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$TITLE  M9-1.GMS: Two-Country Oligopoly with free entry, segmented markets
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$ONTEXT
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	YI	YJ	XI	XJ	NI	NJ	PUI	PUJ	CONI	CONJ	EHTI	ENTJ
PYI	100						-100					
PYJ		100						-100				
PXI			100				-50	-50				
PXJ				100			-50	-50				
FCI					20						-20	
FCJ						20						-20
PSI	-40		-48		-12				100			
PSJ		-40		-48		-12				100		
PUI	-60		-32		-8				100			
PUJ		-60		-32		-8				100		
PWI							200		-200			
PWI								200		-200		
MKI			-10	-10							10	10
MKJ			-10	-10							10	10

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$OFFTEXT
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PARAMETERS
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 TC          trade costs on a gross basis (TC = 1 is costless trade)
 FC          fixed costs
 ENDOWIS     endowment of skilled labor in country i
 ENDOWIL     endowment of unskilled labor in country i
 ENDOWJS     endowment of skilled labor in country j
 ENDOWJL     endowment of unskilled labor in country j
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 SUBSIDY      subsidy to X productioni in country i
 MODELSTAT    indicator whether or not model solved
 REALPUI      real price of unskilled labor in i
 REALPUJ      real price of unskilled labor in i
 REALPSI      real price of skilled labor in j
 REALPSJ      real price of skilled labor in j;


ENDOWIL = 1;
ENDOWIS = 1;
ENDOWJL = 1;
ENDOWJS = 1;
TC = 1;
FC = 8;
SUBSIDY = 0;


POSITIVE VARIABLES
 WFI          welfare in country i
 WFJ          welfare in country j
 YI           production of Y in i
 YJ           production of Y in j
 XI           production of X in i
 XII          supply of XI to market i
 XIJ          supply of XI to market j  (XIJ shipped XIJ over TC recieved)
 XJ           production of X in j
 XJJ          supply of XJ to market j
 XJI          supply of XJ to market j  (XIJ shipped XIJ over TC recieved)
 NI           number of firms in (headquartered in) i
 NJ           number of firms in (headquartered in) j
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 PY         domestic and world price of Y (no trade costs)
 PWI        real consumer price index in i
 PWJ        real consumer price index in j
 PUI        price of unskilled labor in i
 PUJ        price of unskilled labor in j
 PSI        price of skilled labor in i
 PSJ        price of skilled labor in j
 PXI        price of X in i
 PXJ        price of X in j
 PXDI       producer marginal cost of X in i
 PXDJ       producer marginal cost of X in j
 PFI        price of fixed costs in i
 PFJ        price of fixed costs in j
 CONSI      consumer income in i
 CONSJ      consumer income in j
 ENTI       entrepreneurs' markup revenues in i
 ENTJ       entrepreneurs' markup revenues in j
 MARKII     markup on a firm from i's sales in i
 MARKIJ     markup on a firm from i's sales in j
 MARKJI     markup on a firm from j's sales in i
 MARKJJ     markup on a firm from j's sales in j;


EQUATIONS
PRWI       Zero profits for WFI
PRWJ       Zero profits for WFJ
PRXDI      Marginal cost of X in i
PRXII      MR = MC for XII
PRXIJ      MR = MC for XIJ
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PRXDJ       Marginal cost of X in j
PRXJJ       MR = MC for XJJ
PRXJI       MR = MC for XJI
PRYI        Zero profits for YI
PRYJ        Zero profits for YJ
PRFI        Zero profits for FI
PRFJ        Zero profits for FJ
DXDI        X output in country i
DXI         Demand for X in country i
DXDJ        X output in country j
DXJ         Demand for X in country j
DY          Demand for Y
DWI         Demand for welfare in country i
DWJ         Demand for welfare in country j
DFI         Demand for fixed costs in i (markup revenues equal fixed costs)
DFJ         Demand for fixed costs in j (markup revenues equal fixed costs)
SKLABI      Market clearing for SI
SKLABJ      Market clearing for SJ
UNLABI      Market clearing for LI
UNLABJ      Market clearing for LJ
ICONSI      Consumer income in i
ICONSJ      Consumer income in j
IENTREI     Entreprenuer's income (markups) in i
IENTREJ     Entrepreneur's income (markups) in j
MKII        Markup ii
MKIJ        Markup ij
MKJJ        Markup jj
MKJI        Markup ji;
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PRXDI..    (PUI**0.40)*(PSI**0.60)*(1-SUBSIDY) =G= PXDI;

PRXII..    PXDI =G= PXI*(1 - MARKII);

PRXIJ..    PXDI*TC =G= PXJ*(1 - MARKIJ);

PRXDJ..    (PUJ**0.40)*(PSJ**0.60) =G= PXDJ;

PRXJJ..    PXDJ =G= PXJ*(1 - MARKJJ);

PRXJI..    PXDJ*TC =G= PXI*(1 - MARKJI);

PRYI..    (PUI**0.60)*(PSI**0.40) =G= PY;

PRYJ..    (PUJ**0.60)*(PSJ**0.40) =G= PY;

PRWI..    ((PXI/1.25)**0.5)*(PY**0.5) =G= PWI;

PRWJ..    ((PXJ/1.25)**0.5)*(PY**0.5) =G= PWJ;

PRFI..    (PUI**0.40)*(PSI**0.60) =G= PFI;

PRFJ..    (PUJ**0.40)*(PSJ**0.60) =G= PFJ;

DXDI..    XII*40 + XIJ*40 =E= XI*80;
DXDJ..    XJJ*40 + XJI*40 =E= XJ*80;
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DXI..      (XII*40 + XJI*40/TC) =E= 0.5*CONSI/PXI;
DXJ..      (XJJ*40 + XIJ*40/TC) =E= 0.5*CONSJ/PXJ;


DY..       (YI + YJ)*100 =E= 0.5*(CONSI + CONSJ)/PY;


DWI..      WFI*200 =E= CONSI/PWI;


DWJ..      WFJ*200 =E= CONSJ/PWJ;


DFI..      NI*FC =G= ENTI/PFI;


DFJ..      NJ*FC =G= ENTJ/PFJ;


SKLABI.. 100*ENDOWIS =E= 0.40*YI*100*PY/PSI
            + 0.60*(XII+XIJ)*40*(PXDI/(1-SUBSIDY))/PSI  +  0.60*NI*FC*PFI/PSI;


SKLABJ.. 100*ENDOWJS =E= 0.40*YJ*100*PY/PSJ
            + 0.60*(XJJ+XJI)*40*PXDJ/PSJ  +  0.60*NJ*FC*PFJ/PSJ;


UNLABI.. 100*ENDOWIL =E= 0.60*YI*100*PY/PUI
            + 0.40*(XII+XIJ)*40*(PXDI/(1-SUBSIDY))/PUI  +  0.40*NI*FC*PFI/PUI;


UNLABJ.. 100*ENDOWJL =E= 0.60*YJ*100*PY/PUJ
            + 0.40*(XJJ+XJI)*40*PXDJ/PUJ  +  0.40*NJ*FC*PFJ/PUJ;


ICONSI.. CONSI =E= PSI*100*ENDOWIS + PUI*100*ENDOWIL
                -(PUI**0.40)*(PSI**0.60)*SUBSIDY*XI*80;
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ICONSJ.. CONSJ =E= PSJ*100*ENDOWJS + PUJ*100*ENDOWJL;


IENTREI..  ENTI =G= MARKII*PXI*XII*40 + MARKIJ*PXJ*(XIJ/TC)*40;
IENTREJ..  ENTJ =G= MARKJJ*PXJ*XJJ*40 + MARKJI*PXI*(XJI/TC)*40;

MKII..      MARKII =E= XII/(NI*(XII + XJI/TC));
MKIJ..      MARKIJ =E= (XIJ/TC)/(NI*(XIJ/TC + XJJ));
MKJJ..      MARKJJ =E= XJJ/(NJ*(XIJ/TC + XJJ));
MKJI..      MARKJI =E= (XJI/TC)/(NJ*(XII + XJI/TC));


MODEL M54 /DXDI.PXDI, DXDJ.PXDJ, DXI.PXI, DXJ.PXJ, DY.PY,
           DWI.PWI, DWJ.PWJ, DFI.PFI, DFJ.PFJ,
           PRXDI.XI, PRXII.XII, PRXIJ.XIJ,
           PRXDJ.XJ, PRXJJ.XJJ, PRXJI.XJI,
           PRYI.YI, PRYJ.YJ, PRWI.WFI, PRWJ.WFJ,
           PRFI.NI, PRFJ.NJ, SKLABI.PSI, SKLABJ.PSJ,
           UNLABI.PUI, UNLABJ.PUJ, ICONSI.CONSI, ICONSJ.CONSJ,
           IENTREI.ENTI, IENTREJ.ENTJ,
           MKII.MARKII, MKIJ.MARKIJ, MKJJ.MARKJJ, MKJI.MARKJI/;


CONSI.L = 200;
CONSJ.L = 200;
ENTI.L = 20;
ENTJ.L = 20;
XI.L = 1;
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```
XJ.L = 1;
XII.L = 1;
XIJ.L = 1;
XJJ.L = 1;
XJI.L = 1;
YI.L = 1;
YJ.L = 1;
WFI.L = 1;
WFJ.L = 1;
NI.L = 2.5;
NJ.L = 2.5;
PXDI.L = 1;
PXDJ.L = 1;
PXI.L = 1.25;
PXJ.L = 1.25;
PY.L = 1;
PSI.L = 1;
PSJ.L = 1;
PUI.L = 1;
PUJ.L = 1;
PWI.L = 1;
PWJ.L = 1;
PFI.L = 1;
PFJ.L = 1;
MARKII.L = 0.20;
MARKIJ.L = 0.20;
MARKJJ.L = 0.20;
MARKJI.L = 0.20;
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PY.FX = 1;

*M54.ITERLIM = 0;
SOLVE M54 USING MCP;
MODELSTAT = M54.MODELSTAT - 1.;


* counterfactual: trade costs of 20%


TC = 1.2;

SOLVE M54 USING MCP;


* counterfactual: country's identical except for size,
* positive trade costs (home market advantage)


TC = 1.2;
ENDOWIL = 1.5;
ENDOWJL = 0.5;
ENDOWIS = 1.5;
ENDOWJS = 0.5;

SOLVE M54 USING MCP;

REALPUI = PUI.L/PWI.L;
REALPUJ = PUJ.L/PWJ.L;
REALPSI = PSI.L/PWI.L;
REALPSJ = PSJ.L/PWJ.L;
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```
DISPLAY REALPUI, REALPUJ, REALPSI, REALPSJ;


* counterfactual:  home production subsidy of 10%, trade costs 0

TC = 1.;
SUBSIDY = .10;
ENDOWIL = 1;
ENDOWIS = 1;
ENDOWJL = 1;
ENDOWJS = 1;
SOLVE M54 USING MCP;
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