$TITLE  M8-1.GMS: Small open economy 2x2
* strips out trade costs and tariffs for simplicity of exposition

$ONTEXT
CALIBRATION: country exports X1, imports X2
in free-trade SOE

<table>
<thead>
<tr>
<th></th>
<th>Production Sectors</th>
<th>Consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markets</td>
<td>X1</td>
<td>X2</td>
</tr>
<tr>
<td>P1</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>PL</td>
<td>-135</td>
<td>-5</td>
</tr>
<tr>
<td>PK</td>
<td>-15</td>
<td>-45</td>
</tr>
<tr>
<td>PW</td>
<td></td>
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<tr>
<td>PFX</td>
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</tbody>
</table>

$OFFTEXT

* the first four parameters allow changes in (exogenous) world prices

**PARAMETERS**

| PE2 | Export price of good 2 | /0.999/
| PMI | Import price of good 1 | /1.001/
PE1       Export price of good 1          /1/
PM2       Import price of good 2          /1/;

NONNEGATIVE VARIABLES
X1       Activity level for sector X1
X2       Activity level for sector X2
E1       Activity level for sector E1
E2       Activity level for sector E2
M1       Activity level for sector M1
M2       Activity level for sector M2
W        Activity level for sector W

P1        Price index for commodity X
P2        Price index for commodity Y
PL        Price index for primary factor L
PK        Price index for primary factor K
PW        Price index for welfare (consumer price index)
PFX       Real exchange rate index

CONS      Income definition for CONS;

EQUATIONS
PRF_X1    Zero profit for sector X1
PRF_X2    Zero profit for sector X2
PRF_E1    Zero profit for sector E1
PRF_E2    Zero profit for sector E2
PRF_M1  Zero profit for sector M1
PRF_M2  Zero profit for sector M2
PRF_W   Zero profit for sector W

MKT_X1  Supply-demand balance for commodity X1
MKT_X2  Supply-demand balance for commodity X2
MKT_PFX Supply-demand balance for commodity PFX
MKT_L   Supply-demand balance for primary factor L
MKT_K   Supply-demand balance for primary factor L
MKT_W   Supply-demand balance for aggregate demand

I_CONS  Income definition for CONS;

* Zero profit conditions

PRF_X1..  150*PL**(0.9) * PK**(0.1) =G= 150*P1;
PRF_X2..  50*PL**(0.1) * PK**(0.9) =G=  50*P2;
PRF_E1..  50*P1 =G= 50*PFX*PE1;
PRF_E2..  50*P2 =G= 50*PFX*PE2;
PRF_M1..  50*PFX*PM1 =G= 50*P1;
PRF_M2..  50*PFX*PM2 =G= 50*P2;
PRF_W..  100*P1**0.5 * P2**0.5 =G= 100*PW;

*  Market clearance conditions

MKT_X1..  150*X1 + 50*M1 =G= 50*E1 + 100*W*PW/P1;
MKT_X2..  50*X2  + 50*M2 =G= 50*E2 + 100*W*PW/P2 ;
MKT_PFX.. 50*E2*PE2 + 50*E1*PE1 =G= 50*PM2*M2 + 50*PM1*M1;
MKT_W..  200*W =G=  CONS / PW;
MKT_L..  140 =G= 135*X1 * P1/PL +  5*X2*P2/PL;
MKT_K..  60 =G= 15*X1*P1/PK + 45*X2*P2/PK;

*  Income balance

I_CONS..  CONS =E= 140*PL + 60*PK;

MODEL  SOE1 /PRF_X1.X1, PRF_X2.X2, PRF_E1.E1, PRF_E2.E2,
PRF_M1.M1, PRF_M2.M2, PRF_W.W,
MKT_X1.P1, MKT_X2.P2, MKT_PFX.PFX, MKT_L.PL,
MKT_K.PK, MKT_W.PW, I_CONS.CONS /;
* set SOE values:

X1.L = 1;
X2.L = 1;
E2.L = 0;
M1.L = 0;
E1.L = 1;
M2.L = 1;
W.L = 1;
P1.L = 1;
P2.L = 1;
PFX.L = 1;
PK.L = 1;
PL.L = 1;
CONS.L = 200;

* choose the real consumer price index as numeraire

PW.FX = 1;

* check for calibration and starting-value errors

SOE1.ITERLIM = 0;
SOLVE SOE1 USING MCP;
SOE1.ITERLIM = 2000;
SOLVE SOE1 USING MCP;

* counterfactual: a terms-of-trade improvement

PE1 = 1.2;
PM1 = 1.21;
SOE1.ITERLIM = 2000;
SOLVE SOE1 USING MCP;
SOLVE SOE1 USING MCP;