$Title Generic Small Open Economy Model -- "SOEM"

$STitle Version 1 with:

\* 2 goods, 2 activities, 2 households;

\* no market power in the world markets;

\* no firms amongst institutions.

\* SETS ===========================================================

SETS

 AC the global set including all items

\* Since there are no Firms in this exercise, they are excluded from the sets

 /

AGR-A agricultural activity

NAGR-A non-agricultural activity

AGR-C agricultural commodity

NAGR-C non-agricultural commodity

 LAB labour

CAP capital

 U-HHD urban household

R-HHD rural household

GOV government

ROW rest of world

S-I savings-investment

YTAX income tax

STAX sales tax

TAR import tariff

 TOTAL total account in SAM

/

\* Generating the specific sets and subsets

 ACNT(AC) all elements in AC except total

A(AC) activities /AGR-A, NAGR-A/

C(AC) commodities /AGR-C, NAGR-C/

CE(C) exported commodities /AGR-C/

CNE(C) non-exported commodities /NAGR-C/

CM(C) imported commodities /NAGR-C/

CNM(C) non-imported commodities /AGR-C/

F(AC) factors /LAB, CAP/

 I(AC) institutions /U-HHD, R-HHD, GOV, ROW/

H(I) households /U-HHD, R-HHD/

 ;

 \* To exclude TOTAL from ACNT:

 ACNT(AC) = YES;

 ACNT('TOTAL') = NO;

 \* Alias sets to be used when we want to distinguish between two versions, e.g.

\* when summing y(F,F) over columns, we can write SUM(F y(F,FAL))

ALIAS ( AC , ACAL);

ALIAS (C, CAL);

ALIAS (F,FAL);

 ALIAS (I,IAL);

 ALIAS (ACNT,ACNTAL);

 \* PARAMETERS ======================================================

 PARAMETERS

 ad(A) shift in the production fn for activity a

alpha(F,A) elasticity of factor f in the production fn for activity a

aq(C) shift parameter in CES aggregation for commodity c

ax(C) shift parameter in CES transformation for commodity c

beta(C,H) share of households total spending on commodity c

 consumer price index

 cwts(C) weight of commodity c in the CPI

 deltaq(C) share parameter in CES aggregation for commodity c

 deltax(C) share parameter in CES transformation for commodity c

 ir(C,A) IO coeff: qnty of c as intermediate input per unit of activity a

 INV(C) base-year qnty of investment demand for commodity c

 PWE(C) export (world) price for c (foreign currency)

 PWM(C) import (world) price for c (foreign currency)

 QFS(F) total supply of factor f

 QG(C) government demand for commodity c (in quantity)

 rhoq(C) exponent parameter in the CES aggregation for commodity c

 rhox(C) exponent parameter in the CES transformation for commodity c

 shry(H,F) share of household i in income of factor f

 te(C) export subsidy or tax rate for commodity c

 theta(A,C) yield coeff: yield of output c per unit of activity a

 tm(C) import tariff rate for commodity c

 tq(C) sales tax rate for commodity c

 TR(I,IAL) transfer from institution ial to institution i

 ty(H) income tax rate for household h

 ;

 \* VARIABLES =======================================================

 VARIABLES

 \*FREE VARIABLES

 BOP balance of payment (foreign savings) in foreign currency)

 GBS government budget surplus (or deficit)

 QE(C) quantity of exports for commodity c (can be import if <0)

 QFU(F) excess sup. of factor f (e.g. unemployment. <0 if excess demand)

 QM(C) quantity of imports of commodity c (can be export if <0)

 WALR dummy variable (zero at equilibrium)

 \*POSITIVE VARIABLES

 EXR exchange rate (dom. currency per unit of for. currency)

 FPD(F,A) wage distortion factor for factor f in activity a

 IADJ investment adjustment factor

 MPS(H marginal (and average) propensity to save for household h

 PA(A) price of activity a

 PD(C) domestic price of domestic output c

 PE(C) export price for c (domestic currency)

 PF(F) average price of factor f

 PM(C) import price for c (domestic currency)

 PQ(C) composite commodity price for c

PVA(A) value-added price for activity a

 PX(C) producer price for commodity c

 QA(A) level of activity a

 QD(C) quantity sold domestically of domestic output c

 QF(F,A) quantity demanded of factor f from activity a

 QH(C,H) quantity consumed of commodity c by household h

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

 QINV(C) quantity of investment demand for commodity c

 QQ(C) quantity of goods supplied domestically (composite supply)

 QX(C) quantity of domestic output of commodity c

 YF(H,F) transfer of income to institutions i from factor f

 YH(H) income of household h

 ;

 \* EQUATIONS =======================================================

 \* EQUATION NAME ###############

 EQUATIONS

 \* PRICE BLOCK +++++++++++++++++++++++++++

 PMDEF(C) import price for commodity c (domestic currency)

 PEDEF(C) export price for commodity c (domestic currency)

 ABSORB(C) absorption for commodity c

 OUTVAL(C) output value for commodity c

 PADEF(A) price for activity a

 PVADEF(A) value-added price for activity a

 PNORM CPI and the price normalization rule

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

 PRODFN (A) Cobb-Douglas production function for activity a

 FACDEM (F, A) demand for factor f by activity a

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

OUTPUTFN(C) output of commodity c

 CESQ(C) CES aggregation of QD and QM into QQ

 CESX(C) CES transformation of QD and QE into QX

 ESUBMD(C) import-domestic demand ratio for commodity c

 ESUBED(C) export-domestic supply ratio for commodity c

 NMQD(C) composite version for non-imported commodity c

 NEXD(C) transformation for non-exported commodity c

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

 FACTTRNS(H,F) transfer of income from factor f to household h

HHDINC(H) income of household h

 HHDCON(C,H) consumption demand by household h for commodity c

 INVDEM(C) investment demand for commodity c

 GBC government budget surplus

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

 FACTMEQ(F) market equilibrium condition for factor f

 GOODMEQ(C) market equilibrium condition for composite commodity c

 BOPEQ current account balance for ROW

 WALREQ savings-investment balance with WALR dummy to be zero

 ;

 \* EQUATION DESCRIPTION ###############

 \* PRICE BLOCK +++++++++++++++++++++++++++

PMDEF(C)$CM(C).. PM(C) =E= (1 + tm(C))\*EXR\*PWM(C);

 PEDEF(C)$CE(C).. PE(C) =E= (1-te(C))\*EXR\*PWE(C);

 ABSORB(C).. PQ(C)\*QQ(C)=E= (PD(C)\*QD(C) + (PM(C)\*QM(C))$CM(C))\*(1 + tq(C));

 OUTVAL(C).. PX(C)\*QX(C) =E= PD(C)\*QD(C) + (PE(C)\*QE(C))$CE(C);

 PADEF(A).. PA(A) =E= SUM(C, PX(C)\*theta(A,C));

 PVADEF(A).. PVA(A) =E= PA(A)-SUM(C, PQ(C)\*ir(C,A));

 PNORM.. SUM(C, PQ(C)\*cwts(C)) =E= CPI;

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

 PRODFN(A).. QA(A) =E= ad(A)\*PROD(F, QF(F,A)\*\*alpha(F,A));

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

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

 OUTPUTFN(C).. QX(C) =E= SUM(A, theta(A,C)\*QA(A));

 CESQ(C)$CM(C).. QQ(C) =E= aq(C)\*(deltaq(C)\*QM(C)\*\*(-rhoq(C))

+ (1-deltaq(C))\*QD(C)\*\*(-rhoq(C)))\*\*(-1/rhoq(C));

 CESX(C)$CE(C).. QX(C) =E= ax(C)\*(deltax(C)\*QE(C)\*\*(rhox(C))

 + (1-deltax(C))\*QD(C)\*\*(rhox(C)) )\*\*(1/rhox(C));

 ESUBMD(C)$CM(C).. QM(C)/QD(C) =E=

 ( (deltaq(C)/(1-deltaq(C))) \* (PD(C)/PM(C)) )\*\*(1/(1+rhoq(C)));

 ESUBED(C)$CE(C).. QE(C)/QD(C) =E= ( PE(C)/PD(C)\*(1-deltax(C))

 /deltax(C) )\*\*(1/(rhox(C)-1) );

 NMQD(C)$CNM(C).. QQ(C) =E= QD(C);

 NEXD(C)$CNE(C).. QX(C) =E= QD(C);

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

 FACTTRNS(H,F).. YF(H,F) =E= shry(H,F)\*SUM(A, PF(F)\*FPD(F,A)\*QF(F,A));

 HHDINC(H).. YH(H) =E= SUM(F, YF(H,F)) + CPI\*TR(H,'GOV') + EXR\*TR(H,'ROW');

 HHDCON(C,H).. QH(C,H) =E= beta(C,H)\*(1-MPS(H))\*(1-ty(H))\*YH(H)/PQ(C);

 INVDEM(C).. QINV(C) =E= inv(C)\*IADJ;

GBC.. GBS =E=

( SUM(H, ty(H)\*YH(H))

 + SUM(C, tq(C)\*(PD(C)\*QD(C) + (PM(C)\*QM(C))$CM(C)))

 + SUM(C$CM(C), tm(C)\*EXR\*PWM(C)\*QM(C))

 + SUM(C$CE(C), te(C)\*EXR\*PWE(C)\*QE(C))

 + EXR\*TR('GOV','ROW')

 ) -( SUM(C, PQ(C)\*QG(C))

+ SUM(I, CPI\*TR(I,'GOV')$H(I))

 );

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

 FACTMEQ(F).. SUM(A, QF(F,A)) + QFU(F) =E= QFS(F);

 GOODMEQ(C).. QQ(C) =E= SUM(A, QINT(C,A)) + SUM(H, QH(C,H))+ QG(C) + QINV(C);

 BOPEQ.. BOP =E= SUM(C$CM(C), PWM(C)\*QM(C))

 -( SUM(C$CE(C), PWE(C)\*QE(C))

 + SUM(I, TR(I,'ROW')$H(I))

 + TR('GOV','ROW')

 );

 WALREQ.. WALR =E=

 ( SUM(H, MPS(H)\*(1-ty(H))\*YH(H))

 \* + YFRM

 + GBS + EXR\*BOP )

 - ( SUM(C, PQ(C)\*QINV(C)) );

 \* MODEL ===========================================================

 MODELS SOEMV1 "Small Open Economy Model Ver1" /ALL/ ;

 \* use hold fix to speed up the solution

 \* This attribute tells GAMS whether to generate and send to the solver the

 \* variables that are being held fixed by the .fx

SOEMV1.HOLDFIXED = 1;

 \*#############################################################################

 \* SOCIAL ACCOUNTING MATRIX =======================================

 TABLE SAM(AC,ACAL) social accounting matrix

 AGR-A NAGR-A AGR-C NAGR-C LAB CAP U-HHD R-HHD

 AGR-A 0 0 279 0 0 0 0 0

 NAGR-A 0 0 0 394 0 0 0 0

 AGR-C 84 55 0 0 0 0 30 49

 NAGR-C 50 99 0 0 0 0 165 92

 LAB 72 105 0 0 0 0 0 0

 CAP 73 135 0 0 0 0 0 0

 U-HHD 0 0 0 0 95 125 0 0

 R-HHD 0 0 0 0 82 83 0 0

 GOV 0 0 0 0 0 0 0 0

 ROW 0 0 0 105 0 0 0 0

 YTAX 0 0 0 0 0 0 20 5

 STAX 0 0 10 20 0 0 0 0

 TAR 0 0 0 39 0 0 0 0

 S-I 0 0 0 0 0 0 70 40

 + GOV ROW YTAX STAX TAR S-I

 AGR-A 0 0 0 0 0 0

 NAGR-A 0 0 0 0 0 0

 AGR-C 13 30 0 0 0 28

 NAGR-C 67 0 0 0 0 85

 LAB 0 0 0 0 0 0

 CAP 0 0 0 0 0 0

 U-HHD 25 40 0 0 0 0

 R-HHD 5 16 0 0 0 0

 GOV 0 15 25 30 39 0

 ROW 0 0 0 0 0 0

 YTAX 0 0 0 0 0 0

 STAX 0 0 0 0 0 0

 TAR 0 0 0 0 0 0

 S-I 1 4 0 0 0 0

;

 \* GENERATING THE TOTAL COLUMN AND ROW FOR SAM

 \* note the use of ALIAS SET ACNTAL

 SAM('TOTAL',ACNTAL) = SUM(ACNT, SAM(ACNT,ACNTAL));

 SAM(ACNT,'TOTAL') = SUM(ACNTAL, SAM(ACNT,ACNTAL));

 \* CHECKING THE CONSISTENCY: tdiff should be zero

PARAMETER tdiff(AC) "(column total - row total) for account AC";

 tdiff(ACNT) = SAM('TOTAL',ACNT)-SAM(ACNT,'TOTAL');

 DISPLAY SAM, tdiff;

 \* ASSIGNMENTS FOR PARAMETERS AND VARIABLES ======================

 \* The following parameters are used to define the initial values of variables

 PARAMETERS

 EXR0, BOP0, GBS0, FPD0(F,A), IADJ0, MPS0(H), PA0(A), PD0(C), PE0(C), PF0(F),

 PM0(C), PQ0(C), PVA0(A), PX0(C), QA0(A), QD0(C), QE0(C), QF0(F,A),

 QFU0(F), QH0(C,H), QINT0(C,A), QINV0(C), QM0(C), QQ0(C), QX0(C), YF0(H,F),

 YH0(H)

 ;

 \*########## CALIBRATING THE MODEL BY FIXING INITIAL VALUES ########\*

 \* QUANTITIES AND PRICES OF FACTORS ++++++++++++++++++++++++

 PARAMETERS

 \* the initial quantity of labour employed by activity (no. of workers)

 \* for this, use:

 labour(A) /AGR-A 100, NAGR-A 50/

 \* the initial factor prices (only for calibration)

 PFI(F,A)

 \* costgap to check consistency in calibration:

 \* costgap = (factor cost) - (SAM value), should = 0

 costgap(F,A)

 ;

 \* defining factor employment and supply

 \* no factor unemployment allowed initially

 QF0('LAB',A) = labour(A);

QF0('CAP',A) = SAM('CAP',A);

 QFU0(F)=0;

 QFS(F) = SUM(A, QF0(F,A));

 \* computing activity-specific factor prices

 \* note that with this definition PFA for capital is set to 1

 PFI(F,A) = SAM(F,A)/QF0(F,A);

 \* computing average factor prices

 PF0(F) = SUM(A, SAM(F,A))/SUM(A, QF0(F,A));

 \* computing factor price distortions

 FPD0(F,A) = PFI(F,A) / PF0(F);

 \* checking the consistency of the calibration

 costgap(F,A) = PF0(F)\*FPD0(F,A)\*QF0(F,A) - SAM(F,A);

 DISPLAY PFI, PF0, QF0, QFS, QFU0, FPD0, costgap;

 \* COMMODITY PRICES +++++++++++++++++++++++++++

 \* normalised initial commodity prices:

 EXR0 = 1;

 PA0(A) = 1;

 PD0(C) = 1;

 PE0(C) = 1;

 PM0(C) = 1;

 PX0(C) = 1;

\* sales tax rate for each good,

 \* to be consistent with PQ=(1 + tq)\*PD, it should be defined as

 \* tq = (total sales tax)/(total sales value excluding sales tax)

 tq(C) = SAM('STAX',C)/(SAM('TAR',C) + SAM('ROW',C)

 + SUM(A, SAM(A,C))- SAM(C,'ROW') );

 DISPLAY tq;

 \* after tax sales price

 PQ0(C) = (1 + tq(C))\*PD0(C);

 \* CPI normalisation

 cwts(C) = SUM(H, SAM(C,H)) / SUM((CAL,H), SAM(CAL,H));

 CPI = SUM(C, cwts(C)\*PQ0(C));

 DISPLAY cwts, CPI;

\* COMMODITY QUANTITIES:

 \* Note that we should deflate the nominal values using the correct price

 QA0(A) = SAM('TOTAL',A)/PA0(A);

QD0(C) = (SUM(A, SAM(A,C)) - SAM(C,'ROW'))/PD0(C);

 QE0(C) = SAM(C,'ROW')/PE0(C);

 QM0(C) = (SAM('ROW',C) + SAM('TAR',C))/PM0(C);

 QQ0(C) = (SAM('TOTAL',C) - SAM(C,'ROW'))/PQ0(C);

 QX0(C) = SUM(A, SAM(A,C))/PX0(C);

 DISPLAY QA0, QD0, QE0, QM0, QQ0, QX0;

 \* the value added price of each activity as

 \* (value of activity a)/(quantity of activity a):

 PVA0(A) = SUM(F, SAM(F,A)) / QA0(A);

 DISPLAY PVA0;

 \* IO coeff: unit intermediate input requirement by activity a by commodity c

 ir(C,A) = (SAM(C,A)/PQ0(C)) / QA0(A);

 DISPLAY ir;

 \* yield coeff: amount of commodity c per unit of activity a

 theta(A,C) = (SAM(A,C)/PX0(C)) / QA0(A);

 DISPLAY theta;

 \* export tax or subsidy rates

 te(C) = 0;

 \* world export prices (in foreign currency)

 PWE(C) = PE0(C)/((1 + te(C))\*EXR0);

 \* import tariff rate for each good,

 \* to be consistent with PM=(1 + tm)\*PWM\*EXR, it should be defined as

 \* tm = (total tariff paid)/(total ex tariff import value)

 tm(C)$CM(C) = SAM('TAR',C)/SAM('ROW',C);

 \* world import prices

 PWM(C)$CM(C) = PM0(C)/((1 + tm(C))\*EXR0);

 DISPLAY PWE, PWM, tm;

 \* PRODUCTION, AGGREGATION AND TRANSFORMATION

 \* use by activity a of commodity c as intermediate input

 QINT0(C,A) = SAM(C,A)/PQ0(C);

 DISPLAY QINT0;

 \* share & shift coefficients in the activity prod. fn.

 alpha(F,A) = SAM(F,A) / SUM(FAL, SAM(FAL,A));

 ad(A) = QA0(A) / PROD(F, QF0(F,A)\*\*alpha(F,A));

 DISPLAY alpha, ad;

 \* elasticities of substitution for aGgregation & tranformation

 PARAMETERS

 sigmaq(C) elasticities of substitution for CES aggregation

 sigmax(C) elasticities of substitution for CES tranformation

 ;

sigmaq(C) = 0.7;

 sigmax(C) = 2.0;

\* the implied exponent coefficients in the CES functions:

 rhoq(C) = 1/sigmaq(C)-1;

 rhox(C) = 1/sigmax(C)+1;

DISPLAY rhoq, rhox;

 \* share ceoff in the CES transformation equation

 deltax(C)$CE(C) = 1/( 1 + ( (PD0(C)/PE0(C)) \* ((QE0(C)/QD0(C))\*\*(rhox(C)-1))));

 \* shift ceoff in the CES transformation equation

 ax(C)$CE(C) = QX0(C)/( deltax(C)\*QE0(C)\*\*(rhox(C))

 + (1-deltax(C))\*QD0(C)\*\*(rhox(C)) )\*\*(1/rhox(C));

 DISPLAY deltax, ax;

 \* share ceoff in the CES aggregation equation

 deltaq(C)$CM(C) = 1/(1 + (PD0(C)/PM0(C))\*(QD0(C)/QM0(C))\*\*(1+rhoq(C)));

 \* shift ceoff in the CES aggregation equation

 aq(C)$CM(C) = QQ0(C)/( deltaq(C)\*QM0(C)\*\*(-rhoq(C))

 + (1-deltaq(C))\*QD0(C)\*\*(-rhoq(C)) )\*\*(-1/rhoq(C));

 DISPLAY deltaq, aq;

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

 \* investment adjustment is initially =1 (no adjustment

 IADJ0 = 1;

 \* INV = the relevant SAM rows in the S-I column (properly deflated)

 INV(C) = SAM(C,'S-I')/PQ0(C);

 \* QINV = INV initially as IADJ0 = 1

 QINV0(C) = SAM(C,'S-I')/PQ0(C);

 \* household income shares from factor incomes:

 shry(H,F) = SAM(H,F) / SAM('TOTAL',F);

 \* household factor income

 YF0(H,F) = SAM(H,F);

 \* household total income

 YH0(H) = SAM('TOTAL',H);

 \* household income tax rate

 ty(H) = SAM('YTAX',H) / SAM('TOTAL',H);

 \* household propensity to save (from disposable income)

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

 \* householhd consumption share of commodities

 beta(C,H) = SAM(C,H)/SUM(CAL, SAM(CAL,H));

 \* householhd consumption of commodities

 QH0(C,H) = SAM(C,H)/PQ0(C);

 \* government consumption of commodities

 QG(C) = SAM(C,'GOV')/PQ0(C);

 \* government budget surplus (revenue less expenditure, transfers, etc)

 GBS0 = SAM('GOV','TOTAL') - (SAM('TOTAL','GOV') - SAM('S-I','GOV'));

 \* transfers to households from government

 TR(H,'GOV') = SAM(H,'GOV');

 \* transfers to institutions from abroad

 TR(I,'ROW') = SAM(I,'ROW')/EXR0;

 \* balance of payments with ROW

 BOP0 = SAM('S-I','ROW')/EXR0;

 DISPLAY INV, shry, beta, QG, TR, ty;

 \*########## INITIALIZATION #############\*

 BOP.L = BOP0;

 EXR.L = EXR0;

 FPD.L(F,A) = FPD0(F,A);

 GBS.L = GBS0;

 IADJ.L = IADJ0;

 MPS.L(H) = MPS0(H);

 PA.L(A) = PA0(A);

 PD.L(C) = PD0(C);

 PE.L(C) = PE0(C);

 PF.L(F) = PF0(F);

 PM.L(C) = PM0(C);

 PQ.L(C) = PQ0(C);

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

 PX.L(C) = PX0(C);

 QA.L(A) = QA0(A);

 QD.L(C) = QD0(C);

 QE.L(C) = QE0(C);

 QF.L(F,A) = QF0(F,A);

 QFU.L(F) = QFU0(F);

 QH.L(C,H) = QH0(C,H);

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

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

 QM.L(C) = QM0(C);

 QQ.L(C) = QQ0(C);

 QX.L(C) = QX0(C);

 YF.L(H,F) = YF0(H,F);

 YH.L(H) = YH0(H);

 DISPLAY

 BOP.L, EXR.L, FPD.L, GBS.L, IADJ.L, MPS.L,

 PA.L, PD.L, PE.L, PF.L, PM.L, PQ.L, PVA.L, PX.L,

 QA.L, QD.L, QE.L, QF.L, QFU.L, QH.L, QINT.L, QINV.L, QM.L, QQ.L, QX.L,

 YF.L, YH.L

 ;

 \*######### SELECTING CLOSURES ############\*

 \* WE WRITE THE PROGRAMME TO GIVE A CHOICE TO THE TYPE OF CLOSURES

 \* FOR EXAMPLE, WE CAN HAVE TWO POSSIBLITIES FOR LABOUR MARKET CLEARING:

 \* (i) FIXED WAGE RATE AND THE LABOUR EXCESS SUPPLY ADJUSTS TO CLEAR THE MARKET

 \* (i) FLEXIBLE WAGE RATE WHICH ADJUSTS TO EQUATE DEMAND & SUPPLY

 \* SAVINGS-INVESTMENT BEHAVIOUR +++++++++++++++++++++++++

 \* Define a dummy SICLOS = 1 or 2 so that

 \* if SICLOS = 1, savings is investment-driven

 \* if SICLOS = 2, investment is savings-driven

 SCALAR SICLOS "savings-investment closure" /1/;

 IF(SICLOS EQ 1,

 \* Investment-driven savings,

\* MPS('U-HHD') is flexible, permitting savings value to adjust

 IADJ.FX = IADJ0;

MPS.FX('R-HHD') = MPS0('R-HHD');

 MPS.LO('U-HHD') = -INF;

MPS.UP('U-HHD') = +INF;

 MPS.L('U-HHD') = MPS0('U-HHD');

 );

 IF(SICLOS EQ 2,

 \* Savings-driven investment

 \* IADJ is flexible, permitting investment to adjust

 MPS.FX(H) = MPS0(H);

IADJ.LO = -INF;

 IADJ.UP = +INF;

 IADJ.L = IADJ0;

 );

 \* CAPITAL MARKETS +++++++++++++++++++++++++

 \* Define a dummy CAPCLOS = 1 or 2 so that

 \* if CAPCLOS = 1, capital is mobile and fully employed

 \* if CAPCLOS = 2, capital is activity-specific and fully employed

 SCALAR CAPCLOS "closure for capital market" /2/;

IF(CAPCLOS EQ 1,

 \* Capital is fully and mobile and fully employed, QFU('CAP')=0

 \* FPD('CAP',A) is fixed,

 \* PF('CAP') adjusts to clear the market

 FPD.FX('CAP',A) = FPD0('CAP',A);

 PF.LO('CAP') = -INF;

 PF.UP('CAP') = +INF;

 PF.L('CAP') = PF0('CAP');

 QF.LO('CAP',A) = -INF;

 QF.UP('CAP',A) = +INF;

 QF.L('CAP',A) = QF0('CAP',A);

 QFU.L('CAP')=QFU0('CAP');

 );

 IF(CAPCLOS EQ 2,

 \* Capital is activity-specific and fully employed, , QFU('CAP')=0

 \* PF('CAP') is fixed,

\* FPD('CAP',A) adjusts to clear the market

 FPD.LO('CAP',A) = -INF;

 FPD.UP('CAP',A) = +INF;

 FPD.L('CAP',A) = FPD0('CAP',A);

 PF.FX('CAP') = PF0('CAP');

 QF.FX('CAP',A) = QF0('CAP',A);

 QFU.L('CAP')=QFU0('CAP');

 );

 \* LABOUR MARKETS +++++++++++++++++++++++++

 \* Define a dummy LABCLOS = 1 or 2 so that

\*if LABCLOS = 1, labour is mobile and fully employed

 \*if LABCLOS = 2, labour is mobile and unemployed (fixed wages)

 SCALAR LABCLOS "closure for labour market" /2/;

 IF(LABCLOS EQ 1,

 \* Labor is fully employed and mobile

 \* there is no unemployed labour and QFU('LAB')=0

 \* FPD('LAB',A) is fixed,

 \* PF('LAB') adjusts to clear the market

 FPD.FX('LAB',A) = FPD0('LAB',A);

 PF.LO('LAB') = -INF;

 PF.UP('LAB') = +INF;

 PF.L('LAB') = PF0('LAB');

 QF.LO('LAB',A) = -INF;

 QF.UP('LAB',A) = +INF;

 QF.L('LAB',A) = QF0('LAB',A);

 QFU.L('LAB')=QFU0('LAB');

 );

 IF(LABCLOS EQ 2,

 \* labour is mobile

 \* FPD('LAB',A)\*PF('LAB') is fixed.

 \* there is unemployed labour, QFU('LAB') adjusts to clear the market

 FPD.FX('LAB',A) = FPD0('LAB',A);

 PF.FX('LAB') = PF0('LAB');

 QF.LO('LAB',A) = -INF;

 QF.UP('LAB',A) = +INF;

 QF.L('LAB',A) = QF0('LAB',A);

 QFU.LO('LAB') = -INF;

QFU.UP('LAB') = +INF;

 QFU.L('LAB')=QFU0('LAB');

);

 \* EXCHANGE RATE POLICY +++++++++++++++++++++++++

 \* Define a dummy ROWCLOS = 1 or 2 so that

 \* if ROWCLOS = 1, exchange rate is flexible ensures BOP=0

 \* if ROWCLOS = 2, BOP is flexible and EXR is fixed.

 SCALAR ROWCLOS "exchange rate regime closure" /1/;

 IF(ROWCLOS EQ 1,

 \* BOP is fixed.

 \* A flexible exchange rate clears the current account

 BOP.FX = BOP0;

 EXR.LO = -INF;

EXR.UP = +INF;

EXR.L = EXR0;

0 );

 IF(ROWCLOS EQ 2,

 \* The exchange rate is fixed.

 \* A flexible BOP is allowed

 EXR.FX = EXR0;

 BOP.LO = -INF;

 BOP.UP = +INF;

 BOP.L = BOP0;

 );

 DISPLAY SICLOS, CAPCLOS, LABCLOS, ROWCLOS;

 \*######################################################\*

 \* YOU CAN SOLVE THE MODEL FOR THE BASE CASE HERE BY ISSUING THE COMMAND

 \* SOLVE SOEMV1 USING MCP;

 \* BUT THIS WOULD BE THE SAME AS THE CALIBRATED VALUES DISPLAYED ABOVE.

 \* BUT IT IS NICER TO SET A LOOP SOLUTION IN WHICH:

 \* THE 1ST ITEM GENERATES THE BASE SOLUTION,

 \* THE 2ND ITEM GENERATES THE SOLUTION FOR A GIVEN SHOCK,

 \* THE 3RD ITEM GENERATES THE SOLUTION FOR ANOTHER GIVEN SHOCK, ETC.

 \*######### SETTING UP FOR SIMULATING FOR BASE & SHOCKED CASES #########\*

 \*#### SETS AND PARAMETERS FOR REPORTING THE RESULTS #####\*

 SETS

 \* CASES FOR WHICH A SOLUTION IS TO BE OBTAINED IN THE LOOP

 SIM simulations

 /

 BASE "base simulation = calibrated values"

 PWEINCR "SHOCK 1 = 25% increase in agricultural export price PWE('AGR-C')"

 /

 \* SET OF VARIABLE SOLUTION VALUES TO BE DISPLAYED

 ACGDP "All GDP items"

 /

 GDPFC GDP at factor prices

 GDPGAP gap bt alternative calculations for GDP at market prices

 GDPMP1 GDP at market prices (from spending side)

 GDPMP2 GDP at market prices (from income side)

 GOVCON government consumption

 INVEST investment

 EXP exports of goods and services

 IMP imports of goods and services

 NITAX net indirect taxes

 PRVCON private consumption

 /

 ACGDP1(ACGDP) "components of GDP at market prices"

 /

 EXP exports of goods and services

 GOVCON government consumption

 IMP imports of goods and services

 INVEST investment

 PRVCON private consumption

 /

 ;

 PARAMETERS

 \* VARIABLE VALUES TO BE USED IN SOLUTION FOR BASE & SHOCKED CASES

 PWEAGRSIM(SIM) agricultural export price (just for an experiment)

 \* VARIABLE VALUES TO BE REPORTED FOR BASE & SHOCKED CASES

 PWEREP(C,SIM) export price for commodity c (value used)

 BOPREP(SIM) foreign savings (foreign currency)

 EXRREP(SIM) exchange rate (dom. cur. per unit of for. cur.)

 FPDREP(F,A,SIM) wage distortion factor for factor f in activity a

 GBSREP(SIM) government budget surplus

 GDPREP(\*,SIM) nominal GDP data: National Income Accounts

 IADJREP(SIM) investment adjustment factor

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

 PAREP(A,SIM) price of activity a

 PDREP(C,SIM) domestic price of domestic output c

 PEREP(C,SIM) export price for c (domestic currency)

 PFREP(F,SIM) average price of factor f

 PFAREP(F,A,SIM) price of factor f for activity a

 PMREP(C,SIM) import price for c (domestic currency)

 PQREP(C,SIM) composite commodity price for c

 PVAREP(A,SIM) value-added price for activity a

 PXREP(C,SIM) producer price for commodity c

 QAREP(A,SIM) level of activity a

 QDREP(C,SIM) quantity sold domestically of domestic output c

 QEREP(C,SIM) quantity of exports for commodity c

 QFREP(F,A,SIM) demand for factor f from activity a

 QFUREP(F,SIM) excess supply of factor f for sim

 QHREP(C,H,SIM) consumption of commodity c by household h

 QINTREP(C,A,SIM) qnty of commodity c as intermed. input for activity a

 QINVREP(C,SIM) quantity of investment by commodity of origin c

 QMREP(C,SIM) quantity of imports for commodity c

 QQREP(C,SIM) quantity of composite goods supplied domestically

 QXREP(C,SIM) quantity of domestic output of commodity c

 YFREP(H,F,SIM) income of household h from factor f

 YHREP(H,SIM) income of household h

 WALRREP(SIM) dummy variable (zero at equilibrium)

 ;

 \* SETTING THE BENCH & SHOCKED CASES ++++++++++++++++

 PWEAGRSIM('BASE') = PWE('AGR-C');

 PWEAGRSIM('PWEINCR') = 1.25\*PWE('AGR-C');

 DISPLAY PWEAGRSIM;

 \* SOLVING FOR THE BENCH & SHOCKED CASES ++++++++++++++++

 \* THE LOOP BELOW RUNS OVER THE SET SIM ={BASE, PWEINCR}, AND

 \* FOR EACH SOLUTION STORES THE VALUES OF THE VARIABLES AS REQUIRED

 LOOP(SIM,

 \* CHOOSING THE VALUE OF THE VARIABLE THAT IS SHOCKED

 PWE('AGR-C') = PWEAGRSIM(SIM);

 \* SOLVING THE MODEL

 SOLVE SOEMV1 USING MCP;

 \* STORING THE SOLUTION

 PWEREP (CE,SIM) = PWE(CE);

 BOPREP (SIM) = BOP.L;

 EXRREP (SIM) = EXR.L;

 FPDREP (F, A ,SIM) = FPD.L(F,A);

 GBSREP (SIM) = GBS.L;

 IADJREP (SIM) = IADJ.L;

 MPSREP (H, SIM) = MPS.L(H);

 PAREP (A, SIM) = PA.L(A);

 PDREP (C, SIM) = PD.L(C);

 PEREP (CE, SIM) = PE.L(CE);

 PFREP (F, SIM) = PF.L(F);

 PFAREP (F,A, SIM) = PF.L(F)\*FPD.L(F,A);

 PMREP (CM, SIM) = PM.L(CM);

 PQREP (C, SIM) = PQ.L(C);

 PVAREP (A, SIM) = PVA.L(A);

 PXREP (C, SIM) = PX.L(C);

 QAREP (A, SIM) = QA.L(A);

 QDREP (C, SIM) = QD.L(C);

 QEREP (CE, SIM) = QE.L(CE);

 QFREP (F,A, SIM) = QF.L(F,A);

 QFUREP (F, SIM) = QFU.L(F);

 QHREP (C, H, SIM) = QH.L(C,H);

 QINTREP (C, A, SIM) = QINT.L(C,A);

 QINVREP (C, SIM) = QINV.L(C);

 QMREP (CM, SIM) = QM.L(CM);

 QQREP (C, SIM) = QQ.L(C);

 QXREP (C, SIM) = QX.L(C);

 YFREP (H, F , SIM) = YF.L(H,F);

 YHREP (H, SIM) = YH.L(H);

 WALRREP (SIM) = WALR.L;

\* CREATING AND PROCESSING THE GDP data

\* This is the equivalent of the National Income Table

 GDPREP ('PRVCON', SIM) = SUM((C,H), PQ.L(C)\*QH.L(C,H)) ;

 GDPREP ('GOVCON', SIM) = SUM(C, PQ.L(C)\*QG(C));

 GDPREP ('INVEST', SIM) = SUM(C, PQ.L(C)\*QINV.L(C));

 GDPREP ('EXP', SIM) = SUM(C, EXR.L\*PWE(C)\*QE.L(C));

 GDPREP ('IMP', SIM) = - SUM(C, EXR.L\*PWM(C)\*QM.L(C));

 GDPREP ('GDPFC', SIM) = SUM((F,A), PF.L(F)\*FPD.L(F,A)\*QF.L(F,A));

 GDPREP ('NITAX', SIM)

 = SUM(C, tq(C)\*(PD.L(C)\*QD.L(C) + (PM.L(C)\*QM.L(C))$CM(C)))

 + SUM(C$CM(C), tm(C)\*EXR.L\*PWM(C)\*QM.L(C))

 + SUM(C$CE(C), te(C)\*EXR.L\*PWE(C)\*QE.L(C));

)

;

 \*Processing GDP data

 GDPREP('GDPMP1',SIM) = SUM(ACGDP1, GDPREP(ACGDP1,SIM));

 GDPREP('GDPMP2',SIM) = GDPREP('GDPFC',SIM) + GDPREP('NITAX',SIM);

 GDPREP('GDPGAP',SIM) = GDPREP('GDPMP1',SIM)-GDPREP('GDPMP2',SIM);

 \* SETTING THE DISPLAY FORMATIN OPTIONS

 OPTION QFREP : 3 : 1: 1, QHREP:3:1:1, QINTREP:3:1:1, PFAREP:3:1:1,

 PFAREP : 3 : 1 : 1, FPDREP : 3 : 1 : 1, YFREP : 3 : 1 : 1

 ;

 \* DISPLAYING THE RESULTS

 DISPLAY

 PWEREP, BOPREP, EXRREP, FPDREP, GBSREP, IADJREP, MPSREP, PAREP, PDREP,

 PEREP, PFREP, PFAREP, PMREP, PQREP, PVAREP, PXREP, QAREP, QDREP, QEREP,

 QFREP, QFUREP, QHREP, QINTREP, QINVREP, QMREP, QQREP, QXREP, YFREP,

YHREP, WALRREP, GDPREP

 ;