

\$TITLE M7-3.GMS: Oligopoly with Free Entry, homogeneous good, Cournot  
 \* competition. Uses Cobb-Douglas demand

\$ONTEXT

Markets	Production Sectors				Consumers	
	X	N	Y	W	CONS	ENTRE
PX	100			-100		
PY			100	-100		
PN		20				-20
PW				200	-200	
PL	80	-20	-100		200	
MK	-20					20

\$OFFTEXT

### PARAMETERS

SIGMA Elasticity of substitution  
 ENDOW Endowment scale multiplier  
 MODELSTAT statistic indicating model solved: 0 = solved  
 XPF X output per firm;

SIGMA = 1;  
 ENDOW = 200;

**POSITIVE VARIABLES**

X	Aggregate X production by all firms
N	Number of X sector firms
Y	Activity level of Y output
W	Activity level for welfare
PX	Price of an individual X variety
PN	Price of fixed costs (price of entering)
PY	Price of Y
PL	Price of labor
PW	Price index for utility (consumer price index)
CONS	Income of the representative consumer
ENTRE	Income of the agent ENTRE = markup revenue
MARKUP	Endogenous markup rate = $1$ over $N$ ;

**EQUATIONS**

PRICEX	$MR = MC$ in X
PRICEN	Zero profit condition for fixed costs
PRICEY	Zero profit condition for Y ( $PY = MC$ )

PRICEW      Zero profit condition for W  
  
 DX            Supply-Demand for X  
 DN            Supply-Demand for fixed costs  
 DY            Supply-Demand for Y  
 DW            Supply-Demand for W  
  
 LAB           Supply-demand balance for labor  
  
 ICONS        Consumer (factor owners') income  
 IENTRE       Entrepreneur's profits  
 MK            Markup equation;

PRICEX..     PL =G= PX\*(1 - MARKUP);

PRICEN..     PL =G= PN;

PRICEY..     PL =G= PY;

PRICEW..     ((PX/1.25)\*\*0.5)\*(PY\*\*0.5) =G= PW;

DX..          X\*80 =E= 0.5\*CONS/PX;

DN..          N\*4 =G= ENTRE/PN;

DY..           Y\*100 =E= 0.5\*CONS/PY;

DW..           W\*200 =E= CONS/PW;

LAB..          ENDOW =E= Y\*100 + X\*80 + N\*4;

ICONS..        CONS =E= PL\*ENDOW;

IENTRE..       ENTRE =E= MARKUP\*PX\*X\*80;

MK..           MARKUP\*N =E= 1;

**MODEL** M52 /DX.PX, DY.PY, DW.PW, DN.PN, PRICEX.X, PRICEY.Y,  
          PRICW.W, PRICEN.N,LAB.PL,  
          ICONS.CONNS, IENTRE.ENTRE, MK.MARKUP/;

**OPTION** MCP=MILES;

**OPTION** LIMROW=0;

**OPTION** LIMCOL=0;

\$OFFSYMLIST OFFSYMREF OFFUELLIST OFFUELXREF

CONS.L = 200;

X.L = 1;

Y.L = 1;

W.L = 1;

```
N.L = 5;  
PX.L = 1.25;  
PY.L = 1;  
PL.L = 1;  
PW.L = 1;  
PN.L = 1;  
ENTRE.L = 20;  
MARKUP.L = 0.20;
```

```
PY.FX = 1;
```

```
M52.ITERLIM = 0;  
SOLVE M52 USING MCP;  
MODELSTAT = M52.MODELSTAT - 1.;
```

```
M52.ITERLIM = 1000;  
SOLVE M52 USING MCP;  
MODELSTAT = M52.MODELSTAT - 1.;
```

```
XPF = 80*X.L/N.L;  
DISPLAY XPF;
```

```
* counterfactual: double the size of the economy
```

```
ENDOW = 400;
```

**SOLVE** M52 USING MCP;

XPF = 80\*X.L/N.L;

**DISPLAY** XPF;

*\* show welfare as a function of the economy's size*

**SETS** I indexes 25 different size levels /I1\*I25/;

**PARAMETERS**

SIZE(I)

WELFARE(I)

WELFCAP(I)

FIRMSIZE(I)

FIRMNUMB(I)

MARKUPO(I)

RESULTS(I, \*);

**LOOP**(I,

SIZE(I) = 5.2 - 0.2\***ORD**(I);

ENDOW = 200\*SIZE(I);

**SOLVE** M52 USING MCP;

```
WELFARE(I) = W.L;  
WELFCAP(I) = WELFARE(I)/SIZE(I);  
FIRMSIZE(I) = X.L/N.L*5;  
FIRMNUMB(I) = N.L/5;  
MARKUPO(I) = MARKUP.L;
```

```
);
```

```
RESULTS(I, "SIZE") = SIZE(I);  
RESULTS(I, "WELFARE") = WELFARE(I);  
RESULTS(I, "WELFCAP") = WELFCAP(I);  
RESULTS(I, "FIRMSIZE") = FIRMSIZE(I);  
RESULTS(I, "FIRMNUMB") = FIRMNUMB(I);  
RESULTS(I, "MARKUP") = MARKUPO(I);
```

```
DISPLAY RESULTS;
```

```
* Write parameter RESULTS to an Excel file M7.XLS,  
* starting in Sheet1,
```

```
$LIBINCLUDE XLDUMP RESULTS M7.XLS SHEET1!A3
```

```
Execute_Unload 'M7.gdx' RESULTS
```

```
execute 'gdxrw.exe M7.gdx par=RESULTS rng=SHEET2!A3'
```