STAGE_t: Trade Relationships

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Outline

- Armington 'insight'
- Functional Form Issues
  - Shares
  - CET functions
- STAGE model trade
  - Imports
  - Exports

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Armington 'Insight'

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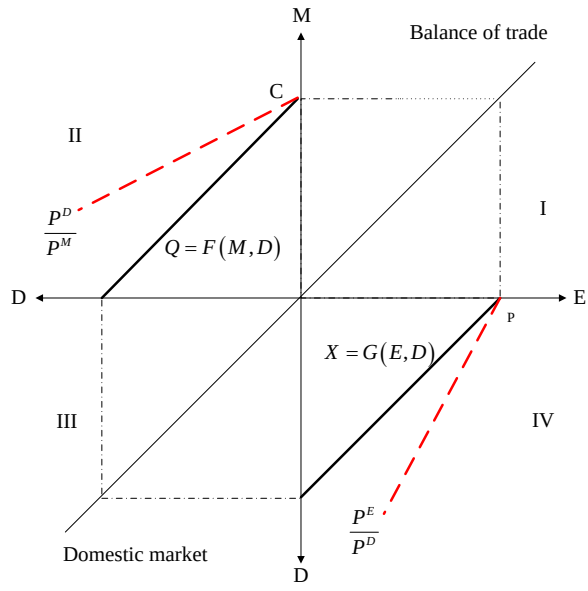
Trade and Homogenous Commodities



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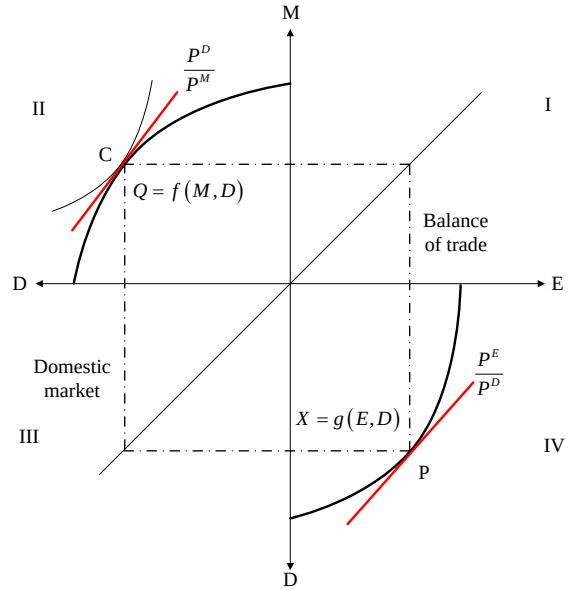
Armington 'Insight' with CET



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Functional Form Issues

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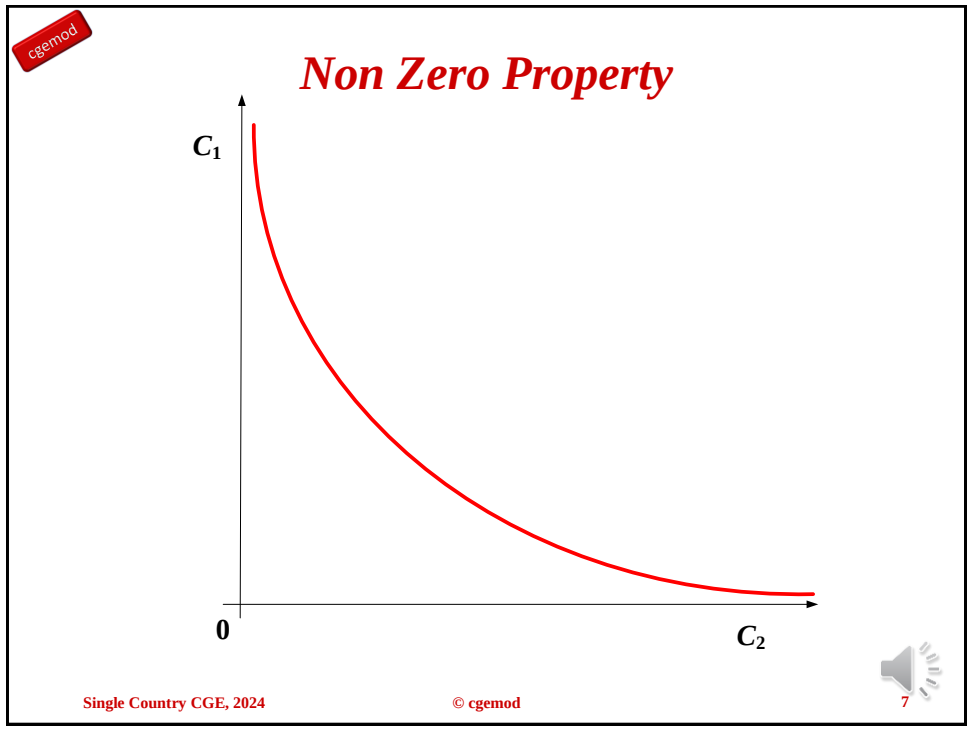
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Non Zero Property
C_1
0
C_2
Single Country CGE, 2024
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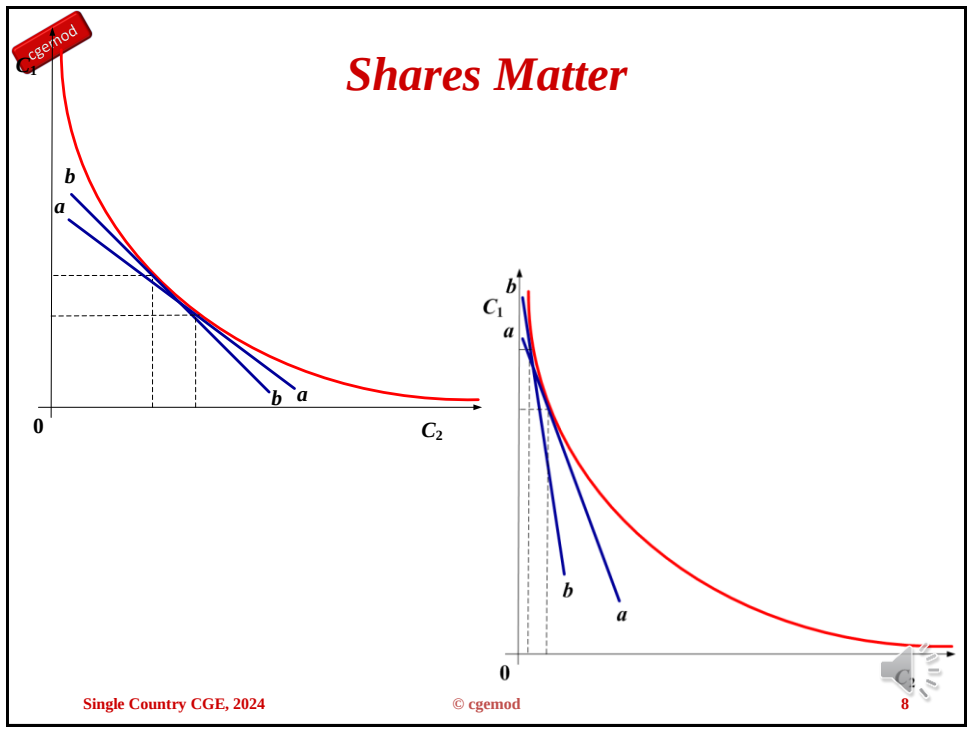
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Shares Matter
C_1
b
a
0
b
a
C_2
C_1
b
a
b
a
0
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Use of CET Functions

- **Use of CET functions violates LOOP**
  - **ONE** mechanism for determining **TWO** prices
  - **TWO** 'apparent' prices in **ONE** row
- **When is it appropriate to violate LOOP?**
  - Pragmatism
  - Theory
  - Commodities
  - Factors
- **Use of CET for Exports**
  - Allows domestic producers to respond to price changes
  - Mitigates the potential for large terms of trade effects
- **BUT**
  - What are the units?
  - How big are the changes?

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Trade System in STAGE_t

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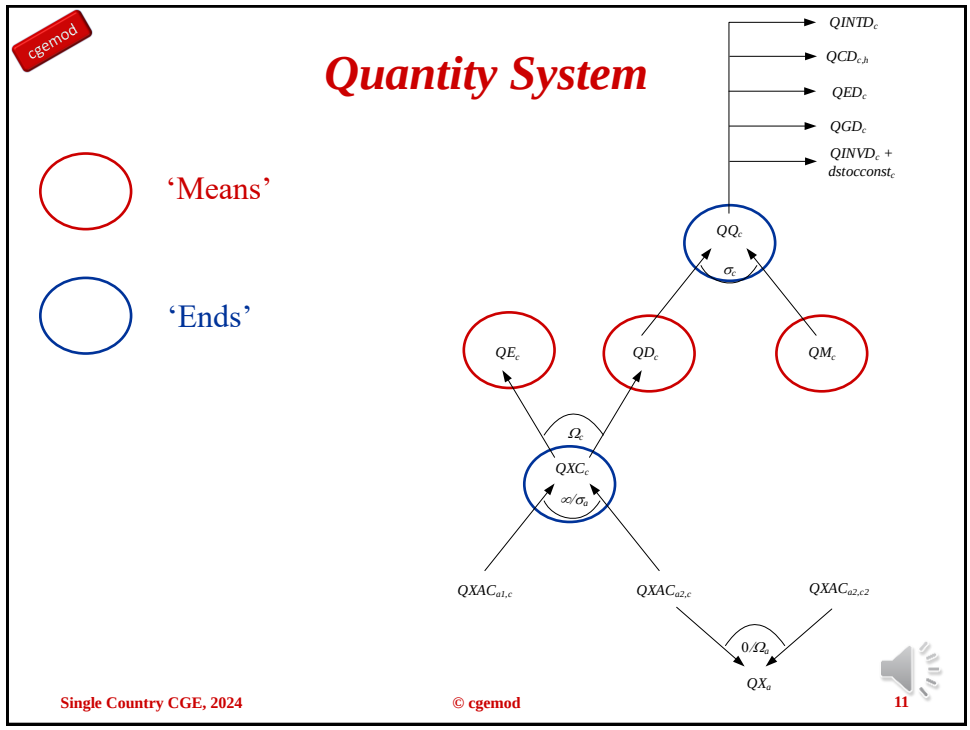
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Quantity System
'Means'
'Ends'
$QINTD_c$
$QCD_{c,h}$
QED_c
QGD_c
$QINVD_c$ + $dstocconst_c$
QQ_c
σ_c
QE_c
QD_c
QM_c
Ω_c
QXC_c
∞/σ_a
$QXAC_{a1,c}$
$QXAC_{a2,c}$
$QXAC_{a2,c2}$
$0/\Omega_a$
QX_a
Single Country CGE, 2024
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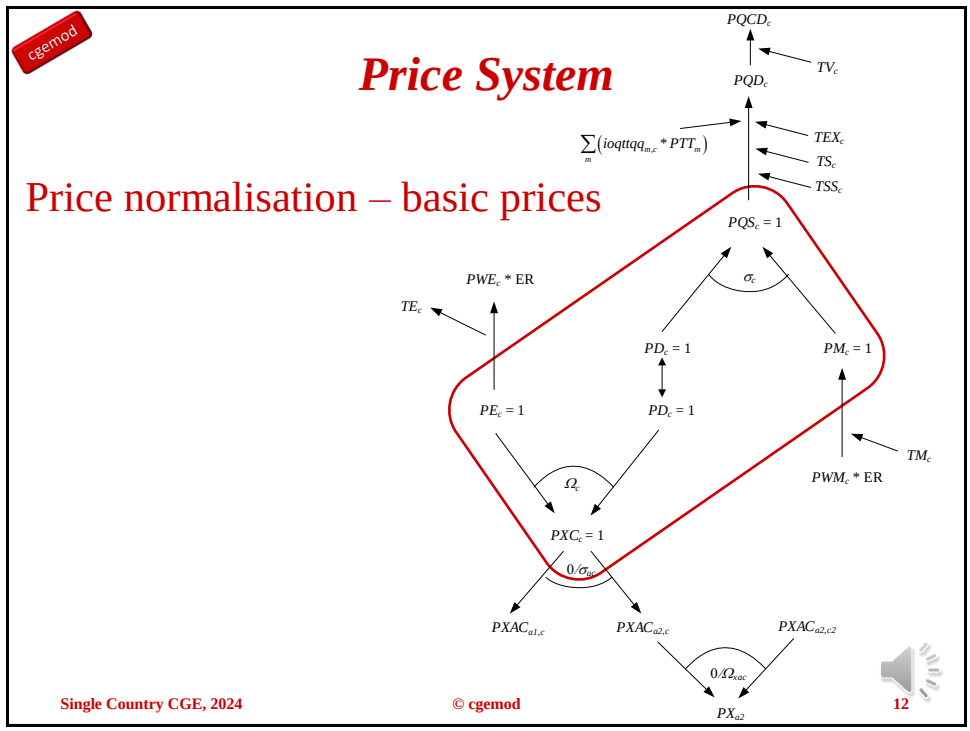
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Price System
Price normalisation – basic prices
$PQCD_c$
TV_c
PQD_c
$\sum_m (ioqttqq_{m,c} * PTT_m)$
TEX_c
TS_c
TSS_c
$PQS_c = 1$
σ_c
PWE_c * ER
TE_c
$PD_c = 1$
$PM_c = 1$
$PE_c = 1$
$PD_c = 1$
TM_c
PWM_c * ER
Ω_c
$PXC_c = 1$
$0/\sigma_{ac}$
$PXAC_{a1,c}$
$PXAC_{a2,c}$
$PXAC_{a2,c2}$
$0/\Omega_{xac}$
PX_{a2}
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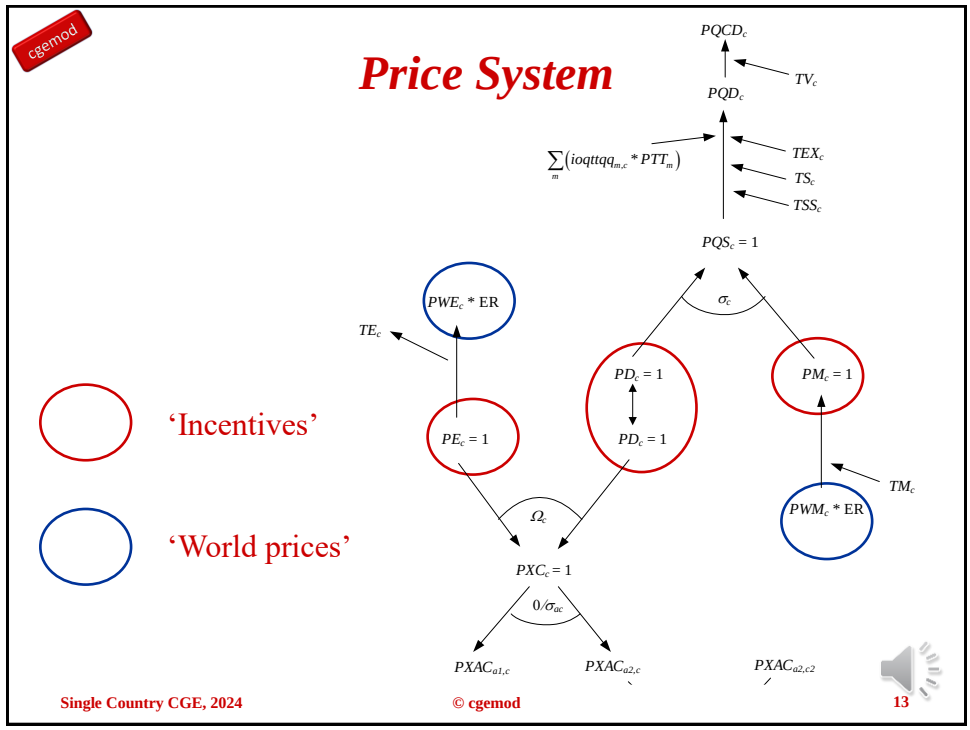
cgemod
Price System
$PQCD_c$
TV_c
PQD_c
$\sum_m (ioqttqq_{m,c} * PTT_m)$
TEX_c
TS_c
TSS_c
$PQS_c = 1$
$PWE_c * ER$
TE_c
σ_c
$PD_c = 1$
$PM_c = 1$
$PE_c = 1$
$PD_c = 1$
TM_c
$PWM_c * ER$
Ω_c
$PXC_c = 1$
$0/\sigma_{ac}$
$PXAC_{a1,c}$
$PXAC_{a2,c}$
$PXAC_{a2,c2}$
'Incentives'
'World prices'
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STAGE_t: Exports
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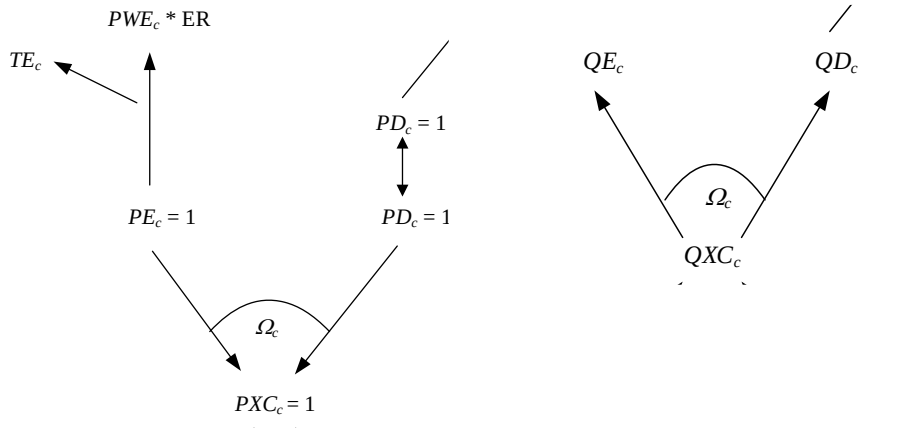
Exports in STAGE_t: Prices & Quantities



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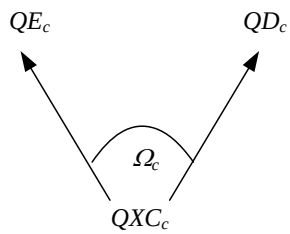
Exports in STAGE_t: Quantities



- Aggregate exports (*QE*) and domestic (*QD*) imperfect substitutes
  - Ω_c the elasticity of transformation
  - 1st order condition by prices (*PE* and *PD*)
- Composite commodity (*QXC*) produced by domestic producers

$$QXC_c = at_c * \left(\gamma_c * QE_c^{\,rhot_c} + (1-\gamma_c) * QD_c^{\,rhot_c}\right)^{\frac{1}{rhot_c}} \quad \forall ce \textbf{ AND } cd$$

```
QXC(c) =E= at(c)*(gamma(c)*QE(c)**rhot(c) +
           (1-gamma(c))*QD(c)**rhot(c))**(1/rhot(c)) ;
```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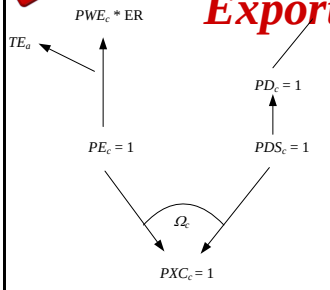
Exports in STAGE_t: Prices



- The price of the composite commodity (*PXC*) produced by domestic producers is a CET aggregate
- Aggregate export prices (*PE*) and domestic prices (*PD*) are imperfect substitutes
  - Ω_c the elasticity of transformation

$$\frac{QE_c}{QD_c} = \left[\frac{PE_c}{PD_c} * \frac{(1-\gamma_c)}{\gamma_c} \right]^{\frac{1}{(rhot_c - 1)}} \qquad \forall ce \textbf{ AND } cd$$

```
QE(c)  =E=  QD(c)*((PE(c)/PD(c))*((1-gamma(c))
            /gamma(c)))**(1/(rhot(c)-1)) ;
```

$$PE_c = PWE_c * ER * (1 - TE_c) \qquad \forall ce$$

```
PE(c)  =E=  PWE(c)  * ER *  (1  -  TE(c)) ;
```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STAGE_t: Export Demand Function

- Downward sloping export demand function – large country case
  - *eta* is the (constant) elasticity of export demand
- World prices of exports (*PWE*) for commodities in *ced* are variables

$$QE_c = econ_c * \left(\frac{PWE_c}{pwse_c} \right)^{-eta_c} \qquad \forall ced$$

```
QE(c)  =E=  econ(c)*((PWE(c)/pwse(c))**(-eta(c)));
```

$$PE_c = PWE_c * ER * (1 - TE_c) \qquad \forall ce$$

```
PE(c)  =E=  PWE(c)  * ER *  (1  -  TE(c)) ;
```


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Conventions and Calibration

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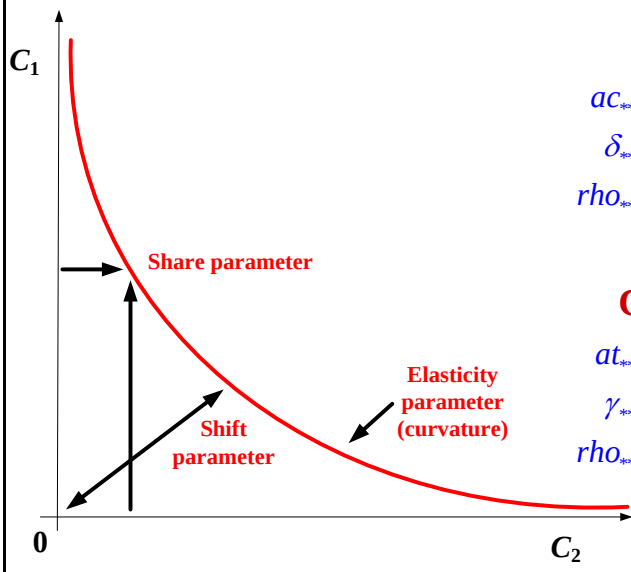
Conventions for CES and CET



CES Function

ac_{**} = intercept parameter

δ_{**} = share parameter

rho_{**} = elasticity parameter

CET Function

at_{**} = intercept parameter

γ_{**} = share parameter

rho_{**} = elasticity parameter

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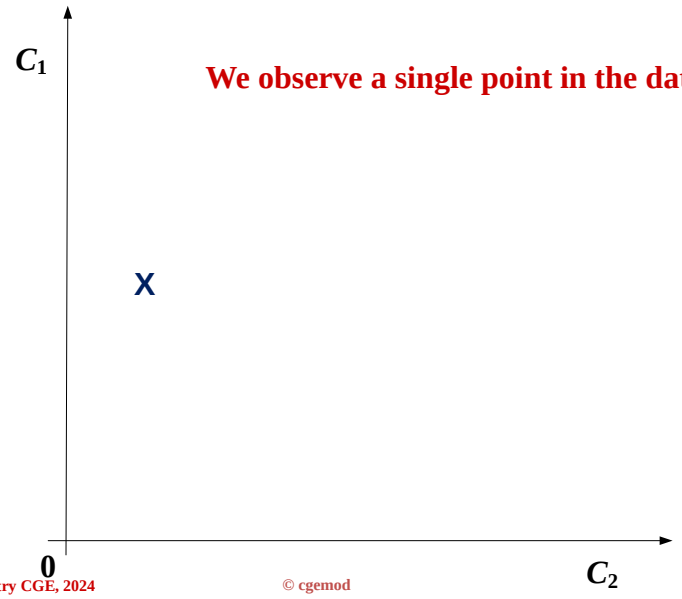
Data for CES (and CET)



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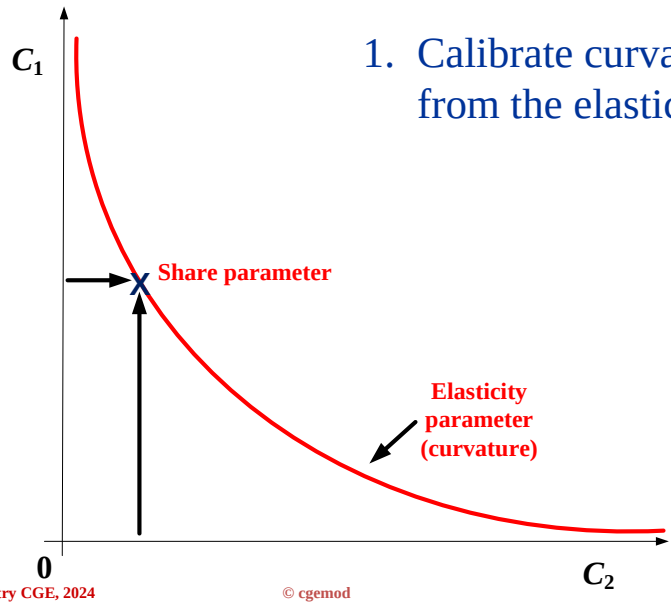
Calibration of CES (and CET): 1



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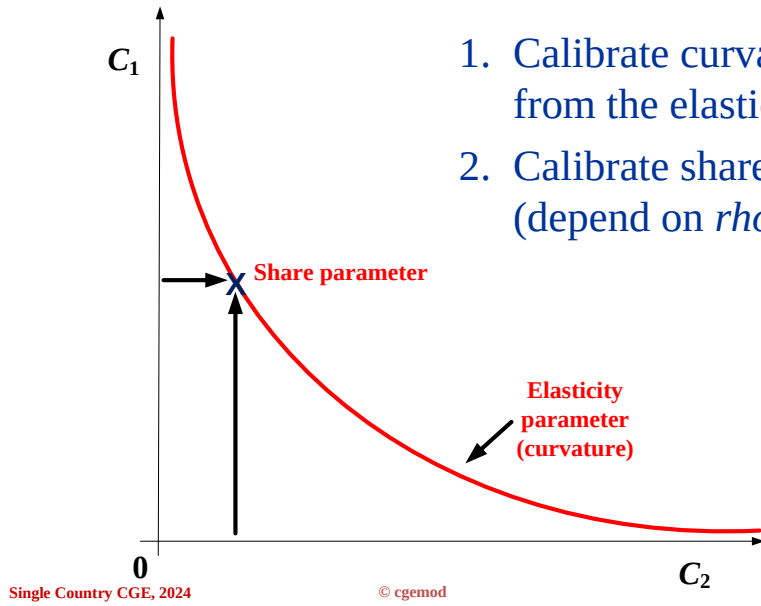
Calibration of CES (and CET): 2



1. Calibrate curvature from the elasticity
2. Calibrate shares (depend on *rho*)

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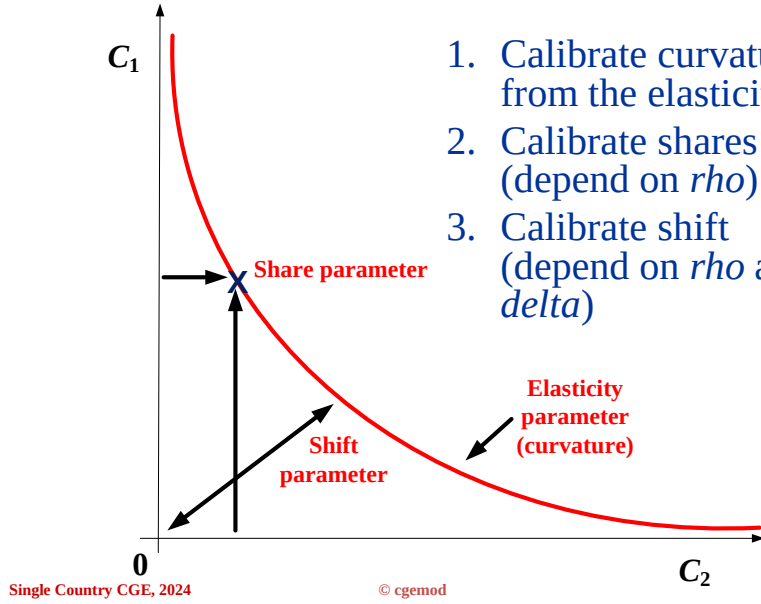
Calibration of CES (and CET): 3



1. Calibrate curvature from the elasticity
2. Calibrate shares (depend on *rho*)
3. Calibrate shift (depend on *rho* and *delta*)

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STAGE_t: Imports

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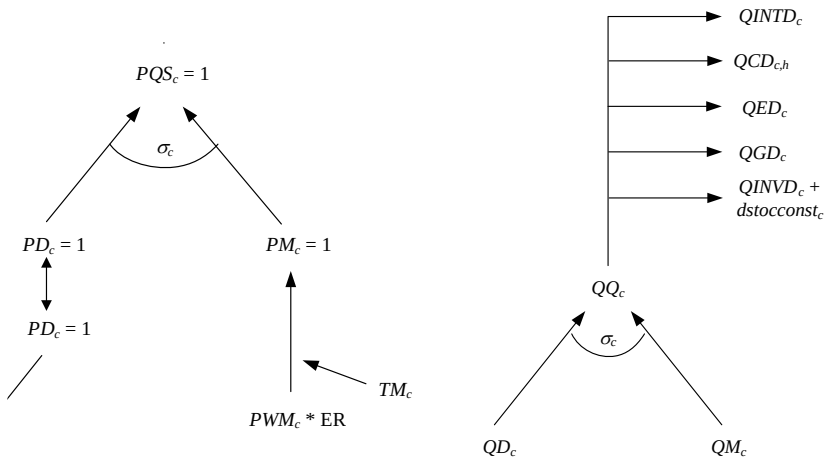
Imports in STAGE_t: Prices & Quantities



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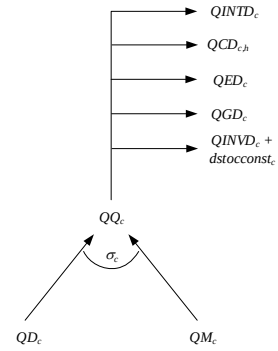
Imports in STAGE_t: Quantities

- Aggregate imports (*QM*) and domestic (*QD*) imperfect substitutes
  - σ_c the elasticity of substitution
  - 1st order condition by prices (*PM* and *PD*)
- Composite commodity (*QQ*) sold to domestic consumers



$$QQ_c = ac_c\left(\delta_c QM_c^{-rhoc_c} + (1-\delta_c) QD_c^{-rhoc_c}\right)^{-\frac{1}{rhoc_c}} \qquad \forall cm \textbf{ AND } cx$$

```
QQ(c)=E= ac(c)*(delta(c)*QM(c)**(-rhoc(c)) +
         (1-delta(c))*QD(c)**(-rhoc(c)))
                **(-1/rhoc(c)) ;
```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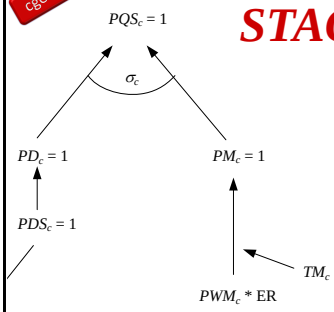
STAGE_t: Import Prices



- The price of the composite commodity (*PQS*) consumed by domestic consumer is a CES aggregate
- Aggregate import prices (*PM*) and domestic prices (*PD*) are imperfect substitutes
  - σ_c the elasticity of substitution

$$PM_c = PWM_c * ER * (1 + TM_c) \qquad \forall cm$$

```
PM(c) =E= (PWM(c) *(1 + TM(c))) * ER ;
```

$$\frac{QM_c}{QD_c} = \left[\frac{PD_c}{PM_c} * \frac{\delta_c}{(1-\delta_c)}\right]^{\frac{1}{(1+rhoc_c)}} \qquad \forall cm \textbf{ AND } cx$$

```
QM(c) =E= QD(c)*((PD(c)/PM(c))*(delta(c)/
          (1-delta(c))))**(1/(1+rhoc(c)));
```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