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$TITLE: M7-2.GMS:  Monopoly with fixed costs

$ONTEXT
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	Production Sectors				Consumers	
Markets	C	FC	Y	W	CONS	ENTR
PX	100			-100		
PY			100	-100		
PFC		20				-20
PW				200	-200	
PL	-80	-20	-100		200	
MK	-20					20

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$OFFTEXT

PARAMETERS
  SIGMA      SIGMA: elasticity of substitution among varieties
  FC         parameter setting the level of fixed costs
  ENDOWL     endowment of MKT_Lor
  INCOMEM    monopoly profit share (markup revenues - fixed costs)
  INCOMEC    income share of the "the people" or MKT_Lor income
  MODELSTAT  statistic indicating model solved: 0 = solved;

SIGMA = 9;
FC = 20;
ENDOWL = 200;
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POSITIVE VARIABLES

  X      Activity level for X (output per firm)
  Y      Activity level of Y output
  W      Activity level for welfare

  PX     Price of an individual X variety
  PY     Price of Y
  PW     Price index for utility (consumer price index)
  PL     Price of MKT_Lor


  CONS     Income of the representative consumer
  SHAREX   Share of X in consumption (value share)
  MARKUP   Markup;

EQUATIONS

  PRICEX     MR = MC in X (associated with X output per firm)
  PRICEY     Zero profit condition for Y (PY = MC)
  PRICEW     Zero profit condition for W (PW = MC of utility)

  MKT_X      Supply-demand balance for X (individual variety)
  MKT_Y      Supply-demand balance for Y
  MKT_W      Supply-demand balance for utility W (welfare)
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  MKT_L      Supply-demand balance for MKT_Lor

  INCOME     National income
  SHX        Share of X in expenditure
  MK         Markup equation;

PRICEX..    80*PL =G= 100*PX*(1-MARKUP);

PRICEY..    100*PL =G= 100*PY;

PRICEW..    (0.5*PX**(1-SIGMA) + 0.5*PY**(1-SIGMA))**(1/(1-SIGMA))
                 =G= PW;

MKT_X..     X*100  =G= PX**(-SIGMA)*(PW**(SIGMA-1))*CONS/2;

MKT_Y..     Y*100 =G=  PY**(-SIGMA)*(PW**(SIGMA-1))*CONS/2;

MKT_W..     200*W =G=  CONS/PW;

MKT_L..     ENDOWL =E= Y*100 + X*80 + FC;

INCOME..    CONS =E= PL*ENDOWL + (100*PX*X*MARKUP - PL*FC);

SHX..       SHAREX =E= 100*PX*X / (100*PX*X + 100*PY*Y) ;

MK..        MARKUP =E= 1/(SIGMA - (SIGMA-1)*SHAREX);
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MODEL MONOPOLY /PRICEX.X, PRICEY.Y, PRICEW.W,
                MKT_X.PX, MKT_Y.PY, MKT_W.PW, MKT_L.PL,
                INCOME.CONS, SHX.SHAREX, MK.MARKUP/;

OPTION MCP=PATH;

*       set benchmark values:
X.L = 1;
Y.L = 1;
W.L = 1;
PX.L = 1;
PY.L = 1;
PL.L = 1;
PW.L = 1;
CONS.L = 200;
SHAREX.L = 0.5;
MARKUP.L = 0.20;

* choose the price of good Y as numeraire

PY.FX = 1;

* check for calibration and starting-value errors

MONOPOLY.ITERLIM = 0;
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SOLVE MONOPOLY USING MCP;

MONOPOLY.ITERLIM = 1000;
SOLVE MONOPOLY USING MCP;

MODELSTAT = MONOPOLY.MODELSTAT - 1.;
DISPLAY MODELSTAT;

INCOMEM = (MARKUP.L*PX.L*X.L*100 - PL.L*FC)/CONS.L;
INCOMEC = (PL.L*ENDOWL)/CONS.L;

DISPLAY INCOMEM, INCOMEC;

* Counterfactual: contract the size of the economy

ENDOWL = 100;

SOLVE MONOPOLY USING MCP;

INCOMEM = (MARKUP.L*PX.L*X.L*100 - PL.L*FC)/CONS.L;
INCOMEC = (PL.L*ENDOWL)/CONS.L;

DISPLAY INCOMEM, INCOMEC;

* Counterfactual: expand the size of the economy
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ENDOWL = 400;

SOLVE MONOPOLY USING MCP;

INCOMEM = (MARKUP.L*PX.L*X.L*100 - PL.L*FC)/CONS.L;
INCOMEC = (PL.L*ENDOWL)/CONS.L;

DISPLAY INCOMEM, INCOMEC;
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