

\$TITLE M8-4b: Small open economy with a benchmark quota
 * *modeled as supply/demand for import licenses*

\$ONTEXT

In this example, units are chosen such that all DOMESTIC prices equal one initially.

Implied world price of import good X2 $P2 = 1/1.2$

| | <i>Production Sectors</i> | | | | <i>Consumer</i> | | |
|----------------|---------------------------|-----------|-----------|-----------|-----------------|----------|-------------|
| <i>Markets</i> | / | <i>X1</i> | <i>X2</i> | <i>E1</i> | <i>M2</i> | <i>W</i> | <i>CONS</i> |
| <i>P1</i> | / | 150 | | -50 | | -100 | |
| <i>P2</i> | / | | 40 | | 60 | -100 | |
| <i>PL</i> | / | -100 | -20 | | | | 120 |
| <i>PK</i> | / | -50 | -20 | | | | 70 |
| <i>PW</i> | / | | | | | 200 | -200 |
| <i>PFX</i> | / | | | 50 | -50 | | |
| <i>PLIC</i> | / | | | | -10 | | 10 |

\$OFFTEXT

PARAMETERS

PE2 Export price of good 2

PM1 Import price of good 1
 PE1 Export price of good 1
 PM2 Import price of good 2
 SLIC Supply of import licenses for X2 (M2)
 ENDOW Endowment multiplier (size of the economy);

PE1 = 1;
 PM2 = 1 / (1.2);
 PE2 = PM2 * 0.99;
 PM1 = 1.01;
 SLIC = 1;
 ENDOW = 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 (expenditure function),

PFX Read exchange rate index,
 CONS Income definition for CONS
 PLIC Price of a license (ad valorem tariff equivalent);

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
 MKT_LIC Market for import licenses;

* *Zero profit conditions*

PRF_X1.. $150 * PL^{**}(2/3) * PK^{**}(1/3) =G= 150 * P1;$

$$\text{PRF_X2..} \quad 40 * \text{PL}^{**}(0.5) * \text{PK}^{**}(0.5) =G= 40 * \text{P2};$$

$$\text{PRF_E1..} \quad 50 * \text{P1} =G= 50 * \text{PFX} * \text{PE1};$$

$$\text{PRF_E2..} \quad 60 * \text{P2} =G= 60 * \text{PFX} * \text{PE2};$$

$$\text{PRF_M1..} \quad 50 * \text{PFX} * \text{PM1} =G= 50 * \text{P1};$$

$$\text{PRF_M2..} \quad 60 * \text{PLIC} + 60 * \text{PFX} * \text{PM2} =G= 60 * \text{P2};$$

$$\text{PRF_W..} \quad 200 * \text{P1}^{**}0.5 * \text{P2}^{**}0.5 =G= 200 * \text{PW};$$

* *Market clearance conditions*

$$\text{MKT_X1..} \quad 150 * \text{X1} + 50 * \text{M1} =G= 50 * \text{E1} + 100 * \text{W} * \text{PW} / \text{P1};$$

$$\text{MKT_X2..} \quad 40 * \text{X2} + 60 * \text{M2} =G= 60 * \text{E2} + 100 * \text{W} * \text{PW} / \text{P2} ;$$

$$\text{MKT_PFX..} \quad 60 * \text{E2} * \text{PE2} + 50 * \text{E1} * \text{PE1} =G= 60 * \text{M2} * \text{PM2} + 50 * \text{PM1} * \text{M1};$$

$$\text{MKT_W..} \quad 200 * \text{W} =G= \text{CONS} / \text{PW};$$

$$\text{MKT_L..} \quad 120 * \text{ENDOW} =G= 100 * \text{X1} * \text{P1} / \text{PL} + 20 * \text{X2} * \text{P2} / \text{PL};$$

$$\text{MKT_K..} \quad 70 * \text{ENDOW} =G= 50 * \text{X1} * \text{P1} / \text{PK} + 20 * \text{X2} * \text{P2} / \text{PK};$$

```
MKT_LIC..    60*SLIC =G= 60*M2;
```

```
*           Income balance
```

```
I_CONS..    CONS =E= 120*ENDOW*PL + 70*ENDOW*PK + 60*PLIC*SLIC;
```

```
MODEL ALGEBRAIC /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,  
                MKT_LIC.PLIC, I_CONS.CONS/;
```

```
*           Check the benchmark:
```

```
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;  
PW.FX = 1;  
PL.L = 1;
```

```
CONS.L = 200;
```

```
PLIC.L = 1/6;
```

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

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

** show what happens if the supply of licenses is greatly expanded*

```
SLIC = 5;  
SOLVE ALGEBRAIC USING MCP;
```

** show that the quota becomes more restrictive as
* the economy grows*

```
SLIC = 1;  
ENDOW = 3;  
SOLVE ALGEBRAIC USING MCP;
```