

\$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.. $200 * (PX^{**}(1/3) * PY^{**}(1/3) * PCA^{**}(1/3)) =G= 200 * PW;$

* *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.CONS, 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;
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```
POLLUTE.ITERLIM = 0;
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```
SOLVE POLLUTE USING MCP;
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```
POLLUTE.ITERLIM = 1000;  
SOLVE POLLUTE USING MCP;
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```
* counterfactual 1: 50% tax
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TX = 0.5;  
SOLVE POLLUTE USING MCP;
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```
TX = 0.75;  
SOLVE POLLUTE USING MCP;
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