

\$TITLE M3-5: use of an initially slack activity

* e.g., modeling tax avoidance or use of "green" but expensive

* technologies

\$ONTEXT

sector "Z" produces good X, but with a less efficient technology than activity X (sector X). High tax on X leads to switching Z could be interpreted as an "informal" or "illegal" technology such as smuggling. Or, Z is an expensive "green" technology

Markets	Production Sectors			Consumers
	X	Y	W	CONS
PX	100		-100	
PY		100	-100	
PW			200	-200
PL	-40	-60		100
PK	-60	-40		100

\$OFFTEXT

PARAMETER

TX Ad-valorem tax rate on X sector inputs

INEF Inefficiency measure in sector Z;

```
TX = 0;  
INEF = 1.1;
```

NONNEGATIVE VARIABLES

X	Activity level for sector X
Y	Activity level for sector Y
Z	Activity level for sector Z initial inefficient
W	Activity level for sector W
PX	Price index for commodity X
PY	Price index for commodity Y
PL	Price index for primary factor L
PK	Price index for Primary factor K
PW	Price index for welfare (expenditure function)
CONS	Income definition for CONS;

EQUATIONS

PRF_X	Zero profit for sector X
PRF_Y	Zero profit for sector Y
PRF_Z	Zero profit for sector Z
PRF_W	Zero profit for sector W
MKT_X	Supply-demand balance for commodity X
MKT_Y	Supply-demand balance for commodity Y
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_X.. 100*(PL**0.4 * PK**0.6) * (1+TX) =G= 100*PX;

PRF_Y.. 100*(PL**0.6 * PK**0.4) =G= 100*PY;

PRF_Z.. 100*INEF*(PL**(0.40) * PK**(0.60)) =G= 100*PX;

PRF_W.. 200 * PX**0.5 * PY**0.5 =E= 200 * PW;

* *Market clearing conditions:*

MKT_X.. 100*X + 100*Z =G= 100*W*PW/PX;

MKT_Y.. 100*Y =G= 100*W*PW/PY;

MKT_W.. 200*W =G= CONS/PW;

MKT_L.. 100 =G= 40*X*(PX/(1+TX))/PL + 60*Y*PY/PL + 40*Z*PX/PL;

MKT_K.. 100 =G= 60*X*(PX/(1+TX))/PK + 40*Y*PY/PK + 60*Z*PX/PK;

* *Income constraints:*

I_CONS.. CONS =E= 100*PL + 100*PK + TX*100*X*(PX/(1+TX));

MODEL SLACK /PRF_X.X, PRF_Y.Y, PRF_Z.Z, PRF_W.W,
 MKT_X.PX, MKT_Y.PY, MKT_L.PL, MKT_K.PK,
 MKT_W.PW, I_CONS.CONST /;

* *Check the benchmark:*

X.L =1;

Y.L =1;

W.L =1;

Z.L =0;

PL.L =1;

PX.L =1;

PY.L =1;

PK.L =1;

PW.FX =1;

CONS.L =200;

TX =0;

** introducing a calibration check*

```
SLACK.ITERLIM = 0;  
SOLVE SLACK USING MCP;
```

** now allow the solver to work*

```
SLACK.ITERLIM = 2000;  
SOLVE SLACK USING MCP;
```

** the first counterfactual shows how a tax leads to switching
* to the inefficient "informal" technology*

```
TX = 0.25;  
SOLVE SLACK USING MCP;
```

** the second counterfactual shows the different in welfare when
* the inefficient technology cannot be used*

```
Z.FX = 0;
```

```
TX = 0.25;  
SOLVE SLACK USING MCP;
```

Z.UP = +INF;

Z.LO = 0;

** scenario generation: loop over values of the tax*

SETS I /I1*I30/;

PARAMETERS

TAXRATE(I)

WELFARE(I)

ZPROD(I)

RESULTS(I, *);

** scenario generation: loop of tax rates*

LOOP(I,

TX = 0.01*ORD(I) - 0.01;

SOLVE SLACK USING MCP;

TAXRATE(I) = TX;

WELFARE(I) = W.L;

ZPROD(I) = Z.L;

);

RESULTS(I, "TAXRATE") = TAXRATE(I);

RESULTS(I, "WEFLARE") = WELFARE(I);

RESULTS(I, "ZPROD") = ZPROD(I);

DISPLAY TAXRATE, WELFARE, ZPROD, RESULTS;

\$LIBINCLUDE XLDUMP TAXRATE M3-5.XLS SHEET1!B3

\$LIBINCLUDE XLDUMP WELFARE M3-5.XLS SHEET1!B6

\$LIBINCLUDE XLDUMP RESULTS M3-5.XLS SHEET1!B9