

\$TITLE: M6-6a.GMS: Modelling pollution as reducing the endowment  
 \* of an environment public good

### \$ONTEXT

*This model is a closed economy: two goods and one factor, one consumer  
 Pollution is generated by the production of X, pollution reduces utility  
 Pollution is modeled as a reduction in the endowment of CLEAN AIR  
 Initial endowment of clear air is 200, with 100 reduced by X pollution  
 and 100 entering utility.*

Markets	Production Sectors			Consumers
	X	Y	W	
PX	100		-100	
PY		100	-100	
PW			300	-300
PL	-100	-100		200
PCA			-100	(200 - 100)

### \$OFFTEXT

### PARAMETERS

TX ad-valorem tax rate for X sector inputs  
 POLINT pollution intensity multiplier;

TX = 0;  
POLINT = 1;

## POSITIVE VARIABLES

X activity level for X production  
Y activity level for Y production  
W activity level for the "production" of welfare from X Y

PX price of good X  
PY price of good Y  
PCA price of clean air  
PW price of a unit of welfare (real consumer-price index)  
PL price of labor

CONS income of the representative consumer  
POL pollution;

## EQUATIONS

PRF\_X zero profit for sector X  
PRF\_Y zero profit for sector Y  
PRF\_W zero profit for sector W (Hicksian welfare index)

MKT\_X supply-demand balance for commodity X

MKT\_Y     supply-demand balance for commodity Y  
 MKT\_CA    market for clean air (determines shadow value PCA)  
 MKT\_L     supply-demand balance for primary factor L  
 MKT\_W     supply-demand balance for aggregate demand  
  
 I\_CONS    income definition for CONS  
 PPOL      pollution caused by production - consumption of X;

\*           *Zero profit inequalities*

PRF\_X..     $100 * PL * (1 + TX) = G = 100 * PX;$   
 PRF\_Y..     $100 * PL = G = 100 * PY;$   
 PRF\_W..     $300 * (PX^{**}(1/3) * PY^{**}(1/3) * PCA^{**}(1/3)) = G = 300 * PW;$

\*           *Market clearance inequalities*

MKT\_X..     $100 * X = G = 100 * W * PW / PX;$   
 MKT\_Y..     $100 * Y = G = 100 * W * PW / PY;$   
 MKT\_CA..    $200 - 100 * POL = G = 100 * W * PW / PCA;$   
 MKT\_W..     $300 * W = E = CONS / PW;$

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MKT_L.. 200 =G= 100*X + 100*Y;
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* Income balance equations (don't forget tax revenue)
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I_CONS.. CONS =E= 200*PL + (200-100*POL)*PCA + TX*100*X*PL;
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PPOL.. 100*POL =G= POLINT*100*X;
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```
MODEL POLLUTE /PRF_X.X, PRF_Y.Y, PRF_W.W,  
                MKT_X.PX, MKT_Y.PY, MKT_CA.PCA, MKT_L.PL,  
                MKT_W.PW,I_CONS.CONST, PPOL.POL /;
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* Chose a numeraire: real consumer price index
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PW.FX = 1;
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* Set initial values of variables:
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```
X.L=1; Y.L=1; W.L=1;
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```
PX.L=1; PY.L=1; PL.L=1; POL.L = 1; PCA.L = 1;
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```
CONS.L=300;
```

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

```
POLLUTE.ITERLIM = 1000;  
SOLVE POLLUTE USING MCP;
```

```
* counterfactual 1: 50% tax
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```
TX = 0.5;  
SOLVE POLLUTE USING MCP;
```

```
TX = 0.75;  
SOLVE POLLUTE USING MCP;
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