (1.5)$$

1.3 First order conditions

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

2 FIRM $s \in SEC$

2.1 Optimisation problem

$$\max_{Y^{(s)}, K^{(s)}, L^{(s)}, (X^{(s_i, s)})_{s_i \in SEC}, VA^{(s)}, CI^{(s)}, T\dot{p}^{(s)}} \pi^{(s)} = T\dot{p}^{(s)} (1 - \tau) \quad (2.1)$$

s.t. :

$$Y^{(s)} = \left(\beta^{va(s)} VA^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) + \beta^{ci(s)} CI^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) \right)^{\gamma^{(s)} (-1 + \gamma^{(s)})^{-1}} \left(\lambda^{FIRM^1(s)} \right) \quad (2.2)$$

$$VA^{(s)} = \left(\beta^{k(s)} K^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) + \beta^{l(s)} L^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) \right)^{\gamma^{(s)} (-1 + \gamma^{(s)})^{-1}} \left(\lambda^{FIRM^2(s)} \right) \quad (2.3)$$

$$CI^{(s)} = \left(\sum_{s_i \in SEC} \chi^{(s_i, s)} X^{(s_i, s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) \right)^{\gamma^{(s)} (-1 + \gamma^{(s)})^{-1}} \left(\lambda^{FIRM^3(s)} \right) \quad (2.4)$$

$$T\dot{p}^{(s)} = p^{(s)} Y^{(s)} - L^{(s)} (1 + t^l) - p^k K^{(s)} (1 + t^k) - \sum_{s_i \in SEC} p^{(s_i)} X^{(s_i, s)} \left(\lambda^{FIRM^4(s)} \right) \quad (2.5)$$

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2.2 First order conditions

$$-\lambda^{FIRM^1(s)} + \lambda^{FIRM^4(s)} p^{(s)} = 0 \quad (Y^{(s)}) \quad (2.6)$$

$$-p^k \lambda^{FIRM^4(s)} (1 + t^k) + \beta^{k(s)} \lambda^{FIRM^2(s)} K^{(s)-1 + \gamma^{(s)-1} (-1 + \gamma^{(s)})} \left(\beta^{k(s)} K^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) + \beta^{l(s)} L^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) \right)^{-1 + \gamma^{(s)} (-1 + \gamma^{(s)})^{-1}} = 0 \quad (K^{(s)}) \quad (2.7)$$

$$\lambda^{FIRM^4(s)} (-1 - t^l) + \beta^{l(s)} \lambda^{FIRM^2(s)} L^{(s)-1 + \gamma^{(s)-1} (-1 + \gamma^{(s)})} \left(\beta^{k(s)} K^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) + \beta^{l(s)} L^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) \right)^{-1 + \gamma^{(s)} (-1 + \gamma^{(s)})^{-1}} = 0 \quad (L^{(s)}) \quad (2.8)$$

$$s_i \in SEC: \quad -\lambda^{FIRM^4(s)} p^{(s_i)} + \chi^{(s_i, s)} \lambda^{FIRM^3(s)} X^{(s_i, s)-1 + \gamma^{(s)-1} (-1 + \gamma^{(s)})} \left(\sum_{s_i \in SEC} \chi^{(s_i, s)} X^{(s_i, s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) \right)^{-1 + \gamma^{(s)} (-1 + \gamma^{(s)})^{-1}} = 0 \quad (X^{(s_i, s)}) \quad (2.9)$$

$$-\lambda^{FIRM^2(s)} + \beta^{va(s)} \lambda^{FIRM^1(s)} VA^{(s)-1 + \gamma^{(s)-1} (-1 + \gamma^{(s)})} \left(\beta^{va(s)} VA^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) + \beta^{ci(s)} CI^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) \right)^{-1 + \gamma^{(s)} (-1 + \gamma^{(s)})^{-1}} = 0 \quad (VA^{(s)}) \quad (2.10)$$

$$-\lambda^{FIRM^3(s)} + \beta^{ci(s)} \lambda^{FIRM^1(s)} CI^{(s)-1 + \gamma^{(s)-1} (-1 + \gamma^{(s)})} \left(\beta^{va(s)} VA^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) + \beta^{ci(s)} CI^{(s)} \gamma^{(s)-1} (-1 + \gamma^{(s)}) \right)^{-1 + \gamma^{(s)} (-1 + \gamma^{(s)})^{-1}} = 0 \quad (CI^{(s)}) \quad (2.11)$$

$$1 - \tau - \lambda^{FIRM^4(s)} = 0 \quad (T\dot{p}^{(s)}) \quad (2.12)$$

2.3 First order conditions after reduction

$$-p^k (1+t^k) (1-\tau) + \beta^k \beta^{va\langle s \rangle} p^{\langle s \rangle} (1-\tau) K^{\langle s \rangle -1 + \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} VA^{\langle s \rangle -1 + \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} \left(\beta^k K^{\langle s \rangle \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} + \beta^l L^{\langle s \rangle \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} \right)^{-1 + \gamma^{\langle s \rangle} (-1 + \gamma^{\langle s \rangle})^{-1}} \left(\beta^{va\langle s \rangle} VA^{\langle s \rangle \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} \right)^{-1} \quad (2.13)$$

$$(-1-t^l) (1-\tau) + \beta^l \beta^{va\langle s \rangle} p^{\langle s \rangle} (1-\tau) L^{\langle s \rangle -1 + \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} VA^{\langle s \rangle -1 + \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} \left(\beta^k K^{\langle s \rangle \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} + \beta^l L^{\langle s \rangle \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} \right)^{-1 + \gamma^{\langle s \rangle} (-1 + \gamma^{\langle s \rangle})^{-1}} \left(\beta^{va\langle s \rangle} VA^{\langle s \rangle \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} \right)^{-1} \quad (2.14)$$

$$\dot{s} \in SEC: -p^{\langle \dot{s} \rangle} (1-\tau) + \beta^{ci\langle \dot{s} \rangle} \chi^{\langle \dot{s}, s \rangle} p^{\langle s \rangle} (1-\tau) CI^{\langle s \rangle -1 + \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} X^{\langle \dot{s}, s \rangle -1 + \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} \left(\beta^{va\langle s \rangle} VA^{\langle s \rangle \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} + \beta^{ci\langle s \rangle} CI^{\langle s \rangle \gamma^{\langle s \rangle -1} (-1 + \gamma^{\langle s \rangle})} \right)^{-1 + \gamma^{\langle s \rangle} (-1 + \gamma^{\langle s \rangle})^{-1}} \left(\sum_{\dot{s} \in SEC} \dots \right)^{-1} \quad (2.15)$$

3 GOVERNMENT

3.1 Identities

$$G^{inc} = TR \quad (3.1)$$

$$G^{inc} = T^{hh} + T^{firms} + T^{lk} \quad (3.2)$$

$$T^{hh} = \tau^h H^{inc} \quad (3.3)$$

$$T^{firms} = \tau \left(\sum_{s \in SEC} T\dot{\pi}^{\langle s \rangle} \right) \quad (3.4)$$

$$T^{lk} = t^l \left(\sum_{\dot{s} \in SEC} L^{\langle \dot{s} \rangle} \right) + t^k p^k \left(\sum_{s \in SEC} K^{\langle s \rangle} \right) \quad (3.5)$$

4 EQUILIBRIUM

4.1 Identities

$$s \in SEC: Y^{\langle s \rangle} = D^{\langle s \rangle} + \sum_{\dot{s} \in SEC} X^{\langle s, \dot{s} \rangle} \quad (4.1)$$

$$K = \sum_{s \in SEC} K^{\langle s \rangle} \quad (4.2)$$

5 Equilibrium relationships (before expansion and reduction)

$$pw^k - K = 0 \quad (5.1)$$

$$pw^l - L = 0 \quad (5.2)$$

$$-G^{\text{inc}} + TR = 0 \quad (5.3)$$

$$-K + \sum_{s \in SEC} K^{(s)} = 0 \quad (5.4)$$

$$-T^{\text{hh}} + \tau^{\text{h}} H^{\text{inc}} = 0 \quad (5.5)$$

$$-T^{\text{firms}} + \tau \left(\sum_{s \in SEC} T\bar{p}^{(s)} \right) = 0 \quad (5.6)$$

$$U - \left(\sum_{s \in SEC} \alpha^{(s)} D^{(s)} \omega^{-1(-1+\omega)} \right)^{\omega(-1+\omega)^{-1}} = 0 \quad (5.7)$$

$$-T^{\text{lk}} + t^{\text{l}} \left(\sum_{\bar{s} \in SEC} L^{(\bar{s})} \right) + t^{\text{k}} p^{\text{k}} \left(\sum_{s \in SEC} K^{(s)} \right) = 0 \quad (5.8)$$

$$-H^{\text{inc}} (1 - \tau^{\text{h}}) - \sum_{s \in SEC} \pi^{(s)} + \sum_{s \in SEC} p^{(s)} D^{(s)} = 0 \quad (5.9)$$

$$-G^{\text{inc}} + T^{\text{hh}} + T^{\text{firms}} + T^{\text{lk}} = 0 \quad (5.10)$$

$$-H^{\text{inc}} + L + TR + p^{\text{k}} K = 0 \quad (5.11)$$

$$s \in SEC: \quad \pi^{(s)} - T\bar{p}^{(s)} (1 - \tau) = 0 \quad (5.12)$$

$$s \in SEC: \quad -CI^{(s)} + \left(\sum_{\bar{s} \in SEC} \chi^{(\bar{s},s)} X^{(\bar{s},s)} \gamma^{(s)-1(-1+\gamma^{(s)})} \right)^{\gamma^{(s)}(-1+\gamma^{(s)})^{-1}} = 0 \quad (5.13)$$

$$s \in SEC: \quad -VA^{(s)} + \left(\beta^{\text{k}(s)} K^{(s)} \gamma^{(s)-1(-1+\gamma^{(s)})} + \beta^{\text{l}(s)} L^{(s)} \gamma^{(s)-1(-1+\gamma^{(s)})} \right)^{\gamma^{(s)}(-1+\gamma^{(s)})^{-1}} = 0 \quad (5.14)$$

$$s \in SEC: \quad -Y^{(s)} + \left(\beta^{\text{va}(s)} VA^{(s)} \gamma^{(s)-1(-1+\gamma^{(s)})} + \beta^{\text{ci}(s)} CI^{(s)} \gamma^{(s)-1(-1+\gamma^{(s)})} \right)^{\gamma^{(s)}(-1+\gamma^{(s)})^{-1}} = 0 \quad (5.15)$$

$$s \in SEC: \quad \lambda^{\text{CONSUMER}^1} p^{(s)} + \alpha^{(s)} D^{(s)} \omega^{-1(-1+\omega)} \left(\sum_{s \in SEC} \alpha^{(s)} D^{(s)} \omega^{-1(-1+\omega)} \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \quad (5.16)$$

$$s \in SEC: \quad (-1 - t^l) (1 - \tau) + \beta^{l\langle s \rangle} \beta^{va\langle s \rangle} p^{\langle s \rangle} (1 - \tau) L^{\langle s \rangle - 1 + \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} VA^{\langle s \rangle - 1 + \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} \left(\beta^{k\langle s \rangle} K^{\langle s \rangle \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} + \beta^{l\langle s \rangle} L^{\langle s \rangle \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} \right)^{-1 + \gamma^{\langle s \rangle} (-1 + \gamma^{\langle s \rangle})^{-1}} \left(\beta^{va\langle s \rangle} \right) \quad (5.17)$$

$$s \in SEC: \quad -p^k (1 + t^k) (1 - \tau) + \beta^{k\langle s \rangle} \beta^{va\langle s \rangle} p^{\langle s \rangle} (1 - \tau) K^{\langle s \rangle - 1 + \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} VA^{\langle s \rangle - 1 + \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} \left(\beta^{k\langle s \rangle} K^{\langle s \rangle \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} + \beta^{l\langle s \rangle} L^{\langle s \rangle \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} \right)^{-1 + \gamma^{\langle s \rangle} (-1 + \gamma^{\langle s \rangle})^{-1}} \left(\beta^{va\langle s \rangle} \right) \quad (5.18)$$

$$s \in SEC: \quad D^{\langle s \rangle} - Y^{\langle s \rangle} + \sum_{\tilde{s} \in SEC} X^{\langle s, \tilde{s} \rangle} = 0 \quad (5.19)$$

$$s \in SEC: \quad -T\tilde{p}^{\langle s \rangle} + p^{\langle s \rangle} Y^{\langle s \rangle} - L^{\langle s \rangle} (1 + t^l) - p^k K^{\langle s \rangle} (1 + t^k) - \sum_{\tilde{s} \in SEC} p^{\langle \tilde{s} \rangle} X^{\langle \tilde{s}, s \rangle} = 0 \quad (5.20)$$

$$s \in SEC: \quad \tilde{s} \in SEC: \quad -p^{\langle \tilde{s} \rangle} (1 - \tau) + \beta^{ci\langle \tilde{s} \rangle} \chi^{\langle \tilde{s}, s \rangle} p^{\langle s \rangle} (1 - \tau) CI^{\langle s \rangle - 1 + \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} X^{\langle \tilde{s}, s \rangle - 1 + \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} \left(\beta^{va\langle s \rangle} VA^{\langle s \rangle \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} + \beta^{ci\langle s \rangle} CI^{\langle s \rangle \gamma^{\langle s \rangle - 1} (-1 + \gamma^{\langle s \rangle})} \right)^{-1 + \gamma^{\langle s \rangle} (-1 + \gamma^{\langle s \rangle})^{-1}} \quad (5.21)$$

6 Equilibrium relationships (after expansion and reduction)

$$pw^k - K = 0 \quad (6.1)$$

$$pw^l - L = 0 \quad (6.2)$$

$$-G^{inc} + TR = 0 \quad (6.3)$$

$$-T^{hh} + \tau^h H^{inc} = 0 \quad (6.4)$$

$$-T^{firms} + \tau \left(T\tilde{p}^{\langle A \rangle} + T\tilde{p}^{\langle B \rangle} + T\tilde{p}^{\langle C \rangle} \right) = 0 \quad (6.5)$$

$$U - \left(\alpha^{\langle A \rangle} D^{\langle A \rangle \omega^{-1} (-1 + \omega)} + \alpha^{\langle B \rangle} D^{\langle B \rangle \omega^{-1} (-1 + \omega)} + \alpha^{\langle C \rangle} D^{\langle C \rangle \omega^{-1} (-1 + \omega)} \right)^{\omega(-1 + \omega)^{-1}} = 0 \quad (6.6)$$

$$\pi^{\langle A \rangle} - T\tilde{p}^{\langle A \rangle} (1 - \tau) = 0 \quad (6.7)$$

$$\pi^{\langle B \rangle} - T\tilde{p}^{\langle B \rangle} (1 - \tau) = 0 \quad (6.8)$$

$$\pi^{\langle C \rangle} - T\tilde{p}^{\langle C \rangle} (1 - \tau) = 0 \quad (6.9)$$

$$-CI^{\langle A \rangle} + \left(\chi^{\langle A, A \rangle} X^{\langle A, A \rangle \gamma^{\langle A \rangle - 1} (-1 + \gamma^{\langle A \rangle})} + \chi^{\langle B, A \rangle} X^{\langle B, A \rangle \gamma^{\langle A \rangle - 1} (-1 + \gamma^{\langle A \rangle})} + \chi^{\langle C, A \rangle} X^{\langle C, A \rangle \gamma^{\langle A \rangle - 1} (-1 + \gamma^{\langle A \rangle})} \right)^{\gamma^{\langle A \rangle} (-1 + \gamma^{\langle A \rangle})^{-1}} = 0 \quad (6.10)$$

$$-CI^{\langle B \rangle} + \left(\chi^{\langle A, B \rangle} X^{\langle A, B \rangle \gamma^{\langle B \rangle - 1} (-1 + \gamma^{\langle B \rangle})} + \chi^{\langle B, B \rangle} X^{\langle B, B \rangle \gamma^{\langle B \rangle - 1} (-1 + \gamma^{\langle B \rangle})} + \chi^{\langle C, B \rangle} X^{\langle C, B \rangle \gamma^{\langle B \rangle - 1} (-1 + \gamma^{\langle B \rangle})} \right)^{\gamma^{\langle B \rangle} (-1 + \gamma^{\langle B \rangle})^{-1}} = 0 \quad (6.11)$$

$$-CI^{(C)} + \left(\chi^{(A,C)} X^{(A,C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) + \chi^{(B,C)} X^{(B,C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) + \chi^{(C,C)} X^{(C,C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) \right)^{\gamma^{(C)} (-1+\gamma^{(C)})^{-1}} = 0 \quad (6.12)$$

$$-VA^{(A)} + \left(\beta^{k(A)} K^{(A)} \gamma^{(A)-1} (-1+\gamma^{(A)}) + \beta^{l(A)} L^{(A)} \gamma^{(A)-1} (-1+\gamma^{(A)}) \right)^{\gamma^{(A)} (-1+\gamma^{(A)})^{-1}} = 0 \quad (6.13)$$

$$-VA^{(B)} + \left(\beta^{k(B)} K^{(B)} \gamma^{(B)-1} (-1+\gamma^{(B)}) + \beta^{l(B)} L^{(B)} \gamma^{(B)-1} (-1+\gamma^{(B)}) \right)^{\gamma^{(B)} (-1+\gamma^{(B)})^{-1}} = 0 \quad (6.14)$$

$$-VA^{(C)} + \left(\beta^{k(C)} K^{(C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) + \beta^{l(C)} L^{(C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) \right)^{\gamma^{(C)} (-1+\gamma^{(C)})^{-1}} = 0 \quad (6.15)$$

$$-Y^{(A)} + \left(\beta^{va(A)} VA^{(A)} \gamma^{(A)-1} (-1+\gamma^{(A)}) + \beta^{ci(A)} CI^{(A)} \gamma^{(A)-1} (-1+\gamma^{(A)}) \right)^{\gamma^{(A)} (-1+\gamma^{(A)})^{-1}} = 0 \quad (6.16)$$

$$-Y^{(B)} + \left(\beta^{va(B)} VA^{(B)} \gamma^{(B)-1} (-1+\gamma^{(B)}) + \beta^{ci(B)} CI^{(B)} \gamma^{(B)-1} (-1+\gamma^{(B)}) \right)^{\gamma^{(B)} (-1+\gamma^{(B)})^{-1}} = 0 \quad (6.17)$$

$$-Y^{(C)} + \left(\beta^{va(C)} VA^{(C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) + \beta^{ci(C)} CI^{(C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) \right)^{\gamma^{(C)} (-1+\gamma^{(C)})^{-1}} = 0 \quad (6.18)$$

$$\lambda^{\text{CONSUMER}^1} p^{(A)} + \alpha^{(A)} D^{(A)} \omega^{-1} (-1+\omega) \left(\alpha^{(A)} D^{(A)} \omega^{-1} (-1+\omega) + \alpha^{(B)} D^{(B)} \omega^{-1} (-1+\omega) + \alpha^{(C)} D^{(C)} \omega^{-1} (-1+\omega) \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \quad (6.19)$$

$$\lambda^{\text{CONSUMER}^1} p^{(B)} + \alpha^{(B)} D^{(B)} \omega^{-1} (-1+\omega) \left(\alpha^{(A)} D^{(A)} \omega^{-1} (-1+\omega) + \alpha^{(B)} D^{(B)} \omega^{-1} (-1+\omega) + \alpha^{(C)} D^{(C)} \omega^{-1} (-1+\omega) \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \quad (6.20)$$

$$\lambda^{\text{CONSUMER}^1} p^{(C)} + \alpha^{(C)} D^{(C)} \omega^{-1} (-1+\omega) \left(\alpha^{(A)} D^{(A)} \omega^{-1} (-1+\omega) + \alpha^{(B)} D^{(B)} \omega^{-1} (-1+\omega) + \alpha^{(C)} D^{(C)} \omega^{-1} (-1+\omega) \right)^{-1+\omega(-1+\omega)^{-1}} = 0 \quad (6.21)$$

$$-p^{(A)} (1-\tau) + \beta^{ci(A)} \chi^{(A,A)} p^{(A)} (1-\tau) CI^{(A)} \gamma^{(A)-1} (-1+\gamma^{(A)}) X^{(A,A)} \gamma^{(A)-1} (-1+\gamma^{(A)}) \left(\beta^{va(A)} VA^{(A)} \gamma^{(A)-1} (-1+\gamma^{(A)}) + \beta^{ci(A)} CI^{(A)} \gamma^{(A)-1} (-1+\gamma^{(A)}) \right)^{-1+\gamma^{(A)} (-1+\gamma^{(A)})^{-1}} \left(\chi^{(A,A)} X^{(A,A)} \right)^{-1+\gamma^{(A)} (-1+\gamma^{(A)})^{-1}} \quad (6.22)$$

$$-p^{(A)} (1-\tau) + \beta^{ci(B)} \chi^{(A,B)} p^{(B)} (1-\tau) CI^{(B)} \gamma^{(B)-1} (-1+\gamma^{(B)}) X^{(A,B)} \gamma^{(B)-1} (-1+\gamma^{(B)}) \left(\beta^{va(B)} VA^{(B)} \gamma^{(B)-1} (-1+\gamma^{(B)}) + \beta^{ci(B)} CI^{(B)} \gamma^{(B)-1} (-1+\gamma^{(B)}) \right)^{-1+\gamma^{(B)} (-1+\gamma^{(B)})^{-1}} \left(\chi^{(A,B)} X^{(A,B)} \right)^{-1+\gamma^{(B)} (-1+\gamma^{(B)})^{-1}} \quad (6.23)$$

$$-p^{(A)} (1-\tau) + \beta^{ci(C)} \chi^{(A,C)} p^{(C)} (1-\tau) CI^{(C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) X^{(A,C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) \left(\beta^{va(C)} VA^{(C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) + \beta^{ci(C)} CI^{(C)} \gamma^{(C)-1} (-1+\gamma^{(C)}) \right)^{-1+\gamma^{(C)} (-1+\gamma^{(C)})^{-1}} \left(\chi^{(A,C)} X^{(A,C)} \right)^{-1+\gamma^{(C)} (-1+\gamma^{(C)})^{-1}} \quad (6.24)$$

$$-p^{(B)}(1-\tau)+\beta^{ci(A)}\chi^{(B,A)}p^{(A)}(1-\tau)CI^{(A)-1+\gamma^{(A)-1}(-1+\gamma^{(A)})}X^{(B,A)-1+\gamma^{(A)-1}(-1+\gamma^{(A)})}\left(\beta^{va(A)}VA^{(A)\gamma^{(A)-1}(-1+\gamma^{(A)})}+\beta^{ci(A)}CI^{(A)\gamma^{(A)-1}(-1+\gamma^{(A)})}\right)^{-1+\gamma^{(A)}(-1+\gamma^{(A)})^{-1}}\left(\chi^{(A,A)}X^{(A,A)}\right)^{-1} \quad (6.25)$$

$$-p^{(B)}(1-\tau)+\beta^{ci(B)}\chi^{(B,B)}p^{(B)}(1-\tau)CI^{(B)-1+\gamma^{(B)-1}(-1+\gamma^{(B)})}X^{(B,B)-1+\gamma^{(B)-1}(-1+\gamma^{(B)})}\left(\beta^{va(B)}VA^{(B)\gamma^{(B)-1}(-1+\gamma^{(B)})}+\beta^{ci(B)}CI^{(B)\gamma^{(B)-1}(-1+\gamma^{(B)})}\right)^{-1+\gamma^{(B)}(-1+\gamma^{(B)})^{-1}}\left(\chi^{(A,B)}X^{(A,B)}\right)^{-1} \quad (6.26)$$

$$-p^{(B)}(1-\tau)+\beta^{ci(C)}\chi^{(B,C)}p^{(C)}(1-\tau)CI^{(C)-1+\gamma^{(C)-1}(-1+\gamma^{(C)})}X^{(B,C)-1+\gamma^{(C)-1}(-1+\gamma^{(C)})}\left(\beta^{va(C)}VA^{(C)\gamma^{(C)-1}(-1+\gamma^{(C)})}+\beta^{ci(C)}CI^{(C)\gamma^{(C)-1}(-1+\gamma^{(C)})}\right)^{-1+\gamma^{(C)}(-1+\gamma^{(C)})^{-1}}\left(\chi^{(A,C)}X^{(A,C)}\right)^{-1} \quad (6.27)$$

$$-p^{(C)}(1-\tau)+\beta^{ci(A)}\chi^{(C,A)}p^{(A)}(1-\tau)CI^{(A)-1+\gamma^{(A)-1}(-1+\gamma^{(A)})}X^{(C,A)-1+\gamma^{(A)-1}(-1+\gamma^{(A)})}\left(\beta^{va(A)}VA^{(A)\gamma^{(A)-1}(-1+\gamma^{(A)})}+\beta^{ci(A)}CI^{(A)\gamma^{(A)-1}(-1+\gamma^{(A)})}\right)^{-1+\gamma^{(A)}(-1+\gamma^{(A)})^{-1}}\left(\chi^{(A,A)}X^{(A,A)}\right)^{-1} \quad (6.28)$$

$$-p^{(C)}(1-\tau)+\beta^{ci(B)}\chi^{(C,B)}p^{(B)}(1-\tau)CI^{(B)-1+\gamma^{(B)-1}(-1+\gamma^{(B)})}X^{(C,B)-1+\gamma^{(B)-1}(-1+\gamma^{(B)})}\left(\beta^{va(B)}VA^{(B)\gamma^{(B)-1}(-1+\gamma^{(B)})}+\beta^{ci(B)}CI^{(B)\gamma^{(B)-1}(-1+\gamma^{(B)})}\right)^{-1+\gamma^{(B)}(-1+\gamma^{(B)})^{-1}}\left(\chi^{(A,B)}X^{(A,B)}\right)^{-1} \quad (6.29)$$

$$-p^{(C)}(1-\tau)+\beta^{ci(C)}\chi^{(C,C)}p^{(C)}(1-\tau)CI^{(C)-1+\gamma^{(C)-1}(-1+\gamma^{(C)})}X^{(C,C)-1+\gamma^{(C)-1}(-1+\gamma^{(C)})}\left(\beta^{va(C)}VA^{(C)\gamma^{(C)-1}(-1+\gamma^{(C)})}+\beta^{ci(C)}CI^{(C)\gamma^{(C)-1}(-1+\gamma^{(C)})}\right)^{-1+\gamma^{(C)}(-1+\gamma^{(C)})^{-1}}\left(\chi^{(A,C)}X^{(A,C)}\right)^{-1} \quad (6.30)$$

$$(-1-t^l)(1-\tau)+\beta^{l(A)}\beta^{va(A)}p^{(A)}(1-\tau)L^{(A)-1+\gamma^{(A)-1}(-1+\gamma^{(A)})}VA^{(A)-1+\gamma^{(A)-1}(-1+\gamma^{(A)})}\left(\beta^{k(A)}K^{(A)\gamma^{(A)-1}(-1+\gamma^{(A)})}+\beta^{l(A)}L^{(A)\gamma^{(A)-1}(-1+\gamma^{(A)})}\right)^{-1+\gamma^{(A)}(-1+\gamma^{(A)})^{-1}}\left(\beta^{va(A)}VA^{(A)}\right)^{-1} \quad (6.31)$$

$$(-1-t^l)(1-\tau)+\beta^{l(B)}\beta^{va(B)}p^{(B)}(1-\tau)L^{(B)-1+\gamma^{(B)-1}(-1+\gamma^{(B)})}VA^{(B)-1+\gamma^{(B)-1}(-1+\gamma^{(B)})}\left(\beta^{k(B)}K^{(B)\gamma^{(B)-1}(-1+\gamma^{(B)})}+\beta^{l(B)}L^{(B)\gamma^{(B)-1}(-1+\gamma^{(B)})}\right)^{-1+\gamma^{(B)}(-1+\gamma^{(B)})^{-1}}\left(\beta^{va(B)}VA^{(B)}\right)^{-1} \quad (6.32)$$

$$(-1-t^l)(1-\tau)+\beta^{l(C)}\beta^{va(C)}p^{(C)}(1-\tau)L^{(C)-1+\gamma^{(C)-1}(-1+\gamma^{(C)})}VA^{(C)-1+\gamma^{(C)-1}(-1+\gamma^{(C)})}\left(\beta^{k(C)}K^{(C)\gamma^{(C)-1}(-1+\gamma^{(C)})}+\beta^{l(C)}L^{(C)\gamma^{(C)-1}(-1+\gamma^{(C)})}\right)^{-1+\gamma^{(C)}(-1+\gamma^{(C)})^{-1}}\left(\beta^{va(C)}VA^{(C)}\right)^{-1} \quad (6.33)$$

$$-p^k(1+t^k)(1-\tau)+\beta^{k(A)}\beta^{va(A)}p^{(A)}(1-\tau)K^{(A)-1+\gamma^{(A)-1}(-1+\gamma^{(A)})}VA^{(A)-1+\gamma^{(A)-1}(-1+\gamma^{(A)})}\left(\beta^{k(A)}K^{(A)\gamma^{(A)-1}(-1+\gamma^{(A)})}+\beta^{l(A)}L^{(A)\gamma^{(A)-1}(-1+\gamma^{(A)})}\right)^{-1+\gamma^{(A)}(-1+\gamma^{(A)})^{-1}}\left(\beta^{va(A)}VA^{(A)}\right)^{-1} \quad (6.34)$$

$$-p^k(1+t^k)(1-\tau)+\beta^{k(B)}\beta^{va(B)}p^{(B)}(1-\tau)K^{(B)-1+\gamma^{(B)-1}(-1+\gamma^{(B)})}VA^{(B)-1+\gamma^{(B)-1}(-1+\gamma^{(B)})}\left(\beta^{k(B)}K^{(B)\gamma^{(B)-1}(-1+\gamma^{(B)})}+\beta^{l(B)}L^{(B)\gamma^{(B)-1}(-1+\gamma^{(B)})}\right)^{-1+\gamma^{(B)}(-1+\gamma^{(B)})^{-1}}\left(\beta^{va(B)}VA^{(B)}\right)^{-1} \quad (6.35)$$

$$-p^k (1+t^k) (1-\tau) + \beta^{k\langle C \rangle} \beta^{va\langle C \rangle} p^{\langle C \rangle} (1-\tau) K^{\langle C \rangle -1+\gamma^{\langle C \rangle -1}(-1+\gamma^{\langle C \rangle})} VA^{\langle C \rangle -1+\gamma^{\langle C \rangle -1}(-1+\gamma^{\langle C \rangle})} \left(\beta^{k\langle C \rangle} K^{\langle C \rangle \gamma^{\langle C \rangle -1}(-1+\gamma^{\langle C \rangle})} + \beta^{l\langle C \rangle} L^{\langle C \rangle \gamma^{\langle C \rangle -1}(-1+\gamma^{\langle C \rangle})} \right)^{-1+\gamma^{\langle C \rangle}(-1+\gamma^{\langle C \rangle})^{-1}} \left(\beta^{va\langle C \rangle} V \right) \quad (6.36)$$

$$-T^{lk} + t^l (L^{\langle A \rangle} + L^{\langle B \rangle} + L^{\langle C \rangle}) + t^k p^k (K^{\langle A \rangle} + K^{\langle B \rangle} + K^{\langle C \rangle}) = 0 \quad (6.37)$$

$$-G^{inc} + T^{hh} + T^{firms} + T^{lk} = 0 \quad (6.38)$$

$$-H^{inc} + L + TR + p^k K = 0 \quad (6.39)$$

$$-K + K^{\langle A \rangle} + K^{\langle B \rangle} + K^{\langle C \rangle} = 0 \quad (6.40)$$

$$D^{\langle A \rangle} + X^{\langle A,A \rangle} + X^{\langle A,B \rangle} + X^{\langle A,C \rangle} - Y^{\langle A \rangle} = 0 \quad (6.41)$$

$$D^{\langle B \rangle} + X^{\langle B,A \rangle} + X^{\langle B,B \rangle} + X^{\langle B,C \rangle} - Y^{\langle B \rangle} = 0 \quad (6.42)$$

$$D^{\langle C \rangle} + X^{\langle C,A \rangle} + X^{\langle C,B \rangle} + X^{\langle C,C \rangle} - Y^{\langle C \rangle} = 0 \quad (6.43)$$

$$-\pi^{\langle A \rangle} - \pi^{\langle B \rangle} - \pi^{\langle C \rangle} - H^{inc} (1-\tau^h) + p^{\langle A \rangle} D^{\langle A \rangle} + p^{\langle B \rangle} D^{\langle B \rangle} + p^{\langle C \rangle} D^{\langle C \rangle} = 0 \quad (6.44)$$

$$-T\dot{x}^{\langle A \rangle} - p^{\langle A \rangle} X^{\langle A,A \rangle} + p^{\langle A \rangle} Y^{\langle A \rangle} - p^{\langle B \rangle} X^{\langle B,A \rangle} - p^{\langle C \rangle} X^{\langle C,A \rangle} - L^{\langle A \rangle} (1+t^l) - p^k K^{\langle A \rangle} (1+t^k) = 0 \quad (6.45)$$

$$-T\dot{x}^{\langle B \rangle} - p^{\langle A \rangle} X^{\langle A,B \rangle} - p^{\langle B \rangle} X^{\langle B,B \rangle} + p^{\langle B \rangle} Y^{\langle B \rangle} - p^{\langle C \rangle} X^{\langle C,B \rangle} - L^{\langle B \rangle} (1+t^l) - p^k K^{\langle B \rangle} (1+t^k) = 0 \quad (6.46)$$

$$-T\dot{x}^{\langle C \rangle} - p^{\langle A \rangle} X^{\langle A,C \rangle} - p^{\langle B \rangle} X^{\langle B,C \rangle} - p^{\langle C \rangle} X^{\langle C,C \rangle} + p^{\langle C \rangle} Y^{\langle C \rangle} - L^{\langle C \rangle} (1+t^l) - p^k K^{\langle C \rangle} (1+t^k) = 0 \quad (6.47)$$

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7 Parameter settings

$$t^k = 0 \quad (7.1)$$

$$t^l = 0 \quad (7.2)$$

$$\tau^h = 0 \quad (7.3)$$

$$\tau = 0 \quad (7.4)$$

8 Equilibrium values

	Equilibrium value
$\lambda^{\text{CONSUMER}^1}$	-0.9978
p^k	1.0001
G^{inc}	0
H^{inc}	80.0057
K	40
L	40
T^{hh}	0
T^{firms}	0
T^{lk}	0
TR	0
U	79.8271
$p^{(A)}$	1.0013
$p^{(B)}$	1.0026
$p^{(C)}$	1.0023
$\pi^{(A)}$	0
$\pi^{(B)}$	0
$\pi^{(C)}$	0
$CI^{(A)}$	39.8256
$CI^{(B)}$	29.8056
$CI^{(C)}$	49.6959
$D^{(A)}$	29.9529
$D^{(B)}$	9.997
$D^{(C)}$	39.9004
$K^{(A)}$	19.9931
$K^{(B)}$	9.9852
$K^{(C)}$	10.0217
$L^{(A)}$	9.9994
$L^{(B)}$	19.9761
$L^{(C)}$	10.0245
$T\bar{x}^{(A)}$	0
$T\bar{x}^{(B)}$	0
$T\bar{x}^{(C)}$	0
$VA^{(A)}$	29.9561
$VA^{(B)}$	29.9249
$VA^{(C)}$	20.0401
$X^{(A,A)}$	9.9763
$X^{(A,B)}$	9.9615
$X^{(A,C)}$	19.9301
$X^{(B,A)}$	19.8974
$X^{(B,B)}$	9.937
$X^{(B,C)}$	19.881
$X^{(C,A)}$	9.958
$X^{(C,B)}$	9.9433
$X^{(C,C)}$	9.9516
$Y^{(A)}$	69.8208
$Y^{(B)}$	59.7124
$Y^{(C)}$	69.7533

9 Equilibrium values

	Equilibrium value
$\lambda^{\text{CONSUMER}^1}$	-0.9978
p^k	0.8001
G^{inc}	8.0011
H^{inc}	80.0057
K	40
L	40
T^{hh}	0
T^{firms}	0
T^{lk}	8.0011
TR	8.0011
U	79.8271
$p^{(A)}$	1.0013
$p^{(B)}$	1.0026
$p^{(C)}$	1.0023
$\pi^{(A)}$	0
$\pi^{(B)}$	0
$\pi^{(C)}$	0
$CI^{(A)}$	39.8256
$CI^{(B)}$	29.8056
$CI^{(C)}$	49.6959
$D^{(A)}$	29.9529
$D^{(B)}$	9.997
$D^{(C)}$	39.9004
$K^{(A)}$	19.9931
$K^{(B)}$	9.9852
$K^{(C)}$	10.0217
$L^{(A)}$	9.9994
$L^{(B)}$	19.9761
$L^{(C)}$	10.0245
$T\bar{x}^{(A)}$	0
$T\bar{x}^{(B)}$	0
$T\bar{x}^{(C)}$	0
$VA^{(A)}$	29.9561
$VA^{(B)}$	29.9249
$VA^{(C)}$	20.0401
$X^{(A,A)}$	9.9763
$X^{(A,B)}$	9.9615
$X^{(A,C)}$	19.9301
$X^{(B,A)}$	19.8974
$X^{(B,B)}$	9.937
$X^{(B,C)}$	19.881
$X^{(C,A)}$	9.958
$X^{(C,B)}$	9.9433
$X^{(C,C)}$	9.9516
$Y^{(A)}$	69.8208
$Y^{(B)}$	59.7124
$Y^{(C)}$	69.7533