

\$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
PW	Price index for utility (consumer price index)
PL	Price of labor
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,
 PRICEW.W, PRICEN.N, LAB.PL,
 ICONS.CONS, IENTRE.ENTRE, MK.MARKUP/;

OPTION MCP=MILES;

OPTION LIMROW=0;

OPTION LIMCOL=0;

\$OFFSYMLIST OFFSYMXREF 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'
```