CHAPTER 6. TWO EXTENSIONS OF THE MODEL OF CHAPTER 5

1. Intermediate demands

1.1. Changes in the mathematical model statement

Parameters

ica_{ca} quantity of *c* as intermediary input per unit of output in activity *a*

Variables

PVA_a value-added (or net) price of activity *a*

$QINT_{ca}$ quantity of commodity *c* as intermediate input in activity *a*

Equations

Production and commodity block

$$WF_f = \frac{a_{fa} \cdot PVA_a \cdot QA_a}{QF_{fa}} \qquad f \in F, a \in A$$

$$\mathrm{QINT}_{ca} = ica_{ca} \cdot QA_a \qquad c \in C, a \in A$$

$$PVA_a = PA_a - \sum_{c \in C} P_c \cdot ica_{ca} \qquad a \in A$$

System Constraint Block

$$Q_c = \sum_{h \in H} QH_{ch} + \sum_{a \in A} QINT_{ca} \qquad c \in C$$

The new SAM

It is shown in the following table. New payment flows, representing payments for intermediate goods, have been added in the cells at commodity row and activity column intersections. The accounts in the SAM are unchanged.

	AGR-A	NAGR-A	AGR-C	NAGR-C	LAB	CAP	U-HHD	R-HHD	TOTAL
AGR-A			225						225
NAGR-A				250					250
AGR-C	60	40					50	75	225
NAGR-C	40	60					100	50	250
LAB	62	55							117
CAP	63	95							158
U-HHD					60	90			150
R-HHD					57	68			125
TOTAL	225	250	225	250	117	158	150	125	

1.2. Changes in the code

PARAMETERS

ica(C,A) qnty of c as intermediate input per unit of activity a

VARIABLES

PVA(A) value-added (or net) price for activity a

QINT(C,A) qnty of commodity c as intermediate input to activity a

EQUATIONS

*PRODUCTION AND COMMODITY BLOCK++++++++

INTDEM(C,A) intermediate demand for commodity c from activity a

PVADEF(A) value-added price for activity a

*PRODUCTION AND COMMODITY BLOCK++++++++

FACDEM(F,A).. WF(F) =E= alpha(F,A)*PVA(A)*QA(A) / QF(F,A);

INTDEM(C,A).. QINT(C,A) =E= ica(C,A)*QA(A);

PVADEF(A).. PVA(A) =E= PA(A)—SUM(C, P(C)*ica(C,A));

*SYSTEM CONSTRAINT BLOCK+++++++++++++++

COMEQ(‘AGR-C’).. Q(‘AGR-C’) =E=

SUM(H, QH(‘AGR-C’,H)) + SUM(A, QINT(‘AGR-C’,A));

*MODEL===

MODEL

CGE2 Simple CGE model /ALL/

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TABLE SAM(AC,ACP) social accounting matrix

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TABLE SAM(AC,ACP) social accounting matrix

          AGR-A  NAGR-A  AGR-C  NAGR-C  LAB  CAP  U-HHD  R-HHD
AGR-A                    225
NAGR-A                          250
AGR-C      60      40                              50     75
NAGR-C     40      60                             100     50
LAB        62      55
CAP        63      95
U-HHD                                  60   90
R-HHD                                  57   68
;
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*ASSIGNMENTS FOR PARAMETERS AND

VARIABLES=========================

PARAMETERS

*The following parameters are used to define initial values of

*model variables.

P0(C), PA0(A), PVA0, Q0(C), QA0(A), QF0(F,A), QH0(C,H), QINT0(C,A),

WF0(F), YF0(H,F), YH0(H)

*PRODUCTION AND COMMODITY BLOCK++++++++

If $P_c = PA_a = 1$, PVA_a cannot be equal to 1.

PVA0(A) = SUM(F, SAM(F,A)) / (SAM(A,'TOTAL')/PA0(A));

QINT0(C,A) = SAM(C,A)/P0(C);

ica(C,A) = (SAM(C,A)/P0(C)) / QA0(A);

*INITIALIZING ALL VARIABLES++++++++++++

PVA.L(A) = PVA0(A);

QINT.L(C,A) = QINT0(C,A);

```
DISPLAY
ad, alpha, beta, cpi, cwts, ica, qfs, shry, theta,
P.L, PA.L, PVA.L, Q.L, QA.L, QF.L, QH.L, QINT.L, WF.L, YF.L, YH.L
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SOLVE CGE2 USING MCP;

*REPORT SETUP AND BASE REPORT==================================
*SET AND PARAMETERS FOR REPORTS++++++++

PARAMETERS
PVAREP(A,SIM) value-added price for activity a
QINTREP(C,A,SIM) qnty of commodity c as intermed. input for activity a

LOOP(SIM,
        qfs("CAP") = QFSCAPSIM(SIM);

        SOLVE CGE2 USING MCP;

PVAREP(A,SIM) = PVA.L(A);
QINTREP(C,A,SIM) = QINT.L(C,A);
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2. Saving and investment

2.1. A verbal model presentation

The new SAM includes one new account called savings-investment (S-I. Its row receives payments from the household (the only saver in this simple economy); its column shows spending on commodities used for investment. Note that investment is defined in terms of the commodities used in the production of the capital stock, not the activity of destination (the activity that receives the investment goods as an addition to its capital stock). This means that the model only applies to a period so short that there is not enough time for new investments to provide additional production capacity. For a model relevant to a longer time period (for

example a multi-periods model), it would also be necessary to consider explicitly the resulting changes in capital stock.

	AGR-A	NAGR-A	AGR-C	NAGR-C	LAB	CAP	U-HHD	R-HHD	S-I	TOTAL
AGR-A			250							250
NAGR-A				305						305
AGR-C	60	40					50	75	25	250
NAGR-C	40	60					100	50	55	305
LAB	72	80								152
CAP	78	125								203
U-HHD					80	120				200
R-HHD					72	83				155
S-I							50	30		80
TOTAL	250	305	250	305	152	203	200	155	80	

For savings-investment, assume the following: (a) household income is allocated in fixed shares to savings and consumption; (b) investment is savings-driven, that is, the value of total investment spending is determined by the value of savings; and (c) investment spending is allocated to the two commodities in a manner such that the ratio between the quantities is fixed.

The set of equilibrium conditions that is functionally dependent now includes not only the commodity market equilibrium conditions, but also the savings-investment balance. It would be possible to drop one of these equations. In the suggested answer, another approach is selected. Instead of dropping one of these equations, a variable called WALRAS is introduced in the savings-investment balance. This approach is commonly used for this class of models. The model still has an equal number of variables and equations. If the model works, the savings-investment balance should hold, that is, the value of WALRAS should be zero.

2.2. Changes in the mathematical model statement

Sets

S-I saving-investment

Parameters

mpsh marginal (and average) propensity to save for household *h*

Variables
$QINV_c$ quantity of investment demand for commodity *c*
WALRAS check variable (zero at equilibrium)

Equations
Institution block

$$QH_{ch} = \frac{\beta_{ch} \cdot (1 - mps_h) \cdot YH_h}{P_c} \qquad c \in C, h \in H$$

System control block

$$Q_c = \sum_{h \in H} QH_{ch} + \sum_{a \in A} QINT_{ca} + QINV_c \qquad c \in C$$

$$\sum_{c \in C} P_c \cdot QINV_c + WALRAS = \sum_{h \in H} mps_h \cdot YH_h$$

2.3. Changes in the code

Sets

S-I savings-investment

Parameters

mps(H) marginal (and average) propensity to save for household h
inv(C) share in investment spending on commodity c

Variables
QINV(C) quantity of investment demand for commodity c
WALRAS check variable (zero at equilibrium)

Equations

Institution block
HHDEM(C,H).. QH(C,H) =E= beta(C,H)*(1—MPS(H))*YH(H)/P(C);

INVDEM investment demand for agricultural commodity
INVDEM.. P("AGR-C")*QINV("AGR-C") =E= inv("AGR-C")*SUM(C, P(C)*QINV(C));

System control block

SAVINV savings-investment balance

COMEQ(C).. Q(C) =E= SUM(H, QH(C,H)) + SUM(A, QINT(C,A)) + QINV(C);

SAVINV.. SUM(C, P(C)*QINV(C)) + WALRAS =E= SUM(H, MPS(H)*YH(H))

**MODEL==========*

MODEL

CGE3 Simple CGE model /ALL/

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195  TABLE SAM(AC,ACP) social accounting matrix
196
197           AGR-A   NAGR-A   AGR-C   NAGR-C   LAB   CAP   U-HHD   R-HHD   S-I
198  AGR-A                      250
199  NAGR-A                             305
200  AGR-C      60       40                                    50      75     25
201  NAGR-C     40       60                                   100      50     55
202  LAB        72       80
203  CAP        78      125
204  U-HHD                                        80   120
205  R-HHD                                        72    83
206  S-I                                                     50      30
207  ;
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PARAMETERS

*The following parameters are used to define initial values of

*model variables.

MPS0(H), P0(C), PA0(A), PVA0, Q0(C), QA0(A), QF0(F,A), QH0(C,H), QINT0(C,A), QINV0(C), WF0(F), YF0(H,F), YH0(H)

*INSTITUTION BLOCK++++++++++++++++++++

MPS0(H) = SAM("S-I",H)/SAM("TOTAL",H);

QINV0(C) = SAM(C,"S-I")/P0(C);

*INITIALIZING ALL VARIABLES++++++++++++

INVDEM.L=INVDEM0;

QINV.L(C) = QINV0(C);

DISPLAY

ad, alpha, beta, cpi, cwts, ica, qfs, shry, theta,

mps, P.L, PA.L, PVA.L, Q.L, QA.L, QF.L, QH.L, QINT.L,QINV.L,

WF.L, YF.L, YH.L

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*REPORT SETUP AND BASE REPORT==========

*SET AND PARAMETERS FOR REPORTS++++++++

PARAMETERS
MPSREP(H,SIM) marginal (and average) propensity to save for household h

QINVREP(C,SIM) quantity of investment by commodity of origin c
WALRASREP(SIM) dummy variable (zero at equilibrium)