CGE model development (2)

CGE model development based on U&V matrix



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From IO to U&V

- IO table shows relationship between commodity and commodity.
 - IO table represents "In order to make a commodity, which commodity and how much commodity is needed."
 - Negative inputs except import and subsidy can be seen.
 - by-products
 - wastes generation
 - For energy analysis, differentiation between sector and commodity is convenient.
 - joint product: oil refinery sector produces gasoline, diesel oil, heavy oil and so on from crude oil.
 - power sector: Hydro power, thermal power and so on produce electricity.
- > IO table is converted to U matrix and V matrix.



2

relationship between IO and U&V in SAM (Social Account Matrix)

						expenditure				
		activity	commodity	factor	enterprise	household	government	capital account	rest of the world	total
	activity		gross output							total sale
	commodity	intermediate demand				household consumption	government consumption	investment	export	aggregate demand
	factor	value added							factor service export	factor income
	enterprise			gross profit			transfer			enterprise income
receipt	household			wage	distributed profits		transfer		foreign remittance	household income
	government	indirect tax	tariff	factor tax	enterprise taxes	direct taxes				government income
	capital account				retained earnings	households savings	government saving		capital transfer	total saving
	rest of the world		import	factor service import		transfers abroad	transfers abroad	capital transfer		foreign payment
	total	total cost	aggregate supply	factor expenditure	enterprise expenditure	household expenditure	government expenditure	total investment	foreign receipt	



relationship between IO and U&V in SAM (Social Account Matrix)

						expenditure				
		activity	commodity	factor	enterprise	household	government	capital account	rest of the world	total
	activity		V matrix							total sale
	commodity		10			household consumption	government consumption	investment	export	aggregate demand
	factor	matrix	table						factor service export	factor income
	enterprise			gross profit			transfer			enterprise income
receipt	household			wage	distributed profits		transfer		foreign remittance	household income
	government	indirect tax	tariff	factor tax	enterprise taxes	direct taxes				government income
	capital account				retained earnings	households savings	government saving		capital transfer	total saving
	rest of the world		import	factor service import		transfers abroad	transfers abroad	capital transfer		foreign payment
	total	total cost	aggregate supply	factor expenditure	enterprise expenditure	household expenditure	government expenditure	total investment	foreign receipt	



U matrix (Use matrix)

- commodity X sector
- U matrix represents inputs in activity, and supply & demand of commodity.

U matrix	sec A	sec B	con	inv	total
com 1	80	20	60	30	190
com 2	40	100	40	50	230
cap	30	60			
lab	50	40			
total	200	220			

Above table shows following information;

- * Sector A demands 80 of commodity 1, 40 of commodity 2, 30 of capital and 50 of labor, and then sales 200.
- * 190 of commodity 1 are supplied, and 80 in sector A, 20 in sector B, 60 in consumption, and 30 in investment are demanded.



V matrix (make matrix)

- > sector X commodity
- V matrix represents produced commodities from each sector.

V matrix	com 1	com 2	total
sec A	150	50	200
sec B	40	180	220
total	190	230	

Above table shows following information;

* Sector A produces 150 of commodity 1 and 50 of commodity 2.



Relation between U and V

U matrix	sec A	sec B	con	inv	total			
com 1	80	20	60	30	190+			
com 2	40	100	40	50	230			
сар	30	60						
lab	50	40						
total	200	220	In U, r	row total is	ow total is not			
		Sector	total in U					
V matrix	com 1	com 2	total	must be equal to				
sec A	150	50	200	sector t	otal in V			
sec B	40	180	220	Commod	lity total in U			
total	190	230		must be equal to				
				<u>commod</u>	ity total in V			



set sec com v_a ;	sector comm value	r nodity added	/sec1, sec2/ /com1, com2, com3/ /cap, lab/		com3/	scalar tot_c tot_i tot_k tot_l	total consumption total investment total capital total labor
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com2	40	100	40	40		tot_l	= sum(sec, U("lab",sec)) ;
com3	60	50	40	0			
сар	30	70					
lab	70	50					
;							
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sec1	160	120	0				
sec2	40	100	150				
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ACT(com) ! production	ACT(sec) ! production
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D_I ! fixed capital formation	D_I ! fixed capital formation
\$commodities:	\$commodities:
PY(com) ! commodity	PY(com) ! commodity
PK ! capital	PK ! capital
PL ! labor	PL ! labor
PC ! final consumption	PC ! final consumption
PI ! investment	PI ! investment
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PK ! capital	PK ! capital
PL ! labor	PL ! labor
PC ! final consumption	PC ! final consumption
PI ! investment	PI ! investment
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Making U matrix

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On Excel sheet, U matrix (commodity x sector) is created.



Making V matrix

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On Excel sheet, V matrix (sector x commodity) is prepared.



How to create U & V matrix

- 1. If your country distributes both these data, you can use them directly.
- 2. If you have IO table and V matrix, you can calculate U matrix by yourself.

From V matrix and input coefficient of IO table, U matrix can be calculated using assumption that "each commodity has the same input structure even though it is produced in any different industries"; $U=AV^{T}$

3. If you have only IO table, you can directly use IO table as U matrix, and create table, in which diagonal elements are equal to output of U matrix, as V matrix.



Creation of U matrix from IO and V

ю	com 1	com 2	final demand	total
com 1	80	20	100	200
com 2	40	100	20	160
value added	80	40		
total	200	160		
-				
Α	com 1	com 2	final demand	total
com 1	0.4	0.125	100	200
com 2	0.2	0.625	20	160
value added	0.4	0.250		
total	1	1		

V	com 1	com 2	total
-	400		400
act A	120	60	180
act B	80	100	180
total	200	160	



VT	act A	act B	total
com 1	120	80	200
com 2	60	100	160
total	180	180	

U	act A	act B	final demand	total		
com 1	55.5	44.5	100	200		
com 2	61.5	78.5	20	160		
value added	63.0	57.0				
total	180	180				



Creation of U & V matrix from IO

10	com 1	com 2	final demand	total
com 1	80	20	100	200
com 2	40	100	20	160
value added	80	40		
total	200	160		

		\sim		
U	act A	act B	final demand	total
com 1	80	20	100	200
com 2	40	100	20	160
value added	80	40		
total	200	160		

V	com 1	com 2	total
act A	200	0	200
act B	0	160	160
total	200	160	



Creation of U & V matrix from IO with negative inputs

ю	com 1	com 2	final demand	total	
com 1	80	-10	130	200	
com 2	40	100	20	160	
value added	80	70			
total	200	160			

Negative demand = output

U	act A	act B	final demand	total
com 1	80	0	130	210
com 2	40	100	20	160
value added	80	70		
total	200	170		

۷	com 1	com 2	total
act A	200	0	200
act B	10	160	170
total	210	160	

- 1. Negative values in IO are transferred in V matrix.
- 2. In U matrix, negative values are converted in 0.
- 3. Total values in row and column in U matrix are calculated.
- 4. Total values in U matrix are transferred in V matrix.
- 5. Each cell in V matrix is calculated to keep the consistency.



Homework until tomorrow

- Make U matrix and V matrix for your country CGE model on Excel sheet.
- Check consistency between U matrix and V matrix.

