Introduction to a Single Country CGE Model (smod_t)

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Outline

- Introduction
- Accounts
- Social Accounting Matrix
- Behaviour
  - from Closed Economy model - **yellow**
    - plus Stone-Geary utility functions
  - from the R_123 Model - **green**
- Behavioural Relationships
  - Commodity Price & Quantity System
  - Production System
- Model Structure
  - Model Sets
  - Conventions

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Introduction

- Model - 'state-of-the-art' c 1990s
- smod_t
  - Closed economy model
  - 123 model
  - smod_t - 4*4*4*2*1
- Database
  - Pedagogic
    - Structure 'matters'
    - Handling data
  - Aggregates of regions

smod_t: a model that provides a framework that can be augmented to produce a model that is 'state-of-the-art' in 2010

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Accounts

- Commodities: "*c*" prefix
- Activities: "*a*" prefix
- Factors: "*f*" prefix
- Household: "*h*" prefix
- Government: no standard prefix
- Taxes
  - Import tax (*tm*), Export tax (*te*), Sales tax (*ts*)
  - Production tax (*tx*)
  - Income tax (*tyh*)
- Savings_Investment: "*i_s*"
- Rest of World: "*row*" (*w*)

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Social Accounting Matrix

	cagr	cnres	cmanu	cserv	aagr	anres	amanu	aserv	flnd	fuskl	fsklb	fcap	h_urban	h_rural	imptax	exptax	saltax	prodtax	dirtax	Govt	i_s	row	total
cagr	0	0	0	0	31	0	52	9	0	0	0	0	136	44	0	0	0	0	0	0	3	22	297
cnres	0	0	0	0	0	7	86	1	0	0	0	0	1	0	0	0	0	0	0	0	0	219	315
cmanu	0	0	0	0	36	36	356	171	0	0	0	0	271	109	0	0	0	0	0	7	190	143	1,318
cserv	0	0	0	0	25	33	174	201	0	0	0	0	219	105	0	0	0	0	0	178	19	62	1,016
aagr	276	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	276
anres	0	291	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	291
amanu	0	0	930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	930
aserv	0	0	0	935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	935
flnd	0	0	0	0	24	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90
fuskl	0	0	0	0	110	17	93	156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	375
fsklb	0	0	0	0	1	3	19	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139
fcap	0	0	0	0	45	123	134	258	0	0	0	0	0	0	0	0	0	0	0	0	0	0	559
h_urban	0	0	0	0	0	0	0	0	57	307	112	222	0	0	0	0	0	0	0	0	0	0	698
h_rural	0	0	0	0	0	0	0	0	33	68	27	176	0	0	0	0	0	0	0	0	0	0	304
imptax	6	1	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61
exptax	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
saltax	1	0	33	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
prodtax	0	0	0	0	5	7	17	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	51
dirtax	0	0	0	0	0	0	0	0	0	0	0	0	20	16	0	0	0	0	0	0	0	0	36
Govt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	3	42	51	36	0	0	0	193
i_s	0	0	0	0	0	0	0	0	0	0	0	162	51	29	0	0	0	0	0	8	0	-38	212
row	14	22	299	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	408
total	297	315	1,318	1,016	276	291	930	935	90	375	139	559	698	304	61	3	42	51	36	193	212	408	

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Behaviour

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Behaviour: Closed Economy Model

- Functional forms:
  - Production
    - Leontief fixed coefficients for intermediate inputs
    - Cobb Douglas production over value added with multiple inputs
  - Government
    - Fixed real shares of government income
  - Taxes
    - GST, Production taxes, Income taxes
  - Investment
    - Fixed real shares of savings

PLUS
Utility: Stone-Geary/LES over multiple commodities

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Behaviour: R_123 Model

- Trade with ROW (rest of world)
- Imports
  - Armington (CES)
  - *Ad valorem* tariffs
- Exports
  - Symmetrical treatment to imports (CET)
  - *Ad valorem* taxes (or subsidies)
- Current Account balance
  - If the value of imports exceeds the value of exports, there are savings from the ROW
- Small country assumption
  - World price of imports (pwm_c) fixed
  - World price of exports (pwe_c) fixed
- Exchange rate

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Behavioural SAM

	Commodities	Activities	Factors	Households	Government	Investment	Rest of World	Totals	
Commodities	0	Leontief Input-Output Coefficients	0	Stone-Geary Douglas Utility Functions	Fixed (real) Exogenously	Fixed Shares of Savings	Commodity Exports	Commodity Demand	Consumer Commodity Prices, Export prices
Activities	Domestic Production	0	0	0	0	0	0	Domestic Production	Activity Prices
Factors	o	Cobb Douglas Production Functions	0	0	0	0	0	Factor Income	Factor Prices
Households	0	0	Fixed Shares of Factor Income	0	0	0	0	Household Income	
Government	Sales Taxes, Import Duties and Export Taxes	Production Taxes	0	Direct Taxes on Household Income	0	0	0	Government Income	
Savings	0	0	Depreciation	Household Savings	Government Savings (Residual)	0	Current Account 'Deficit'	Total Savings	
Rest of World	Commodity Imports	0	0	0	0	0	0	Total 'Expenditure' Abroad	
Totals	Commodity Supply	Activity Inputs	Factor Expenditure	Household Expenditure	Government Expenditure	Total Investment	Total 'Income' from Abroad		
	Producer Commodity Prices, Domestic and World Prices for Imports	Value Added Prices							

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Commodity and Production Systems

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Commodity Price System

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Commodity Quantity System

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Production Quantity System

QXC_c

QX_a

0

$\bullet$

0

$ioqintdqx_{c1,a} *$ QX_a

$ioqintdqx_{c2,a} *$ QX_a

QVA_a

1

$FD_{l,a}$

$FD_{k,a}$

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Production Price System

$PXC_c = 1$

PX_a

$tx_a \leftarrow$

$\bullet$

0

$\bullet$

0

$ioqintdqx_{c1,a}$ $* PQD_{c1}$

$ioqintdqx_{c2,a}$ $* PQD_{c2}$

PVA_a

1

$WF_{l,a}$

$WF_{k,a}$

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smod_t Model Sets

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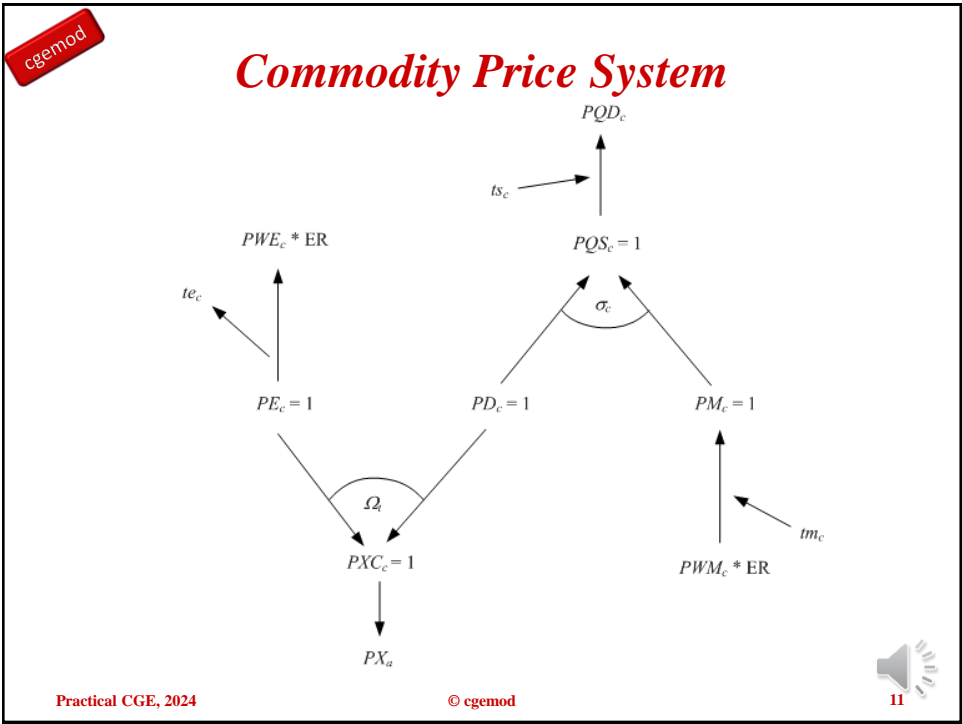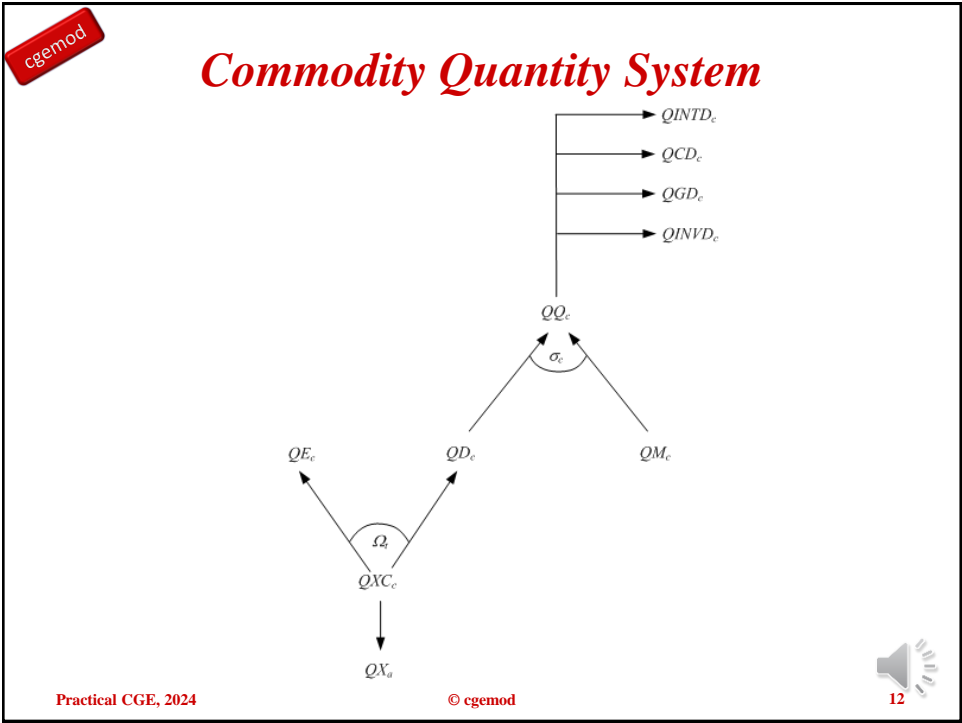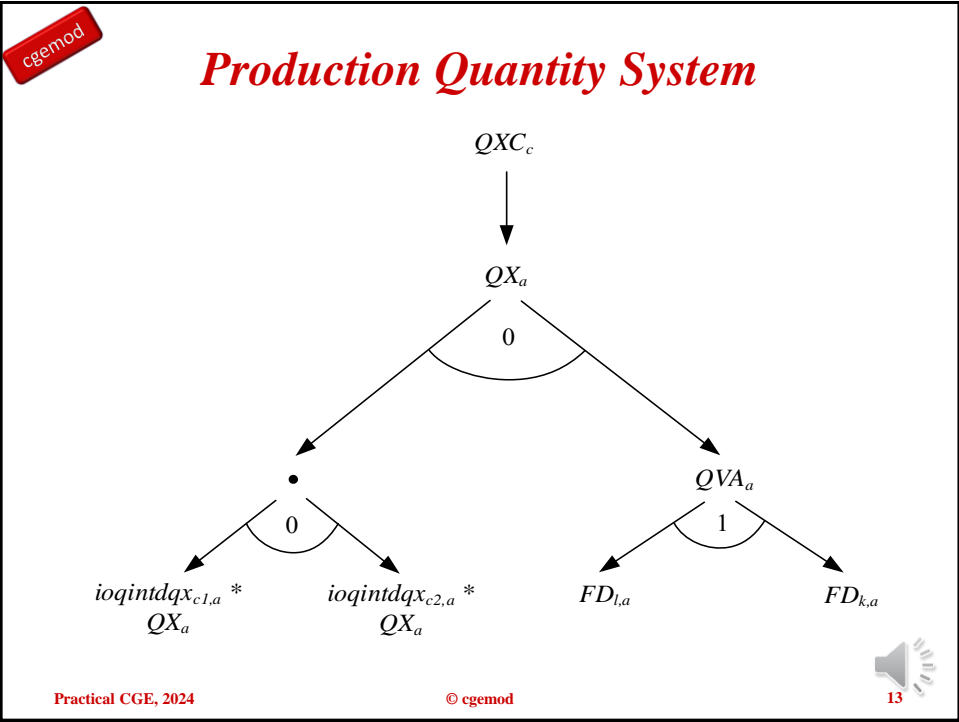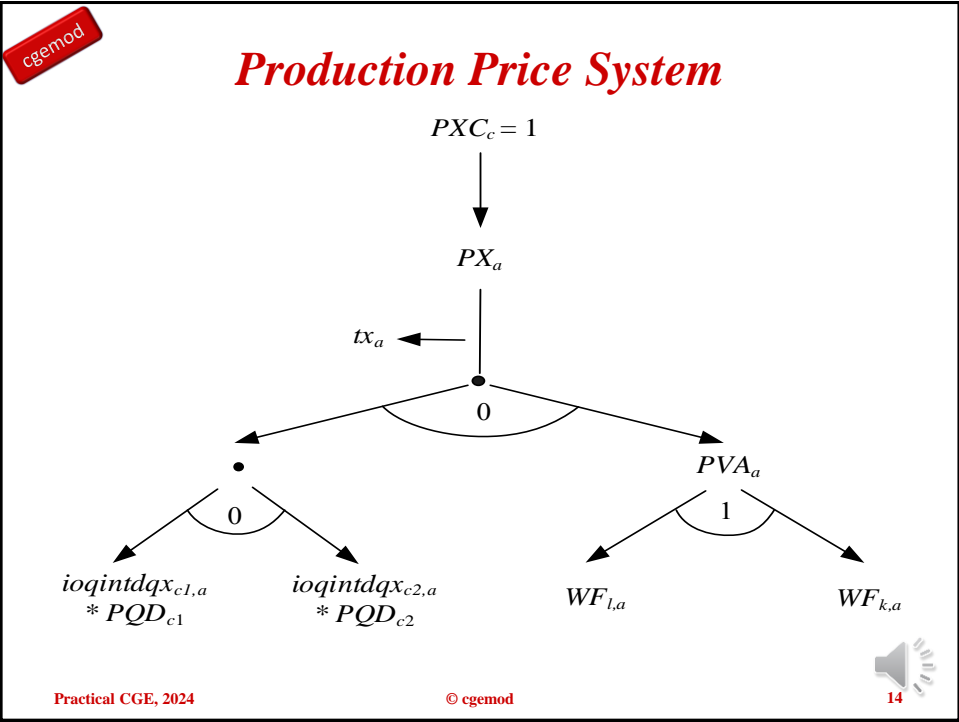
Model Sets

$$c = \{\text{cagr, cnres, cmanu, cserv}\}$$

$$a = \{\text{aagr, anres, amanu, aserv}\}$$

$$f = \{\text{flnd, fuskl, fsklb, fcap}\}$$

$$h = \{\text{h\_rich, h\_poor}\}$$

$$g = \{\text{imptax, exptax, saltax, prodtax, dirtax, govt}\}$$

$$i = \{i\_s\}$$

$$w = \{\text{row}\}$$

$$sac = \{c, a, f, h, g, i, w, total\}$$

$$sacn(sac)$$

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Dynamic Model Sets

$ce(c)$ = export commodities

$cen(c)$ = non-export commodities

$cm(c)$ = imported commodities

$cmn(c)$ = non-imported commodities

$cx(c)$ = commodities produced domestically

$cxn(c)$ = commodities NOT produced domestically AND imported

$cd(c)$ = commodities produced and demanded domestically

$cdn(c)$ = commodities NOT produced and demanded domestically

$acx(a)$ = activities purchased domestically

$acxn(a)$ = activities NOT purchased domestically

Dynamic sets?

Calibrated using information in the data to assign sets

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Code Conventions

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Standard Conventions

- All VARIABLES are in upper case.
- Standard prefixes for variable names:
  - *P* price variables
  - *Q* quantity variables
  - *W* factor prices
  - *F* factor quantities
  - *E* expenditure variables
  - *Y* income variables
  - *V* value variables.
- VARIABLE**0** is the base (0) value for VARIABLE.
- All other parameters are in lower case.
- ***ADJ** allows equiproportionate multiplicative adjustment of groups of variables, where ** is the variable series adjusted.
- Parameter and variable names are less than 10 characters.

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Standard Conventions

- Parameter suffixes distinguish their definition:
  - ***sh* is a share parameter
  - ***av* is an average
  - ***const* is a constant parameter.
- All coefficients have the form *io*****
  - ***** consists of two parts that identify the two variables related by the coefficient.
- The index ordering follows the specification in the SAM.
- All sets have another name, an alias, given by the set name followed by "*p*".

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Standard Conventions

- Constant Elasticity of Substitution (CES) functions
  - elasticity parameters *rho***
  - share parameters *delta***
  - shift/efficiency *ac***
    - where ** identifies the function in which the parameter operates.
- Constant Elasticity of Transformation (CET) functions
  - elasticity parameters *rho***
  - share parameters *gamma***
  - shift/efficiency parameters *at***
    - where ** identifies the function in which the parameter operates.
- Linear Expenditure System (LES)
  - Marginal budget shares *beta*
- Cobb-Dougals (CD) functions
  - Expenditure shares *alpha*

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The End

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