

## Index sets

$$\begin{aligned}
 COU &= \{COU1, COU2, COU3, COU4\} \\
 COU_{big} &= \{COU3, COU4\} \\
 COU_f &= \{COU2, COU3, COU4\} \\
 COU_h &= \{COU1\} \\
 COU_{only} &= \{COU1, COU2\} \\
 SEC &= \{SEC1, SEC2, SEC3, SEC4, SEC5, SEC6, SEC7, SEC8\} \\
 SEC_{nr} &= \{SEC2, SEC3, SEC4, SEC5, SEC6, SEC7, SEC8\} \\
 SEC_{nt} &= \{SEC1, SEC2, SEC3, SEC4, SEC5, SEC6, SEC7\} \\
 SEC_r &= \{SEC1\} \\
 SEC_t &= \{SEC8\}
 \end{aligned}$$

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## 1 CONSUMER $c \in COU$

### 1.1 Optimisation problem

$$\max_{(DD^{(c,s)})_{s \in SEC}, (DM^{(c,s)})_{s \in SEC}, (DT^{(c,s)})_{s \in SEC}} U^{CONS(c)} = \left( \sum_{s \in SEC} \alpha^{dt(c,s)} DT^{(c,s)} \sigma^{u(c)-1} (-1 + \sigma^{u(c)}) \right)^{\sigma^{u(c)} (-1 + \sigma^{u(c)})^{-1}} \quad (1.1)$$

s.t. :

$$INC^{CONS(c)} = SV^{CONS(c)} + \sum_{s \in SEC} p^{(c,s)} DD^{(c,s)} \left( 1 + tssd^{priv(c,s)} \right) + \sum_{s \in SEC} p^{imp(c,s)} DM^{(c,s)} \left( 1 + tssm^{priv(c,s)} \right) \left( \lambda^{CONSUMER^1(c)} \right) \quad (1.2)$$

$$s \in SEC: \quad DT^{(c,s)} = \left( \alpha^{dd(c,s)} DD^{(c,s)} \sigma^{arm(c,s)-1} (-1 + \sigma^{arm(c,s)}) + (1 - \alpha^{dd(c,s)}) DM^{(c,s)} \sigma^{arm(c,s)-1} (-1 + \sigma^{arm(c,s)}) \right)^{\sigma^{arm(c,s)} (-1 + \sigma^{arm(c,s)})^{-1}} \left( \lambda^{CONSUMER^2(c,s)} \right) \quad (1.3)$$

## 1.2 Identities

$$INC^{CONS\langle c \rangle} = -DEP^{\langle c \rangle} + SUB^{\langle c \rangle} + \phi^{\langle c \rangle} PROFIT + p^{k\langle c \rangle} K^{\langle c \rangle} \left(1 - \text{tinc}^{k\langle c \rangle}\right) + p^{l\langle c \rangle} L^{\langle c \rangle} \left(1 - \text{tinc}^{l\langle c \rangle}\right) \quad (1.4)$$

$$INC^{CONS\langle c \rangle} SV^{CONS\langle c \rangle} = \text{saving}^{\text{rate}^{CONS\langle c \rangle}} \quad (1.5)$$

$$DEP^{\langle c \rangle} = \delta^{\langle c \rangle} p^{k\langle c \rangle} K^{\langle c \rangle} \quad (1.6)$$

$$L^{\langle c \rangle} = \text{scale}^{\langle c \rangle}{}^{-1} \left( -L^{\text{slack}\langle c \rangle} + \sum_{s \in SEC} L^{\text{data}\langle c, s \rangle} \right) \quad (1.7)$$

$$K^{\langle c \rangle} = \text{scale}^{\langle c \rangle}{}^{-1} \left( \sum_{s \in SEC} K^{\text{data}\langle c, s \rangle} \right) \quad (1.8)$$

## 1.3 First order conditions

$$s \in SEC: \quad \lambda^{\text{CONSUMER}^1\langle c \rangle} p^{\langle c, s \rangle} \left(1 + \text{tssl}^{\text{priv}\langle c, s \rangle}\right) + \alpha^{\text{dd}\langle c, s \rangle} \lambda^{\text{CONSUMER}^2\langle c, s \rangle} DD^{\langle c, s \rangle}{}^{-1+\sigma^{\text{arm}\langle c, s \rangle}-1} \left(-1+\sigma^{\text{arm}\langle c, s \rangle}\right) \left( \alpha^{\text{dd}\langle c, s \rangle} DD^{\langle c, s \rangle}{}^{\sigma^{\text{arm}\langle c, s \rangle}-1} \left(-1+\sigma^{\text{arm}\langle c, s \rangle}\right) + \left(1 - \alpha^{\text{dd}\langle c, s \rangle}\right) DM^{\langle c, s \rangle}{}^{\sigma^{\text{arm}\langle c, s \rangle}} \right) \quad (1.9)$$

$$s \in SEC: \quad \lambda^{\text{CONSUMER}^1\langle c \rangle} p^{\text{imp}\langle c, s \rangle} \left(1 + \text{tssm}^{\text{priv}\langle c, s \rangle}\right) + \lambda^{\text{CONSUMER}^2\langle c, s \rangle} \left(1 - \alpha^{\text{dd}\langle c, s \rangle}\right) DM^{\langle c, s \rangle}{}^{-1+\sigma^{\text{arm}\langle c, s \rangle}-1} \left(-1+\sigma^{\text{arm}\langle c, s \rangle}\right) \left( \alpha^{\text{dd}\langle c, s \rangle} DD^{\langle c, s \rangle}{}^{\sigma^{\text{arm}\langle c, s \rangle}-1} \left(-1+\sigma^{\text{arm}\langle c, s \rangle}\right) + \left(1 - \alpha^{\text{dd}\langle c, s \rangle}\right) \right) \quad (1.10)$$

$$s \in SEC: \quad -\lambda^{\text{CONSUMER}^2\langle c, s \rangle} + \alpha^{\text{dt}\langle c, s \rangle} DT^{\langle c, s \rangle}{}^{-1+\sigma^{\text{u}\langle c \rangle}-1} \left(-1+\sigma^{\text{u}\langle c \rangle}\right) \left( \sum_{s \in SEC} \alpha^{\text{dt}\langle c, s \rangle} DT^{\langle c, s \rangle}{}^{\sigma^{\text{u}\langle c \rangle}-1} \left(-1+\sigma^{\text{u}\langle c \rangle}\right) \right)^{-1+\sigma^{\text{u}\langle c \rangle}} \left(-1+\sigma^{\text{u}\langle c \rangle}\right)^{-1} = 0 \quad \left( DT^{\langle c, s \rangle} \right) \quad (1.11)$$





$$\dot{s}i \in SEC: \quad -p^{\text{imp}\langle c, \dot{s}i \rangle} \left(1 + tssm^{\text{prod}\langle c, s, \dot{s}i \rangle}\right) + \lambda^{\text{FIRM}^4 \langle c, s, \dot{s}i \rangle} \left(1 - \alpha^{\text{icd}\langle c, s, \dot{s}i \rangle}\right) ICM^{\langle c, s, \dot{s}i \rangle - 1 + \sigma^{\text{arm}\langle c, \dot{s}i \rangle - 1} (-1 + \sigma^{\text{arm}\langle c, \dot{s}i \rangle})} \left(\alpha^{\text{icd}\langle c, s, \dot{s}i \rangle} ICD^{\langle c, s, \dot{s}i \rangle \sigma^{\text{arm}\langle c, \dot{s}i \rangle - 1} (-1 + \sigma^{\text{arm}\langle c, \dot{s}i \rangle})}\right) + \left(1 - \alpha^{\text{icd}\langle c, s, \dot{s}i \rangle}\right) IC \quad (2.18)$$

$$\dot{s}i \in SEC: \quad -\lambda^{\text{FIRM}^4 \langle c, s, \dot{s}i \rangle} + \alpha^{\text{ict}\langle c, s, \dot{s}i \rangle} tfp^{y\langle c, s \rangle} p^{\langle c, s \rangle} \left(1 - \alpha^{\text{fac}\langle c, s \rangle}\right) \left(1 - tprod^{\langle c, s \rangle}\right) IC^{\langle c, s \rangle - 1 + \sigma^{y\langle c, s \rangle - 1} (-1 + \sigma^{y\langle c, s \rangle})} ICT^{\langle c, s, \dot{s}i \rangle - 1 + \sigma^{\text{ic}\langle c, s \rangle - 1} (-1 + \sigma^{\text{ic}\langle c, s \rangle})} \left(\alpha^{\text{fac}\langle c, s \rangle} FAC^{\langle c, s \rangle \sigma^{y\langle c, s \rangle - 1} (-1 + \sigma^{y\langle c, s \rangle})}\right) \quad (2.19)$$

### 3 IMPORT BIG $c \in COU$ big $s \in SEC$

#### 3.1 Optimisation problem

$$(IM^{\langle \alpha, c, s \rangle}) \max_{\alpha \in COU, IMPORT^{\langle c, s \rangle}} \pi^{\text{imp}\langle c, s \rangle} = p^{\text{imp}\langle c, s \rangle} IMPORT^{\langle c, s \rangle} - scale^{\langle c \rangle - 1} \left( \sum_{\alpha \in COU} scale^{\langle \alpha \rangle} p^{\text{cif}\langle \alpha, c, s \rangle} IM^{\langle \alpha, c, s \rangle} \left(1 + trm^{\langle \alpha, c, s \rangle}\right) \right) \quad (3.1)$$

s.t. :

$$IMPORT^{\langle c, s \rangle} = \theta^{\text{im}\langle c, s \rangle} \left( \sum_{\alpha \in COU} \alpha^{\text{im}\langle \alpha, c, s \rangle} \left( scale^{\langle c \rangle - 1} scale^{\langle \alpha \rangle} IM^{\langle \alpha, c, s \rangle} \left(1 + icberg^{\text{cost}\langle \alpha, c, s \rangle}\right) \right)^{\sigma^{\text{im}\langle s \rangle - 1} (-1 + \sigma^{\text{im}\langle s \rangle})} \right)^{\sigma^{\text{im}\langle s \rangle} (-1 + \sigma^{\text{im}\langle s \rangle})^{-1}} \left( \lambda^{\text{IMPORTBIG}^1 \langle c, s \rangle} \right) \quad (3.2)$$

#### 3.2 Identities

$$\alpha \in COU: \quad IM^{\langle \alpha, c, s \rangle} = EX^{\langle \alpha, c, s \rangle} \quad (3.3)$$

$$\alpha \in COU: \quad p^{\text{cif}\langle c, \alpha, s \rangle} = p^{\text{fob}\langle c, \alpha, s \rangle} + \tau^{\langle c, \alpha, s \rangle} p^{\text{trans}} \quad (3.4)$$

#### 3.3 First order conditions

$$\alpha \in COU: \quad -scale^{\langle c \rangle - 1} scale^{\langle \alpha \rangle} p^{\text{cif}\langle \alpha, c, s \rangle} \left(1 + trm^{\langle \alpha, c, s \rangle}\right) + \alpha^{\text{im}\langle \alpha, c, s \rangle} scale^{\langle c \rangle - 1} scale^{\langle \alpha \rangle} \theta^{\text{im}\langle c, s \rangle} \lambda^{\text{IMPORTBIG}^1 \langle c, s \rangle} \left(1 + icberg^{\text{cost}\langle \alpha, c, s \rangle}\right) \left( scale^{\langle c \rangle - 1} scale^{\langle \alpha \rangle} IM^{\langle \alpha, c, s \rangle} \left(1 + icberg^{\text{cost}\langle \alpha, c, s \rangle}\right) \right)^{-1 + \sigma^{\text{im}\langle s \rangle}} \quad (3.5)$$

$$-\lambda^{\text{IMPORTBIG}^1 \langle c, s \rangle} + p^{\text{imp}\langle c, s \rangle} = 0 \quad \left( IMPORT^{\langle c, s \rangle} \right) \quad (3.6)$$

### 3.4 First order conditions after reduction

$$\alpha \in COU: \quad -scale^{(c)^{-1}} scale^{(\alpha)} p^{cif^{(\alpha,c,s)}} \left(1 + tmm^{(\alpha,c,s)}\right) + \alpha^{im^{(\alpha,c,s)}} scale^{(c)^{-1}} scale^{(\alpha)} \theta^{im^{(c,s)}} p^{imp^{(c,s)}} \left(1 + iceberg^{cost^{(\alpha,c,s)}}\right) \left(scale^{(c)^{-1}} scale^{(\alpha)} IM^{(\alpha,c,s)} \left(1 + iceberg^{cost^{(\alpha,c,s)}}\right)\right)^{-1 + \sigma^{im^{(s)}} - 1} \quad (3.7)$$

## 4 IMPORT SMALL $c \in COU$ only $s \in SEC$

### 4.1 Optimisation problem

$$\max_{(IM^{(\alpha,c,s)})_{\alpha \in COU \setminus c}, IMPORT^{(c,s)}} \pi^{imp^{(c,s)}} = p^{imp^{(c,s)}} IMPORT^{(c,s)} - scale^{(c)^{-1}} \left( \sum_{\alpha \in COU} scale^{(\alpha)} p^{cif^{(\alpha,c,s)}} IM^{(\alpha,c,s)} \left(1 + tmm^{(\alpha,c,s)}\right) \right) \quad (4.1)$$

s.t. :

$$IMPORT^{(c,s)} = \theta^{im^{(c,s)}} \left( \sum_{\alpha \in COU \setminus c} \alpha^{im^{(\alpha,c,s)}} \left( scale^{(c)^{-1}} scale^{(\alpha)} IM^{(\alpha,c,s)} \left(1 + iceberg^{cost^{(\alpha,c,s)}}\right) \right)^{\sigma^{im^{(s)}} - 1} (-1 + \sigma^{im^{(s)}}) \right)^{\sigma^{im^{(s)}}} (-1 + \sigma^{im^{(s)}})^{-1} \left( \lambda^{IMPORT^{SMALL^1(c,s)}} \right) \quad (4.2)$$

### 4.2 Identities

$$\alpha \in COU: \quad IM^{(\alpha,c,s)} = EX^{(\alpha,c,s)} \quad (4.3)$$

$$scale^{(c)} IM^{(c,c,s)} = 0 \quad (4.4)$$

$$\alpha \in COU: \quad p^{cif^{(c,\alpha,s)}} = p^{fob^{(c,\alpha,s)}} + \tau^{(c,\alpha,s)} p^{trans} \quad (4.5)$$

### 4.3 First order conditions

$$\alpha \in COU \setminus c: \quad -scale^{(c)^{-1}} \left( \sum_{\alpha' \in COU} \delta^{(\alpha,\alpha')} scale^{(\alpha')} p^{cif^{(\alpha',c,s)}} \left(1 + tmm^{(\alpha',c,s)}\right) \right) + \alpha^{im^{(\alpha,c,s)}} scale^{(c)^{-1}} scale^{(\alpha)} \theta^{im^{(c,s)}} \lambda^{IMPORT^{SMALL^1(c,s)}} \left(1 + iceberg^{cost^{(\alpha,c,s)}}\right) \left(scale^{(c)^{-1}} scale^{(\alpha)} IM^{(\alpha,c,s)}\right) \quad (4.6)$$

$$-\lambda^{IMPORT^{SMALL^1(c,s)}} + p^{imp^{(c,s)}} = 0 \quad (IMPORT^{(c,s)}) \quad (4.7)$$

#### 4.4 First order conditions after reduction

$$\alpha \in COU \setminus c: \quad -scale^{(c)^{-1}} \left( \sum_{\alpha' \in COU} \delta^{(\alpha, \alpha')} scale^{(\alpha')} p^{cif(\alpha', c, s)} \left( 1 + trmm^{(\alpha', c, s)} \right) \right) + \alpha^{im(\alpha, c, s)} scale^{(c)^{-1}} scale^{(\alpha)} \theta^{im(c, s)} p^{imp(c, s)} \left( 1 + iceberg^{cost(\alpha, c, s)} \right) \left( scale^{(c)^{-1}} scale^{(\alpha)} IM^{(\alpha, c, s)} \left( 1 + iceberg^{co} \right) \right) \quad (4.8)$$

### 5 GOVERNMENT $c \in COU$

#### 5.1 Optimisation problem

$$\max_{(GT^{(c, s)})_{s \in SEC}, (GD^{(c, s)})_{s \in SEC}, (GM^{(c, s)})_{s \in SEC}} U^{GOV(c)} = \prod_{s \in SEC} GT^{(c, s)} \beta^{gov(c, s)} \quad (5.1)$$

s.t. :

$$s \in SEC: \quad GT^{(c, s)} = \left( \alpha^{gt(c, s)} GD^{(c, s)} \sigma^{arm(c, s)^{-1}(-1 + \sigma^{arm(c, s)})} + \left( 1 - \alpha^{gt(c, s)} \right) GM^{(c, s)} \sigma^{arm(c, s)^{-1}(-1 + \sigma^{arm(c, s)})} \right) \sigma^{arm(c, s)} \left( -1 + \sigma^{arm(c, s)} \right)^{-1} \left( \lambda^{GOVERNMENT^1(c, s)} \right) \quad (5.2)$$

$$INC^{GOV(c)} - SUB^{(c)} = \sum_{s \in SEC} p^{(c, s)} GD^{(c, s)} \left( 1 + tssd^{gov(c, s)} \right) + \sum_{s \in SEC} p^{imp(c, s)} GM^{(c, s)} \left( 1 + tssm^{gov(c, s)} \right) \left( \lambda^{GOVERNMENT^2(c)} \right) \quad (5.3)$$

#### 5.2 Identities

$$INC^{GOV(c)} = T\epsilon^{(c)} + Tf^k(c) + Tf^l(c) + Tinc^{(c)} + Tmm^{(c)} + Tprod^{(c)} + Tssm^{(c)} + Tssd^{(c)} \quad (5.4)$$

$$SUB^{(c)} = gsub^{(c)} INC^{GOV(c)} \quad (5.5)$$

$$Tmm^{(c)} = scale^{(c)^{-1}} \left( \sum_{s \in SEC} \sum_{\alpha \in COU} scale^{(\alpha)} trmm^{(\alpha, c, s)} p^{cif(\alpha, c, s)} IM^{(\alpha, c, s)} \right) \quad (5.6)$$

$$T\epsilon^{(c)} = \sum_{s \in SEC} p^{(c, s)} \left( \sum_{\alpha \in COU} t\epsilon^{(c, \alpha, s)} EX^{(c, \alpha, s)} \right) \quad (5.7)$$

$$Tssm^{(c)} = \sum_{s \in SEC} p^{imp(c, s)} \left( tssm^{priv(c, s)} DM^{(c, s)} + tssm^{gov(c, s)} GM^{(c, s)} + tssm^{cgds(c, s)} CM^{(c, s)} + \sum_{\tilde{s} \in SEC} tssm^{prod(c, \tilde{s}, s)} ICM^{(c, \tilde{s}, s)} \right) \quad (5.8)$$

$$Tssd^{(c)} = \sum_{s \in SEC} p^{(c,s)} \left( tssd^{priv^{(c,s)}} DD^{(c,s)} + tssd^{gov^{(c,s)}} GD^{(c,s)} + tssd^{cgds^{(c,s)}} CD^{(c,s)} + \sum_{\tilde{s} \in SEC} tssd^{prod^{(c,\tilde{s},s)}} ICD^{(c,\tilde{s},s)} \right) \quad (5.9)$$

$$Tf^k^{(c)} = p^k^{(c)} \left( \sum_{s \in SEC} tf^k^{(c,s)} K^{(c,s)} \right) \quad (5.10)$$

$$Tf^l^{(c)} = p^l^{(c)} \left( \sum_{s \in SEC} tf^l^{(c,s)} L^{(c,s)} \right) \quad (5.11)$$

$$Tprod^{(c)} = \sum_{s \in SEC} tprod^{(c,s)} p^{(c,s)} Y^{(c,s)} \quad (5.12)$$

$$Tinc^{(c)} = tinc^k^{(c)} p^k^{(c)} K^{(c)} + tinc^l^{(c)} p^l^{(c)} L^{(c)} \quad (5.13)$$

### 5.3 First order conditions

$$s \in SEC: \quad -\lambda^{GOVERNMENT^1^{(c,s)}} + \beta^{gov^{(c,s)}} GT^{(c,s)^{-1}} \left( \prod_{s' \in SEC} GT^{(c,s')} \beta^{gov^{(c,s')}} \right) = 0 \quad \left( GT^{(c,s)} \right) \quad (5.14)$$

$\infty$

$$s \in SEC: \quad \lambda^{GOVERNMENT^2^{(c)}} p^{(c,s)} \left( 1 + tssd^{gov^{(c,s)}} \right) + \alpha^{gt^{(c,s)}} \lambda^{GOVERNMENT^1^{(c,s)}} GD^{(c,s)^{-1} + \sigma^{arm^{(c,s)}}} (-1 + \sigma^{arm^{(c,s)}})^{-1} \left( \alpha^{gt^{(c,s)}} GD^{(c,s)} \sigma^{arm^{(c,s)}} (-1 + \sigma^{arm^{(c,s)}})^{-1} \right) + \left( 1 - \alpha^{gt^{(c,s)}} \right) GM^{(c,s)} \quad (5.15)$$

$$s \in SEC: \quad \lambda^{GOVERNMENT^2^{(c)}} p^{imp^{(c,s)}} \left( 1 + tssm^{gov^{(c,s)}} \right) + \lambda^{GOVERNMENT^1^{(c,s)}} \left( 1 - \alpha^{gt^{(c,s)}} \right) GM^{(c,s)^{-1} + \sigma^{arm^{(c,s)}}} (-1 + \sigma^{arm^{(c,s)}})^{-1} \left( \alpha^{gt^{(c,s)}} GD^{(c,s)} \sigma^{arm^{(c,s)}} (-1 + \sigma^{arm^{(c,s)}})^{-1} \right) + \left( 1 - \alpha^{gt^{(c,s)}} \right) \quad (5.16)$$

## 6 TRANSPORT

### 6.1 Optimisation problem

$$\max_{TRANS^{global}, (TRANS^{total^{(c)}})_{c \in COU}} \pi^{trans} = p^{trans} TRANS^{global} - \sum_{c \in COU} p^{(c, SEC8)} TRANS^{total^{(c)}} \quad (6.1)$$

s.t. :

$$TRANS^{global} = \theta^{trans} \left( \prod_{c \in COU} TRANS^{total^{(c)}} \beta^{trans^{(c)}} \right) \left( \lambda^{TRANSPORT^1} \right) \quad (6.2)$$



## 6.2 Identities

$$c \in COU: \quad \alpha \in COU: \quad TRANS^{(c,\alpha)} = scale^{(c)} scale^{(\alpha)^{-1}} \left( \sum_{s \in SEC} \tau^{(c,\alpha,s)} IM^{(c,\alpha,s)} \right) \quad (6.3)$$

$$c \in COU \setminus \{COU4\}: \quad TRANS^{total(c)} = -TRANS^{bal(c)} + \sum_{\alpha \in COU} TRANS^{(\alpha,c)} \quad (6.4)$$

$$\sum_{c \in COU} TRANS^{bal(c)} = 0 \quad (6.5)$$

## 6.3 First order conditions

$$-\lambda^{TRANSPORT^1} + p^{trans} = 0 \quad (TRANS^{global}) \quad (6.6)$$

$$c \in COU: \quad -p^{(c,SEC8)} + \theta^{trans} \beta^{trans(c)} \lambda^{TRANSPORT^1} TRANS^{total(c)^{-1}} \left( \prod_{c' \in COU} TRANS^{total(c')} \beta^{trans(c')} \right) = 0 \quad (TRANS^{total(c)}) \quad (6.7)$$

## 6.4 First order conditions after reduction

$$c \in COU: \quad -p^{(c,SEC8)} + \theta^{trans} \beta^{trans(c)} p^{trans} TRANS^{total(c)^{-1}} \left( \prod_{c' \in COU} TRANS^{total(c')} \beta^{trans(c')} \right) = 0 \quad \left( (TRANS^{total(c)})_{c \in COU} \right) \quad (6.8)$$

# 7 BANK

## 7.1 Optimisation problem

$$(INV^{(c)})_{c \in COU}, ((CT^{(c,s)})_{s \in SEC})_{c \in COU}, ((CD^{(c,s)})_{s \in SEC})_{c \in COU}, ((CM^{(c,s)})_{s \in SEC})_{c \in COU} \quad INVEST = \theta^{invest} \left( \prod_{c \in COU} INV^{(c)} \beta^{invest(c)} \right) \quad (7.1)$$

s.t. :

$$SAVINGS = \sum_{c \in COU} \sum_{s \in SEC} p^{(c,s)} CD^{(c,s)} (1 + tssd^{cgds(c,s)}) + \sum_{c \in COU} \sum_{s \in SEC} p^{imp(c,s)} CM^{(c,s)} (1 + tssm^{cgds(c,s)}) \quad (\lambda^{BANK^1}) \quad (7.2)$$

$$c \in COU: \quad INV^{(c)} = \theta^{inv(c)} \left( \prod_{s \in SEC} CT^{(c,s)} \beta^{inv(c,s)} \right) \quad (\lambda^{BANK^2(c)}) \quad (7.3)$$

$$c \in COU: \quad s \in SEC: \quad CT^{(c,s)} = \theta^{ct(c,s)} \left( \alpha^{ct(c,s)} CD^{(c,s)} \sigma^{arm(c,s)^{-1}(-1+\sigma^{arm(c,s)})} + (1 - \alpha^{ct(c,s)}) CM^{(c,s)} \sigma^{arm(c,s)^{-1}(-1+\sigma^{arm(c,s)})} \right) \sigma^{arm(c,s)} (-1+\sigma^{arm(c,s)})^{-1} \quad (\lambda^{BANK^3(s,c)}) \quad (7.4)$$

## 7.2 Identities

$$SAVINGS = \sum_{c \in COU} SV^{REG\langle c \rangle} \quad (7.5)$$

$$c \in COU: \quad SV^{REG\langle c \rangle} = -CA^{(c)} + DEP^{(c)} + SV^{CONS\langle c \rangle} + p^{\langle c, SECs \rangle} TRANS^{bal\langle c \rangle} \quad (7.6)$$

$$\alpha \in COU: \quad CA^{(\alpha)} = - \sum_{\alpha \in COU} EX^{bal\langle \alpha, \alpha \rangle} \quad (7.7)$$

$$c \in COU: \quad \alpha \in COU: \quad scale^{(c)} EX^{bal\langle c, \alpha \rangle} = scale^{(\alpha)} \left( \sum_{s \in SEC} p^{fob\langle \alpha, c, s \rangle} IM^{(\alpha, c, s)} \right) - scale^{(c)} \left( \sum_{s \in SEC} p^{fob\langle c, \alpha, s \rangle} EX^{(c, \alpha, s)} \right) \quad (7.8)$$

## 7.3 First order conditions

$$c \in COU: \quad -\lambda^{BANK^2\langle c \rangle} + \theta^{invest} \beta^{invest\langle c \rangle} INV^{(c)-1} \left( \prod_{c' \in COU} INV^{(c')} \beta^{invest\langle c' \rangle} \right) = 0 \quad (INV^{(c)}) \quad (7.9)$$

$$c \in COU: \quad s \in SEC: \quad -\lambda^{BANK^3\langle s, c \rangle} + \beta^{inv\langle c, s \rangle} \theta^{inv\langle c \rangle} \lambda^{BANK^2\langle c \rangle} CT^{(c, s)-1} \left( \prod_{s' \in SEC} CT^{(c, s')} \beta^{inv\langle c, s' \rangle} \right) = 0 \quad (CT^{(c, s)}) \quad (7.10)$$

$$c \in COU: \quad s \in SEC: \quad \lambda^{BANK^1} p^{\langle c, s \rangle} \left( 1 + tss^{cgds\langle c, s \rangle} \right) + \alpha^{ct\langle c, s \rangle} \theta^{ct\langle c, s \rangle} \lambda^{BANK^3\langle s, c \rangle} CD^{(c, s)-1 + \sigma^{arm\langle c, s \rangle} - 1} \left( -1 + \sigma^{arm\langle c, s \rangle} \right) \left( \alpha^{ct\langle c, s \rangle} CD^{(c, s) \sigma^{arm\langle c, s \rangle} - 1} \left( -1 + \sigma^{arm\langle c, s \rangle} \right) \right) + \left( 1 - \alpha^{ct\langle c, s \rangle} \right) CM^{(c, s)} \quad (7.11)$$

$$c \in COU: \quad s \in SEC: \quad \lambda^{BANK^1} p^{imp\langle c, s \rangle} \left( 1 + tsm^{cgds\langle c, s \rangle} \right) + \theta^{ct\langle c, s \rangle} \lambda^{BANK^3\langle s, c \rangle} \left( 1 - \alpha^{ct\langle c, s \rangle} \right) CM^{(c, s) - 1 + \sigma^{arm\langle c, s \rangle} - 1} \left( -1 + \sigma^{arm\langle c, s \rangle} \right) \left( \alpha^{ct\langle c, s \rangle} CD^{(c, s) \sigma^{arm\langle c, s \rangle} - 1} \left( -1 + \sigma^{arm\langle c, s \rangle} \right) \right) + \left( 1 - \alpha^{ct\langle c, s \rangle} \right) \quad (7.12)$$

## 8 EQUILIBRIUM

### 8.1 Identities

$$c \in COU: \quad s \in SEC: \quad Y^{home\langle c, s \rangle} = CD^{(c, s)} + DD^{(c, s)} + GD^{(c, s)} + \sum_{\tilde{s} \in SEC} ICD^{(c, \tilde{s}, s)} \quad (8.1)$$

$$c \in COU: \quad s \in SEC: \quad Y^{(c, s)} = Y^{home\langle c, s \rangle} + \sum_{\alpha \in COU} EX^{(c, \alpha, s)} \quad (8.2)$$

$$c \in COU: \quad s \in SECT: \quad Y^{(c,s)} = TRANS^{total(c)} + Y^{home(c,s)} + \sum_{\alpha \in COU} EX^{(c,\alpha,s)} \quad (8.3)$$

$$c \in COU: \quad s \in SEC: \quad IMPORT^{(c,s)} = CM^{(c,s)} + DM^{(c,s)} + GM^{(c,s)} + \sum_{\tilde{s} \in SEC} ICM^{(c,\tilde{s},s)} \quad (8.4)$$

$$c \in COU: \quad K^{(c)} = \sum_{s \in SEC} K^{(c,s)} \quad (8.5)$$

$$c \in COU: \quad L^{(c)} = \sum_{s \in SEC} L^{(c,s)} \quad (8.6)$$

$$\left( \sum_{c \in COU} K^{(c)} + \sum_{c \in COU} L^{(c)} \right)^{-1} \left( \sum_{c \in COU} p^{k(c)} K^{(c)} + \sum_{c \in COU} p^{l(c)} L^{(c)} \right) = 1 \quad (8.7)$$

$$PROFIT = \pi^{trans} + \sum_{c \in COU} \sum_{s \in SEC} \pi^{(c,s)} + \sum_{c \in COU} \sum_{s \in SEC} \pi^{imp(c,s)} \quad (8.8)$$

## 9 Equilibrium relationships (before expansion and reduction)

$$- \sum_{c \in COU} TRANS^{bal(c)} = 0 \quad (9.1)$$

$$1 - \left( \sum_{c \in COU} K^{(c)} + \sum_{c \in COU} L^{(c)} \right)^{-1} \left( \sum_{c \in COU} p^{k(c)} K^{(c)} + \sum_{c \in COU} p^{l(c)} L^{(c)} \right) = 0 \quad (9.2)$$

$$INVEST - \theta^{invest} \left( \prod_{c \in COU} INV^{(c)\beta^{invest(c)}} \right) = 0 \quad (9.3)$$

$$-SAVINGS + \sum_{c \in COU} SV^{REG(c)} = 0 \quad (9.4)$$

$$-TRANS^{global} + \theta^{trans} \left( \prod_{c \in COU} TRANS^{total(c)\beta^{trans(c)}} \right) = 0 \quad (9.5)$$

$$\pi^{trans} - p^{trans} TRANS^{global} + \sum_{c \in COU} p^{(c,SEC8)} TRANS^{total(c)} = 0 \quad (9.6)$$

$$-SAVINGS + \sum_{c \in COU} \sum_{s \in SEC} p^{(c,s)} CD^{(c,s)} \left( 1 + tssl^{cgds(c,s)} \right) + \sum_{c \in COU} \sum_{s \in SEC} p^{imp(c,s)} CM^{(c,s)} \left( 1 + tssm^{cgds(c,s)} \right) = 0 \quad (9.7)$$

$$\pi^{\text{trans}} - \text{PROFIT} + \sum_{c \in \text{COU}} \sum_{s \in \text{SEC}} \pi^{(c,s)} + \sum_{c \in \text{COU}} \sum_{s \in \text{SEC}} \pi^{\text{imp}(c,s)} = 0 \quad (9.8)$$

$$c \in \text{COU} \setminus \{\text{COU4}\}: \quad -\text{TRANS}^{\text{total}(c)} - \text{TRANS}^{\text{bal}(c)} + \sum_{\alpha \in \text{COU}} \text{TRANS}^{(\alpha,c)} = 0 \quad (9.9)$$

$$c \in \text{COU}: \quad \text{saving}^{\text{rate}^{\text{cons}(c)}} - \text{INC}^{\text{CONS}(c)-1} \text{SV}^{\text{CONS}(c)} = 0 \quad (9.10)$$

$$c \in \text{COU}: \quad -\lambda^{\text{BANK}^2(c)} + \theta^{\text{invest}} \beta^{\text{invest}(c)} \text{INV}^{(c)-1} \left( \prod_{c' \in \text{COU}} \text{INV}^{(c')} \beta^{\text{invest}(c')} \right) = 0 \quad (9.11)$$

$$c \in \text{COU}: \quad -p^{(c,\text{SEC8})} + \theta^{\text{trans}} \beta^{\text{trans}(c)} p^{\text{trans}} \text{TRANS}^{\text{total}(c)-1} \left( \prod_{c' \in \text{COU}} \text{TRANS}^{\text{total}(c')} \beta^{\text{trans}(c')} \right) = 0 \quad (9.12)$$

$$\alpha \in \text{COU}: \quad -\text{CA}^{(\alpha)} - \sum_{\alpha \in \text{COU}} \text{EX}^{\text{bal}(\alpha,\alpha)} = 0 \quad (9.13)$$

$$c \in \text{COU}: \quad -\text{DEP}^{(c)} + \delta^{(c)} p^{\text{k}(c)} K^{(c)} = 0 \quad (9.14)$$

$$c \in \text{COU}: \quad -\text{INV}^{(c)} + \theta^{\text{inv}(c)} \left( \prod_{s \in \text{SEC}} \text{CT}^{(c,s)} \beta^{\text{inv}(c,s)} \right) = 0 \quad (9.15)$$

$$c \in \text{COU}: \quad -K^{(c)} + \text{scale}^{(c)-1} \left( \sum_{s \in \text{SEC}} K^{\text{data}(c,s)} \right) = 0 \quad (9.16)$$

$$c \in \text{COU}: \quad -K^{(c)} + \sum_{s \in \text{SEC}} K^{(c,s)} = 0 \quad (9.17)$$

$$c \in \text{COU}: \quad -L^{(c)} + \text{scale}^{(c)-1} \left( -L^{\text{slack}(c)} + \sum_{s \in \text{SEC}} L^{\text{data}(c,s)} \right) = 0 \quad (9.18)$$

$$c \in \text{COU}: \quad -L^{(c)} + \sum_{s \in \text{SEC}} L^{(c,s)} = 0 \quad (9.19)$$

$$c \in \text{COU}: \quad -\text{SUB}^{(c)} + \text{gsb}^{(c)} \text{INC}^{\text{GOV}(c)} = 0 \quad (9.20)$$

$$c \in \text{COU}: \quad -\text{Tee}^{(c)} + \sum_{s \in \text{SEC}} p^{(c,s)} \left( \sum_{\alpha \in \text{COU}} \text{tee}^{(c,\alpha,s)} \text{EX}^{(c,\alpha,s)} \right) = 0 \quad (9.21)$$

$$c \in COU: \quad -Tf^k(c) + p^k(c) \left( \sum_{s \in SEC} tf^k(c,s) K^{(c,s)} \right) = 0 \quad (9.22)$$

$$c \in COU: \quad -Tf^l(c) + p^l(c) \left( \sum_{s \in SEC} tf^l(c,s) L^{(c,s)} \right) = 0 \quad (9.23)$$

$$c \in COU: \quad -Tmm^{(c)} + scale^{(c)-1} \left( \sum_{s \in SEC} \sum_{\alpha \in COU} scale^{(\alpha)} tmm^{(\alpha,c,s)} p^{cif(\alpha,c,s)} IM^{(\alpha,c,s)} \right) = 0 \quad (9.24)$$

$$c \in COU: \quad -Tprod^{(c)} + \sum_{s \in SEC} tprod^{(c,s)} p^{(c,s)} Y^{(c,s)} = 0 \quad (9.25)$$

$$c \in COU: \quad -Tssm^{(c)} + \sum_{s \in SEC} p^{imp(c,s)} \left( tssm^{priv(c,s)} DM^{(c,s)} + tssm^{gov(c,s)} GM^{(c,s)} + tssm^{cgds(c,s)} CM^{(c,s)} + \sum_{\tilde{s} \in SEC} tssm^{prod(c,\tilde{s},s)} ICM^{(c,\tilde{s},s)} \right) = 0 \quad (9.26)$$

$$c \in COU: \quad -Tssd^{(c)} + \sum_{s \in SEC} p^{(c,s)} \left( tssd^{priv(c,s)} DD^{(c,s)} + tssd^{gov(c,s)} GD^{(c,s)} + tssd^{cgds(c,s)} CD^{(c,s)} + \sum_{\tilde{s} \in SEC} tssd^{prod(c,\tilde{s},s)} ICD^{(c,\tilde{s},s)} \right) = 0 \quad (9.27)$$

$$c \in COU: \quad U^{CONS(c)} - \left( \sum_{s \in SEC} \alpha^{dt(c,s)} DT^{(c,s)} \sigma^{u(c)-1} (-1 + \sigma^{u(c)}) \right)^{\sigma^{u(c)} (-1 + \sigma^{u(c)})^{-1}} = 0 \quad (9.28)$$

$$c \in COU: \quad U^{GOV(c)} - \prod_{s \in SEC} GT^{(c,s)} \beta^{gov(c,s)} = 0 \quad (9.29)$$

$$c \in COU: \quad -Tinc^{(c)} + tinc^k(c) p^k(c) K^{(c)} + tinc^l(c) p^l(c) L^{(c)} = 0 \quad (9.30)$$

$$c \in COU: \quad -INC^{GOV(c)} + SUB^{(c)} + \sum_{s \in SEC} p^{(c,s)} GD^{(c,s)} \left( 1 + tssd^{gov(c,s)} \right) + \sum_{s \in SEC} p^{imp(c,s)} GM^{(c,s)} \left( 1 + tssm^{gov(c,s)} \right) = 0 \quad (9.31)$$

$$c \in COU: \quad -INC^{CONS(c)} + SV^{CONS(c)} + \sum_{s \in SEC} p^{(c,s)} DD^{(c,s)} \left( 1 + tssd^{priv(c,s)} \right) + \sum_{s \in SEC} p^{imp(c,s)} DM^{(c,s)} \left( 1 + tssm^{priv(c,s)} \right) = 0 \quad (9.32)$$

$$c \in COU: \quad -CA^{(c)} + DEP^{(c)} + SV^{CONS(c)} - SV^{REG(c)} + p^{(c,SECS)} TRANS^{bal(c)} = 0 \quad (9.33)$$

$$c \in COU: \quad -DEP^{(c)} - INC^{CONS(c)} + SUB^{(c)} + \phi^{(c)} PROFIT + p^k(c) K^{(c)} \left( 1 - tinc^k(c) \right) + p^l(c) L^{(c)} \left( 1 - tinc^l(c) \right) = 0 \quad (9.34)$$

$$c \in COU: \quad -INC^{GOV(c)} + Te^{(c)} + Tf^k(c) + Tf^l(c) + Tinc^{(c)} + Tmm^{(c)} + Tprod^{(c)} + Tssm^{(c)} + Tssd^{(c)} = 0 \quad (9.35)$$

$$c \in COU: \quad \alpha \in COU: \quad -TRANS^{(c,\alpha)} + scale^{(c)} scale^{(\alpha)^{-1}} \left( \sum_{s \in SEC} \tau^{(c,\alpha,s)} IM^{(c,\alpha,s)} \right) = 0 \quad (9.36)$$

$$c \in COU: \quad \alpha \in COU: \quad -scale^{(c)} \left( \sum_{s \in SEC} p^{fob^{(c,\alpha,s)}} EX^{(c,\alpha,s)} \right) + scale^{(\alpha)} \left( \sum_{s \in SEC} p^{fob^{(\alpha,c,s)}} IM^{(\alpha,c,s)} \right) - scale^{(c)} EX^{bal^{(c,\alpha)}} = 0 \quad (9.37)$$

$$c \in COU: \quad s \in SEC: \quad -\lambda^{CONSUMER^2^{(c,s)}} + \alpha^{dt^{(c,s)}} DI^{(c,s)^{-1+\sigma^u(c)^{-1}}(-1+\sigma^u(c))} \left( \sum_{s \in SEC} \alpha^{dt^{(c,s)}} DI^{(c,s)} \sigma^{u(c)^{-1}}(-1+\sigma^u(c)) \right)^{-1+\sigma^u(c)^{-1}} = 0 \quad (9.38)$$

$$c \in COU: \quad s \in SEC: \quad -\lambda^{GOVERNMENT^1^{(c,s)}} + \beta^{gov^{(c,s)}} GI^{(c,s)^{-1}} \left( \prod_{s' \in SEC} GI^{(c,s')} \beta^{gov^{(c,s')}} \right) = 0 \quad (9.39)$$

$$c \in COU: \quad s \in SEC: \quad -\lambda^{BANK^3^{(s,c)}} + \beta^{inv^{(c,s)}} \theta^{inv^{(c)}} \lambda^{BANK^2^{(c)}} CI^{(c,s)^{-1}} \left( \prod_{s' \in SEC} CI^{(c,s')} \beta^{inv^{(c,s')}} \right) = 0 \quad (9.40)$$

$$c \in COU: \quad s \in SEC: \quad -CI^{(c,s)} + \theta^{ct^{(c,s)}} \left( \alpha^{ct^{(c,s)}} CD^{(c,s)} \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} + \left( 1 - \alpha^{ct^{(c,s)}} \right) CM^{(c,s)} \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} \right) \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} = 0 \quad (9.41)$$

$$c \in COU: \quad s \in SEC: \quad -DI^{(c,s)} + \left( \alpha^{dd^{(c,s)}} DD^{(c,s)} \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} + \left( 1 - \alpha^{dd^{(c,s)}} \right) DM^{(c,s)} \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} \right) \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} = 0 \quad (9.42)$$

$$c \in COU: \quad s \in SEC: \quad -FAC^{(c,s)} + \left( \alpha^k^{(c,s)} K^{(c,s)} \sigma^{fac^{(c,s)^{-1}}(-1+\sigma^{fac^{(c,s)}})} + \left( 1 - \alpha^k^{(c,s)} \right) L^{(c,s)} \sigma^{fac^{(c,s)^{-1}}(-1+\sigma^{fac^{(c,s)}})} \right) \sigma^{fac^{(c,s)^{-1}}(-1+\sigma^{fac^{(c,s)}})} = 0 \quad (9.43)$$

$$c \in COU: \quad s \in SEC: \quad -GI^{(c,s)} + \left( \alpha^{gt^{(c,s)}} GD^{(c,s)} \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} + \left( 1 - \alpha^{gt^{(c,s)}} \right) GM^{(c,s)} \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} \right) \sigma^{arm^{(c,s)^{-1}}(-1+\sigma^{arm^{(c,s)}})} = 0 \quad (9.44)$$

$$c \in COU: \quad s \in SEC: \quad -IC^{(c,s)} + \left( \sum_{\tilde{s} \in SEC} \alpha^{ict^{(c,s,\tilde{s})}} ICT^{(c,s,\tilde{s})} \sigma^{ic^{(c,s)^{-1}}(-1+\sigma^{ic^{(c,s)}})} \right) \sigma^{ic^{(c,s)^{-1}}(-1+\sigma^{ic^{(c,s)}})} = 0 \quad (9.45)$$

$$c \in COU: \quad s \in SEC: \quad -Y^{(c,s)} + tfp^{y^{(c,s)}} \left( \alpha^{fac^{(c,s)}} FAC^{(c,s)} \sigma^{y^{(c,s)^{-1}}(-1+\sigma^{y^{(c,s)}})} + \left( 1 - \alpha^{fac^{(c,s)}} \right) IC^{(c,s)} \sigma^{y^{(c,s)^{-1}}(-1+\sigma^{y^{(c,s)}})} \right) \sigma^{y^{(c,s)^{-1}}(-1+\sigma^{y^{(c,s)}})} = 0 \quad (9.46)$$

$$c \in COU: \quad s \in SEC: \quad -p^{k(c)} \left(1 + tf^{k(c,s)}\right) + \alpha^{\text{fac}(c,s)} \alpha^{k(c,s)} tf p^{y(c,s)} p^{(c,s)} \left(1 - \text{tr}^{al(c,s)}\right) FAC^{(c,s)-1+\sigma^y(c,s)^{-1}(-1+\sigma^y(c,s))} K^{(c,s)-1+\sigma^{\text{fac}(c,s)^{-1}(-1+\sigma^{\text{fac}(c,s)})}} \left(\alpha^{\text{fac}(c,s)} FAC^{(c,s)} \sigma^{y(c,s)^{-1}(-1+\sigma^y(c,s))}\right) \quad (9.47)$$

$$c \in COU: \quad s \in SEC: \quad -p^{l(c)} \left(1 + tf^{l(c,s)}\right) + \alpha^{\text{fac}(c,s)} tf p^{y(c,s)} p^{(c,s)} \left(1 - \alpha^{k(c,s)}\right) \left(1 - \text{tr}^{al(c,s)}\right) FAC^{(c,s)-1+\sigma^y(c,s)^{-1}(-1+\sigma^y(c,s))} L^{(c,s)-1+\sigma^{\text{fac}(c,s)^{-1}(-1+\sigma^{\text{fac}(c,s)})}} \left(\alpha^{\text{fac}(c,s)} FAC^{(c,s)} \sigma^{y(c,s)^{-1}(-1+\sigma^y(c,s))}\right) \quad (9.48)$$

$$c \in COU: \quad s \in SEC: \quad \lambda^{\text{BANK}^1} p^{(c,s)} \left(1 + \text{tss}^{cgds(c,s)}\right) + \alpha^{\text{ct}(c,s)} \theta^{\text{ct}(c,s)} \lambda^{\text{BANK}^3(s,c)} CD^{(c,s)-1+\sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}} \left(\alpha^{\text{ct}(c,s)} CD^{(c,s)} \sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}\right) + \left(1 - \alpha^{\text{ct}(c,s)}\right) CM^{(c,s)} \quad (9.49)$$

$$c \in COU: \quad s \in SEC: \quad \lambda^{\text{BANK}^1} p^{\text{imp}(c,s)} \left(1 + \text{tss}^{cgds(c,s)}\right) + \theta^{\text{ct}(c,s)} \lambda^{\text{BANK}^3(s,c)} \left(1 - \alpha^{\text{ct}(c,s)}\right) CM^{(c,s)-1+\sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}} \left(\alpha^{\text{ct}(c,s)} CD^{(c,s)} \sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}\right) + \left(1 - \alpha^{\text{ct}(c,s)}\right) \quad (9.50)$$

$$c \in COU: \quad s \in SEC: \quad \lambda^{\text{CONSUMER}^1(c)} p^{(c,s)} \left(1 + \text{tss}^{priv(c,s)}\right) + \alpha^{\text{dd}(c,s)} \lambda^{\text{CONSUMER}^2(c,s)} DD^{(c,s)-1+\sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}} \left(\alpha^{\text{dd}(c,s)} DD^{(c,s)} \sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}\right) + \left(1 - \alpha^{\text{dd}(c,s)}\right) \quad (9.51)$$

$$c \in COU: \quad s \in SEC: \quad \lambda^{\text{CONSUMER}^1(c)} p^{\text{imp}(c,s)} \left(1 + \text{tss}^{priv(c,s)}\right) + \lambda^{\text{CONSUMER}^2(c,s)} \left(1 - \alpha^{\text{dd}(c,s)}\right) DM^{(c,s)-1+\sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}} \left(\alpha^{\text{dd}(c,s)} DD^{(c,s)} \sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}\right) + \left(1 - \alpha^{\text{dd}(c,s)}\right) \quad (9.52)$$

$$c \in COU: \quad s \in SEC: \quad \lambda^{\text{GOVERNMENT}^2(c)} p^{(c,s)} \left(1 + \text{tss}^{gov(c,s)}\right) + \alpha^{\text{gt}(c,s)} \lambda^{\text{GOVERNMENT}^1(c,s)} GD^{(c,s)-1+\sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}} \left(\alpha^{\text{gt}(c,s)} GD^{(c,s)} \sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}\right) + \left(1 - \alpha^{\text{gt}(c,s)}\right) \quad (9.53)$$

$$c \in COU: \quad s \in SEC: \quad \lambda^{\text{GOVERNMENT}^2(c)} p^{\text{imp}(c,s)} \left(1 + \text{tss}^{gov(c,s)}\right) + \lambda^{\text{GOVERNMENT}^1(c,s)} \left(1 - \alpha^{\text{gt}(c,s)}\right) GM^{(c,s)-1+\sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}} \left(\alpha^{\text{gt}(c,s)} GD^{(c,s)} \sigma^{\text{arm}(c,s)^{-1}(-1+\sigma^{\text{arm}(c,s)})}\right) \quad (9.54)$$

$$c \in COU: \quad s \in SEC: \quad CD^{(c,s)} + DD^{(c,s)} + GD^{(c,s)} - Y^{\text{home}(c,s)} + \sum_{\tilde{s} \in SEC} ICD^{(c,\tilde{s},s)} = 0 \quad (9.55)$$

$$c \in COU: \quad s \in SEC: \quad CM^{(c,s)} + DM^{(c,s)} + GM^{(c,s)} - IMPORT^{(c,s)} + \sum_{\tilde{s} \in SEC} ICM^{(c,\tilde{s},s)} = 0 \quad (9.56)$$

$$c \in COU: \quad s \in SEC: \quad \pi^{(c,s)} - p^{(c,s)} Y^{(c,s)} \left(1 - t^{\text{prod}(c,s)}\right) + p^{k(c)} K^{(c,s)} \left(1 + t^{\text{fk}(c,s)}\right) + p^{l(c)} L^{(c,s)} \left(1 + t^{\text{fl}(c,s)}\right) + \sum_{\tilde{s} \in SEC} p^{(c,\tilde{s})} ICD^{(c,s,\tilde{s})} \left(1 + t^{\text{ssd}^{\text{prod}(c,s,\tilde{s})}}\right) + \sum_{\tilde{s} \in SEC} p^{\text{imp}(c,\tilde{s})} ICM^{(c,s,\tilde{s})} = 0 \quad (9.57)$$

$$c \in COU: \quad s \in SEC: \quad \alpha \in COU: \quad -p^{\text{fob}(c,\alpha,s)} + p^{(c,s)} \left(1 + t^{\text{te}(c,\alpha,s)}\right) = 0 \quad (9.58)$$

$$c \in COU: \quad s \in SEC: \quad \tilde{s} \in SEC: \quad -\lambda^{\text{FIRM}^4(c,s,\tilde{s})} + \alpha^{\text{ict}(c,s,\tilde{s})} t^{\text{fp}^{\text{y}(c,s)}} p^{(c,s)} \left(1 - \alpha^{\text{fac}(c,s)}\right) \left(1 - t^{\text{rad}(c,s)}\right) IC^{(c,s)}^{-1 + \sigma^{\text{y}(c,s)} - 1} \left(-1 + \sigma^{\text{y}(c,s)}\right) ICT^{(c,s,\tilde{s})}^{-1 + \sigma^{\text{ic}(c,s)} - 1} \left(-1 + \sigma^{\text{ic}(c,s)}\right) \left(\alpha^{\text{fac}(c,s)}\right) = 0 \quad (9.59)$$

$$c \in COU: \quad s \in SEC: \quad \tilde{s} \in SEC: \quad -ICT^{(c,s,\tilde{s})} + \left(\alpha^{\text{icd}(c,s,\tilde{s})} ICD^{(c,s,\tilde{s})} \sigma^{\text{arm}(c,\tilde{s}) - 1} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right) + \left(1 - \alpha^{\text{icd}(c,s,\tilde{s})}\right) ICM^{(c,s,\tilde{s})} \sigma^{\text{arm}(c,\tilde{s}) - 1} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right)\right) \sigma^{\text{arm}(c,\tilde{s})} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right)^{-1} = 0 \quad (9.60)$$

$$c \in COU: \quad s \in SEC: \quad \tilde{s} \in SEC: \quad -p^{(c,\tilde{s})} \left(1 + t^{\text{ssd}^{\text{prod}(c,s,\tilde{s})}}\right) + \alpha^{\text{icd}(c,s,\tilde{s})} \lambda^{\text{FIRM}^4(c,s,\tilde{s})} ICD^{(c,s,\tilde{s})}^{-1 + \sigma^{\text{arm}(c,\tilde{s})} - 1} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right) \left(\alpha^{\text{icd}(c,s,\tilde{s})} ICD^{(c,s,\tilde{s})} \sigma^{\text{arm}(c,\tilde{s}) - 1} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right) + \left(1 - \alpha^{\text{icd}(c,s,\tilde{s})}\right) ICM^{(c,s,\tilde{s})} \sigma^{\text{arm}(c,\tilde{s}) - 1} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right)\right) = 0 \quad (9.61)$$

$$c \in COU: \quad s \in SEC: \quad \tilde{s} \in SEC: \quad -p^{\text{imp}(c,\tilde{s})} \left(1 + t^{\text{ssm}^{\text{prod}(c,s,\tilde{s})}}\right) + \lambda^{\text{FIRM}^4(c,s,\tilde{s})} \left(1 - \alpha^{\text{icd}(c,s,\tilde{s})}\right) ICM^{(c,s,\tilde{s})}^{-1 + \sigma^{\text{arm}(c,\tilde{s})} - 1} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right) \left(\alpha^{\text{icd}(c,s,\tilde{s})} ICD^{(c,s,\tilde{s})} \sigma^{\text{arm}(c,\tilde{s}) - 1} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right) + \left(1 - \alpha^{\text{icd}(c,s,\tilde{s})}\right) ICM^{(c,s,\tilde{s})} \sigma^{\text{arm}(c,\tilde{s}) - 1} \left(-1 + \sigma^{\text{arm}(c,\tilde{s})}\right)\right) = 0 \quad (9.62)$$

$$c \in COU: \quad s \in SECT: \quad TRANS^{\text{total}(c)} - Y^{(c,s)} + Y^{\text{home}(c,s)} + \sum_{\alpha \in COU} EX^{(c,\alpha,s)} = 0 \quad (9.63)$$

$$c \in COU: \quad s \in SECT: \quad -Y^{(c,s)} + Y^{\text{home}(c,s)} + \sum_{\alpha \in COU} EX^{(c,\alpha,s)} = 0 \quad (9.64)$$



$$c \in COUbig: \quad s \in SEC: \quad -IMPORT^{(c,s)} + \theta^{im(c,s)} \left( \sum_{\alpha \in COU} \alpha^{im(\alpha,c,s)} \left( scale^{(c)-1} scale^{(\alpha)} IM^{(\alpha,c,s)} \left( 1 + iceberg^{cost(\alpha,c,s)} \right) \right)^{\sigma^{im(s)-1} (-1 + \sigma^{im(s)})} \right)^{\sigma^{im(s)} (-1 + \sigma^{im(s)})^{-1}} = 0 \quad (9.65)$$

$$c \in COUbig: \quad s \in SEC: \quad \pi^{imp(c,s)} + scale^{(c)-1} \left( \sum_{\alpha \in COU} scale^{(\alpha)} p^{cif(\alpha,c,s)} IM^{(\alpha,c,s)} \left( 1 + tmm^{(\alpha,c,s)} \right) \right) - p^{imp(c,s)} IMPORT^{(c,s)} = 0 \quad (9.66)$$

$$c \in COUbig: \quad s \in SEC: \quad \alpha \in COU: \quad EX^{(\alpha,c,s)} - IM^{(\alpha,c,s)} = 0 \quad (9.67)$$

$$c \in COUbig: \quad s \in SEC: \quad \alpha \in COU: \quad -scale^{(c)-1} scale^{(\alpha)} p^{cif(\alpha,c,s)} \left( 1 + tmm^{(\alpha,c,s)} \right) + \alpha^{im(\alpha,c,s)} scale^{(c)-1} scale^{(\alpha)} \theta^{im(c,s)} p^{imp(c,s)} \left( 1 + iceberg^{cost(\alpha,c,s)} \right) \left( scale^{(c)-1} scale^{(\alpha)} IM^{(\alpha,c,s)} \left( 1 + iceberg^{cost(\alpha,c,s)} \right) \right)^{\sigma^{im(s)-1} (-1 + \sigma^{im(s)})} = 0 \quad (9.68)$$

$$c \in COUbig: \quad s \in SEC: \quad \alpha \in COU: \quad p^{fob(c,\alpha,s)} - p^{cif(c,\alpha,s)} + \tau^{(c,\alpha,s)} p^{trans} = 0 \quad (9.69)$$

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$$c \in COUonly: \quad s \in SEC: \quad -IMPORT^{(c,s)} + \theta^{im(c,s)} \left( \sum_{\alpha \in COU \setminus c} \alpha^{im(\alpha,c,s)} \left( scale^{(c)-1} scale^{(\alpha)} IM^{(\alpha,c,s)} \left( 1 + iceberg^{cost(\alpha,c,s)} \right) \right)^{\sigma^{im(s)-1} (-1 + \sigma^{im(s)})} \right)^{\sigma^{im(s)} (-1 + \sigma^{im(s)})^{-1}} = 0 \quad (9.70)$$

$$c \in COUonly: \quad s \in SEC: \quad \pi^{imp(c,s)} + scale^{(c)-1} \left( \sum_{\alpha \in COU} scale^{(\alpha)} p^{cif(\alpha,c,s)} IM^{(\alpha,c,s)} \left( 1 + tmm^{(\alpha,c,s)} \right) \right) - p^{imp(c,s)} IMPORT^{(c,s)} = 0 \quad (9.71)$$

$$c \in COUonly: \quad s \in SEC: \quad -scale^{(c)} IM^{(c,c,s)} = 0 \quad (9.72)$$

$$c \in COUonly: \quad s \in SEC: \quad \alpha \in COU: \quad EX^{(\alpha,c,s)} - IM^{(\alpha,c,s)} = 0 \quad (9.73)$$

$$c \in COUonly: \quad s \in SEC: \quad \alpha \in COU: \quad p^{fob(c,\alpha,s)} - p^{cif(c,\alpha,s)} + \tau^{(c,\alpha,s)} p^{trans} = 0 \quad (9.74)$$

$$c \in COUonly: \quad s \in SEC: \quad \alpha \in COU \setminus c: \quad -scale^{(c)-1} \left( \sum_{\alpha' \in COU} \delta^{(\alpha,\alpha')} scale^{(\alpha')} p^{cif(\alpha',c,s)} \left( 1 + tmm^{(\alpha',c,s)} \right) \right) + \alpha^{im(\alpha,c,s)} scale^{(c)-1} scale^{(\alpha)} \theta^{im(c,s)} p^{imp(c,s)} \left( 1 + iceberg^{cost(\alpha,c,s)} \right) \left( scale^{(c)-1} scale^{(\alpha)} IM^{(\alpha,c,s)} \left( 1 + iceberg^{cost(\alpha,c,s)} \right) \right)^{\sigma^{im(s)-1} (-1 + \sigma^{im(s)})} = 0 \quad (9.75)$$

## 10 Parameter settings

$$\alpha^{\text{im}\langle\text{COU1,COU1,SEC1}\rangle} = 0 \quad (10.1)$$

$$\alpha^{\text{im}\langle\text{COU1,COU1,SEC2}\rangle} = 0 \quad (10.2)$$

$$\alpha^{\text{im}\langle\text{COU1,COU1,SEC3}\rangle} = 0 \quad (10.3)$$

$$\alpha^{\text{im}\langle\text{COU1,COU1,SEC4}\rangle} = 0 \quad (10.4)$$

$$\alpha^{\text{im}\langle\text{COU1,COU1,SEC5}\rangle} = 0 \quad (10.5)$$

$$\alpha^{\text{im}\langle\text{COU1,COU1,SEC6}\rangle} = 0 \quad (10.6)$$

$$\alpha^{\text{im}\langle\text{COU1,COU1,SEC7}\rangle} = 0 \quad (10.7)$$

$$\alpha^{\text{im}\langle\text{COU1,COU1,SEC8}\rangle} = 0 \quad (10.8)$$

$$\alpha^{\text{im}\langle\text{COU2,COU2,SEC1}\rangle} = 0 \quad (10.9)$$

$$\alpha^{\text{im}\langle\text{COU2,COU2,SEC2}\rangle} = 0 \quad (10.10)$$

$$\alpha^{\text{im}\langle\text{COU2,COU2,SEC3}\rangle} = 0 \quad (10.11)$$

$$\alpha^{\text{im}\langle\text{COU2,COU2,SEC4}\rangle} = 0 \quad (10.12)$$

$$\alpha^{\text{im}\langle\text{COU2,COU2,SEC5}\rangle} = 0 \quad (10.13)$$

$$\alpha^{\text{im}\langle\text{COU2,COU2,SEC6}\rangle} = 0 \quad (10.14)$$

$$\alpha^{\text{im}\langle\text{COU2,COU2,SEC7}\rangle} = 0 \quad (10.15)$$

$$\alpha^{\text{im}\langle\text{COU2,COU2,SEC8}\rangle} = 0 \quad (10.16)$$

$$\phi^{(\text{COU1})} = 0.25 \quad (10.17)$$

$$\phi^{(\text{COU2})} = 0.25 \quad (10.18)$$

$$\phi^{(\text{COU3})} = 0.25 \quad (10.19)$$

$$\phi^{(\text{COU4})} = 0.25 \quad (10.20)$$

$$L^{\text{slack}(\text{COU1})} = 0 \quad (10.21)$$

$$L^{\text{slack}(\text{COU2})} = 0 \quad (10.22)$$

$$L^{\text{slack}(\text{COU3})} = 0 \quad (10.23)$$

$$L^{\text{slack}(\text{COU4})} = 0 \quad (10.24)$$