*A Basic 1*2*3 Open Economy Model: Pt 2*

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Outline

- Introduction
- *Basic 123 Model*
  - *Economic Theory*
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  - *Behaviour and Labels*
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- *Armington's 'Insight'*
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- 'Trade' Functions
- A Basic 123 Model in GAMS
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  - Macroeconomic Closure and Market Clearing

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Programming Problem

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Programming Problem

Max $QQ = F\left(QM, QDD, \sigma\right)$ (absorption)

with respect to QM, QE, QDS, QDD

(1) $G\left(QE, QDS, \Omega\right) \le \overline{QX}$ (technology)

(2) $pw^m.QM \le pw^e.QE + \overline{KAPWOR}$ (balance of trade)

(3) $QDD \le QDS$ (domestic supply and demand)

(1a) $\lambda^x = \dfrac{PX}{PQ}$

(2a) $\lambda^b = \dfrac{ER}{PQ}$ **Shadow Prices**

(3a) $\lambda^d = \dfrac{PD}{PQ}$

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'Trade' Functions: CES and CET

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CES/CET Trade Functions

$$Y = \bar{A}\left[\alpha.QX_1^{\rho} + (1-\alpha).QX_2^{\rho}\right]^{1/\rho}$$

$$P_Y = \bar{A}^{-1}\left[\alpha^{1/(1-\rho)}.P_1^{\rho/(\rho-1)} + (1-\alpha)^{1/(1-\rho)}.P_2^{\rho/(\rho-1)}\right]^{(\rho-1)/\rho}$$

$$QX = at\left(\gamma * QE^{rhot} + (1-\gamma) * QDS^{rhot}\right)^{\frac{1}{rhot}}$$ **CET Function**

$$QQ = ac\left(\delta * QM^{-rhoc} + (1-\delta) * QDD^{-rhoc}\right)^{-\frac{1}{rhoc}}$$ **CES Function**

$$\sigma \textbf{ or } \Omega = \frac{1}{(1-\rho)} \qquad -\infty < \rho < +1$$

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CES/CET Trade Functions

$$\frac{QM}{QDD} = \left[\frac{\delta}{(1-\delta)} \cdot \frac{PD}{PM}\right]^{\sigma}$$

Import Function

$$PQ = \frac{(PM.QM) + (PD.QDD)}{QQ}$$

Expenditure Identity

$$\frac{QE}{QDS} = \left[\frac{(1-\gamma)}{\gamma} \cdot \frac{PE}{PDS}\right]^{\Omega}$$

Export Function

$$PX = \frac{(PE.QE) + (PD.QDS)}{QX}$$

Expenditure Identity

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A Basic 123 Model in GAMS

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Basic 123 Model: Features

Output: *QX.FX*
So no Factors → no factor prices

Government: None
So no taxes → no price 'wedges' or Govt demand

Investment: None
So no savings → no savings rates or Invest. demand

Household: only institution
Sole source of demand
Sole recipient of income

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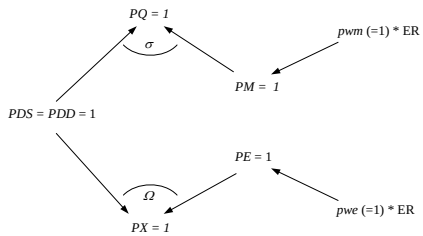
Price Normalisation & Numéraire

- Normalise on BASIC prices
- Numéraire – CPI (*PQ.FX*)
- Exchange rate – *ER* = 1



$PDS = PDD = PM = PE = 1$

$\therefore PQ = PX = 1$

$ER = 1$

$\therefore pwm = pwe = 1$

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Price Block

Small country assumption

$PM = pwm * ER$ World price of imports exogenous

$PE = pwe * ER$ World price of exports exogenous

(Paasche) Quantity Price Indices

$$PQ = \frac{PDD * QDD + PM * QM}{QQ}$$ Purchaser price

$$PX = \frac{PDS * QDS + PE * QE}{QX}$$ 'Producer' price

Application of Euler's theorem

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Supply Block

$$QX = at\left(\gamma * QE^{rhot} + (1-\gamma) * QDS^{rhot}\right)^{\frac{1}{rhot}}$$ *ppf* – concave to origin

$$\frac{QE}{QDS} = \left(\frac{PE}{PDS} * \frac{(1-\gamma)}{\gamma}\right)^{\frac{1}{(rhot-1)}}$$ 1st Order condition for output mix

$$QQ = ac\left(\delta * QM^{-rhoc} + (1-\delta) * QDD^{-rhoc}\right)^{-\frac{1}{rhoc}}$$ *utility* – convex to origin

$$\frac{QM}{QDD} = \left(\frac{PDD}{PM} * \frac{\delta}{(1-\delta)}\right)^{\frac{1}{(1+rhoc)}}$$ 1st Order condition for 'input' mix

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Income & Expenditure Block

$$YH = (PX * QX) + (KAPWOR * ER)$$

Household Income

No Factors: no factor prices
No Government: no taxes
No Investment: no savings

$$QCD = \frac{YH}{PQ}$$

Household Expenditure

Household is the only source of demand
Only one commodity (QQ)

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Market Clearing Block

$$QQ = QCD$$

Supply = Demand

$$QDD = QDS$$

Domestic Supply = Domestic Demand

$$KAPWOR = (pwm * QM - pwe * QE) + \textbf{WALRAS}$$

Trade balance = Imports - Exports

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Macroeconomic Closure Block

$QX = \overline{QX}$ Output Fixed

$PQ = \overline{PQ}$ *CPI* - numéraire

$ER = \overline{ER}$ Exchange rate – fixed ??

$KAPWOR = \overline{KAPWOR}$ Trade balance – fixed ??

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Equation & Variable Counting 1

GAMS Equation Name	Equation Formula	No. Equations	Variable	No. Variables
PXDEF	$PX = \frac{PDS*QDS + PE*QE}{QX}$	1	*PX*	1
COSTMIN	$\frac{QM}{QDD} = \left(\frac{PDD}{PM} * \frac{\delta}{(1-\delta)}\right)^{\frac{1}{(1+rhoc)}}$	1	*QM*	1
			WALRAS	1
			$\overline{PQ}$	1
		14		**16 + 1**

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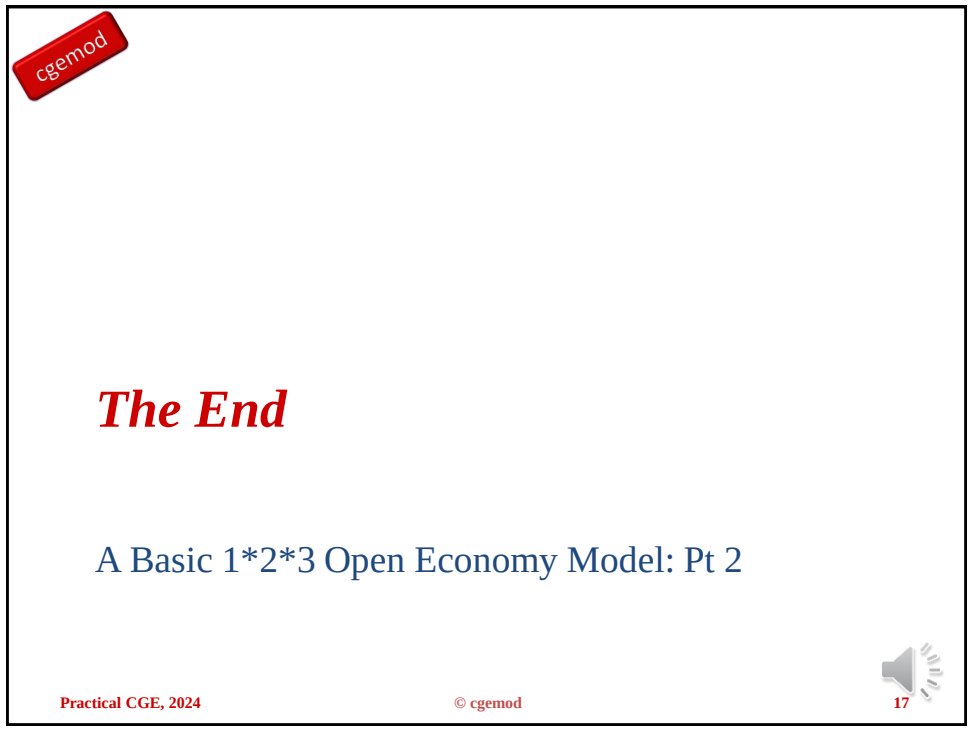
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The End
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