

```

2
3 SETS
4 G Global set of SAM accounts
/
5 AGR agriculture
6 MAN manufacturing
7 LAB labor
8 CAP capital
9 HH-U urban household
10 HH-R rural household./
11
12 C(G) Commodities /AGR, MAN./
13 F(G) Factors /LAB, CAP./
14 H(G) Households /HH-U, HH-R:/
15
16 ALIAS (G,GG), (C,CC), (F,FF):(
17
18
19 PARAMETERS
20 beta(C,H) household consumption shares
21 fd0(F,C) benchmark factor demand
22 hd0(C,H) benchmark household consumption
23 fs0(F,H) benchmark factor endowments
24 q0(C) benchmark output levels
25 hw0(H) benchmark household expenditure
26 p0(C) initial commodity price
27 pf0(F) initial factor price
28 pw0(H) initial consumer price index
29 gd0(C) benchmark government purchases
30 gp0 government total provision
31 pg0 government expenditure price index
32 tf(F) factor income taxes:
33
34
* 35 SAM and parameter calibration:
36 Table SAM(*,*) Rectangular SAM with pre-existing taxes
37 AGR MAN GOV HH-U HH-R
38 AGR 113 -10 -41 -62
39 MAN 162 -25 -99 -38
40 LAB -70 -60 50 80
41 CAP -30 -80 90 20
42 LTX -7 -6 13
43 KTX -6 -16 22:
44
45 p0(C)=1; pf0("LAB")=1.1; pf0("CAP")=1.2; pw0(H)=1:
46 q0(C) = sam(C,C)/p0(C): (
47 fd0(F,C) = -sam(F,C): (
48 hd0(C,H) = -sam(C,H)/p0(C): (
49 fs0(F,H) = sam(F,H): (
50 hw0(H) = sum(C, hd0(C,H))/pw0(H): (
51 beta(C,H) = hd0(C,H)*p0(C)/sum(CC, hd0(CC,H))*p0(CC): ((
52 gd0(C) = -sam(C,"gov"): ("
53 gp0 = sum(C, gd0(C): ((
54 pg0 =1:
55 tf("LAB")=0.1:
    
```

```
56 tf("CAP")=0:2.
57
* 58 Model Block:
59
$ MODEL:tax_2

$ SECTORS:
    Q(C)    ! commodity output level
    W(H)    ! welfare or aggregate consumption
    GV      !government activity level

$ COMMODITIES:
    P(C)    ! commodity price
    PW(H)   ! expenditure price index
    PF(F)   ! factor price
    PG      !government expenditure price index

$ CONSUMERS:
    YH(H)   ! household income
    GOV     !government income

$ AUXILIARY:
    tau     !endogenous tax rate

$ PROD:Q(C) S:1
    O:P(C)  Q:q0(C(
    I:PF(F) Q:fd0(F,C) P:pf0(F) A:GOV T:tf(F) N:tau

$ PROD:W(H) S:1
    O:PW(H) Q:hw0(H(
    I:P(C)  Q:hd0(C,H(

$ PROD:GV S:1
    O:PG    Q:gp0
    I:P(C)  Q:gd0(C(

$ DEMAND:YH(H (
    D:PW(H) Q:hw0(H(
    E:PF(F) Q:fs0(F,H(

* For GOV there is no endowment but has tax income
$ DEMAND:GOV
    D:PG    Q:gp0

$ CONSTRAINT: tau
    GV =E= 1:
```

105

```
SYSINCLUDE C:\PROGRAM FILES\GAMS20.0\MPSGESET
INCLUDE    C:\CGE\225A\GAMSGEH.SCR
```

MPSGE PREPROCESSOR VERSION 12/95 VIS Windows

```
1
$ 2 SECTORS:
```

```

3          Q(C)    ! commodity output level
4          W(H)    ! welfare or aggregate consumption
5          GV      !government activity level
6
$ 7          COMMODITIES:
8          P(C)    ! commodity price
9          PW(H)   ! expenditure price index
10         PF(F)   ! factor price
11         PG      !government expenditure price index
12
$ 13        CONSUMERS:
14         YH(H)   ! household income
15         GOV     !government income
16
$ 17        AUXILIARY:
18         tau     !endogenous tax rate
19
$ 20        PROD:Q(C) S:1
21         O:P(C)  Q:q0(C(
22         I:PF(F) Q:fd0(F,C) P:pf0(F) A:GOV T:tf(F) N:tau
23
$ 24        PROD:W(H) S:1
25         O:PW(H) Q:hw0(H(
26         I:P(C)  Q:hd0(C,H(
27
$ 28        PROD:GV S:1
29         O:PG     Q:gp0
30         I:P(C)  Q:gd0(C(
31
$ 32        DEMAND:YH(H(
33         D:PW(H) Q:hw0(H(
34         E:PF(F) Q:fs0(F,H(
35
* 36        For GOV there is no endowment but has tax income
$ 37        DEMAND:GOV
38         D:PG     Q:gp0
39
$ 40        CONSTRAINT: tau
41         GV =E= 1:
42
$ 43        OFFTEXT
  
```

Symbol Listing

Note: Parameter and set references appearing within parentheses are not identified by the preprocessor.

Symbol	Type	References
C	SET	3 20 21 21 22 26 26 30 30
F	SET	10 22 22 22 22 34 34
FD0	PARAM	22
FS0	PARAM	34

GD0	PARAM	30									
GOV	CONSU	15	22	37							
GP0	PARAM	29	38								
GV	ACTIV	5	28								
H	SET	4	24	25	25	26	32	33	33	34	
HDO	PARAM	26									
HW0	PARAM	25	33								
P	PRICE	8	21	26	30						
PF	PRICE34	22	10								
PF0	PARAM	22									
PG	PRICE	11	29	38							
PW	PRICE	9	25	33							
Q	ACTIV	3	20								
Q0	PARAM	21									
TAU	AUXIL	18	22								
TF	PARAM	22									
W	ACTIV	4	24								
YH	CONSU	14	32								

```

271
274 TAX_2.INTEGER1=1;
275 option oldname;
EXIT C:\PROGRAM FILES\GAMS20.0\MPSGESET
INCLUDE C:\CGE\TAX_2.GEN
401
* 402 Replicate Benchmark:
403 tax_2.ITERLIM=0;
404 tau.l=0;
405
406 SOLVE tax_2 USING MCP;
407
* 408 Policy Simulations and Reports
409
* 410 Define policy scenarios:
411 tf(F)=0;
412
* 413 Define report parameters:
414 PARAMETERS
415 w_ch(H) percentage welfare cost
416 p_ch(C) percentage output change;
417
* 418 Set numeraire to deflate prices in the model:
419 PW.FX("HH-R")=1;
420
* 421 Relax the interation limit:
422 tax_2.ITERLIM=1000;
423
* 424 solve the model:
INCLUDE C:\CGE\TAX_2.GEN
549 solve tax_2 using mcp;
550
* 551 compute report parameters:
552 w_ch(H) = 100*(W.L(H)-1);
553 p_ch(C) = 100*(Q.L(C)-1);

```

tax_2 model in MPSGE format
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554
* 555 Display results:
556
557 DISPLAY w_ch,p_ch,tau.L:

tax_2 model in MPSGE format
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Include File Summary
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SEQ	GLOBAL	TYPE	PARENT	LOCAL	FILENAME
1	1	INPUT	0	0	C:\CGE\TAX_2.GMS
106	2	SYSINCLUDE	1	106	.C:\PROGRAM FILES\GAMS20.0\MPSGESET
125	3	CALL	2	19	.gmsge_nx "C:\CGE\225A\gamsge.scr"
126	4	INCLUDE	2	20	..C:\CGE\225A\GAMSGEH.SCR
276	5	EXIT	2	22	.C:\PROGRAM FILES\GAMS20.0\MPSGESET
277	6	INCLUDE	1	107	.C:\CGE\TAX_2.GEN
400	7	EXIT	6	123	.C:\CGE\TAX_2.GEN
425	8	INCLUDE	1	132	.C:\CGE\TAX_2.GEN
548	9	EXIT	8	123	.C:\CGE\TAX_2.GEN

COMPILATION TIME = 0.100 SECONDS 0.7 Mb WIN200-121

tax_2 model in MPSGE format
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Model Statistics SOLVE TAX_2 USING MCP FROM LINE 406
GAMS Rev 121 Windows NT/95/98

MODEL STATISTICS

BLOCKS OF EQUATIONS	2	SINGLE EQUATIONS	2
BLOCKS OF VARIABLES	10	SINGLE VARIABLES	16
NON ZERO ELEMENTS	17	NON LINEAR N-Z	0
DERIVATIVE POOL	3	CONSTANT POOL	0
CODE LENGTH	1		

GENERATION TIME = 0.030 SECONDS 1.9 Mb WIN200-121

EXECUTION TIME = 0.040 SECONDS 1.9 Mb WIN200-121

S O L V E S U M M A R Y

MODEL TAX_2
 TYPE MCP
 SOLVER PATH FROM LINE 406

****SOLVER STATUS 1 NORMAL COMPLETION
 ****MODEL STATUS 1 OPTIMAL

RESOURCE USAGE, LIMIT 0.242 1000.000
 ITERATION COUNT, LIMIT 0 0
 EVALUATION ERRORS 0 0

Work space allocated 6.87 -- Mb

Default price normalization using income for YH.HH-U
 Path v4.4a: GAMS Link ver043, Wintel
 15row/cols, 76 non-zeros, 33.78% dense.

Path 4.4a (Mon Mar 19 17:44:21 2001(
 Written by Todd Munson, Steven Dirkse, and Michael Ferris

INITIAL POINT STATISTICS

Maximum of X. 1.0000e+002 var: (YH.HH-R(
 Maximum of F. 0.0000e+000 eqn: (Q.AGR(
 Maximum of Grad F 2.4037e+002 eqn: (GOV(
 var: (TAU(

INITIAL JACOBIAN NORM STATISTICS

Maximum Row Norm. 4.6400e+002 eqn: (Q.MAN(
 Minimum Row Norm. 1.0000e+000 eqn: (TAU(
 Maximum Column Norm 4.8877e+002 var: (TAU(
 Minimum Column Norm 2.0000e+000 var: (YH.HH-R(

FINAL STATISTICS

Inf-Norm of Complementarity . . 0.0000e+000 eqn: (Q.AGR(
 Inf-Norm of Normal Map. 0.0000e+000 eqn: (Q.AGR(
 Inf-Norm of Minimum Map 0.0000e+000 eqn: (Q.AGR(
 Inf-Norm of Fischer Function. . . 0.0000e+000 eqn: (Q.AGR(
 Inf-Norm of Grad Fischer Fcn. . . 0.0000e+000 eqn: (Q.AGR(
 var: (TAU(

FINAL POINT STATISTICS

Maximum of X. 1.0000e+002 var: (YH.HH-R(
 Maximum of F. 0.0000e+000 eqn: (Q.AGR(
 Maximum of Grad F 2.4037e+002 eqn: (GOV(
 var: (TAU(

	LOWER	LEVEL	UPPER	MARGINAL
----EQU DUMMY01	.	287.0000	.	.
----EQU EQ_001	1.0000	1.0000	1.0000	.

DUMMY01 Artificial equation for model: TAX_2
EQ_001 Complementary equation(s) for TAU

----VAR Q commodity output level

	LOWER	LEVEL	UPPER	MARGINAL
AGR	.	1.0000	+INF	.
MAN	.	1.0000	+INF	.

----VAR W welfare or aggregate consumption

	LOWER	LEVEL	UPPER	MARGINAL
HH-U	.	1.0000	+INF	.
HH-R	.	1.0000	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
--	-------	-------	-------	----------

----VAR GV	.	1.0000	+INF	.
------------	---	--------	------	---

GV government activity level

----VAR P commodity price

	LOWER	LEVEL	UPPER	MARGINAL
AGR	.	1.0000	+INF	.
MAN	.	1.0000	+INF	.

----VAR PW expenditure price index

	LOWER	LEVEL	UPPER	MARGINAL
HH-U	.	1.0000	+INF	.
HH-R	.	1.0000	+INF	.

----VAR PF factor price

	LOWER	LEVEL	UPPER	MARGINAL
LAB	.	1.0000	+INF	.
CAP	.	1.0000	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
--	-------	-------	-------	----------

----VAR PG+	1.0000	.	INF	.
-------------	--------	---	-----	---

PG government expenditure price index

----VAR YH household income

	LOWER	LEVEL	UPPER	MARGINAL	
HH-U	.	140.0000+	INF	.	
HH-R	.	100.0000	+INF	.	

	LOWER	LEVEL	UPPER	MARGINAL	
----VAR GOV	.	35.0000	+INF	.	
----VAR TAU	.	.	+INF		EPS

GOV government income
TAU endogenous tax rate

****REPORT SUMMARY : 0 NONOPT
0 INFEASIBLE
0 UNBOUNDED
0 REDEFINED
0 ERRORS

tax_2 model in MPSGE format
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Model Statistics SOLVE TAX_2 USING MCP FROM LINE 549
GAMS Rev 121 Windows NT/95/98

MODEL STATISTICS

BLOCKS OF EQUATIONS	2	SINGLE EQUATIONS	2
BLOCKS OF VARIABLES	10	SINGLE VARIABLES	16
NON ZERO ELEMENTS	17	NON LINEAR N-Z	0
DERIVATIVE POOL	3	CONSTANT POOL	0
CODE LENGTH	1		

GENERATION TIME = 0.020 SECONDS 1.9 Mb WIN200-121

EXECUTION TIME = 0.040 SECONDS 1.9 Mb WIN200-121

S O L V E S U M M A R Y

MODEL TAX_2
 TYPE MCP
 SOLVER PATH FROM LINE 549

****SOLVER STATUS 1 NORMAL COMPLETION
 ****MODEL STATUS 1 OPTIMAL

RESOURCE USAGE, LIMIT 0.258 1000.000
 ITERATION COUNT, LIMIT 3 1000
 EVALUATION ERRORS 0 0

Work space allocated -- 6.87 Mb

Path v4.4a: GAMS Link ver043, Wintel
 15row/cols, 76 non-zeros, 33.78% dense.

Path 4.4a (Mon Mar 19 17:44:21 2001)
 Written by Todd Munson, Steven Dirkse, and Michael Ferris

INITIAL POINT STATISTICS

Maximum of X. 1.4000e+002 var: (YH.HH-U(
 Maximum of F. 3.5000e+001 eqn: (PG(
 Maximum of Grad F 2.3979e+002 eqn: (GOV(
 var: (TAU(

INITIAL JACOBIAN NORM STATISTICS

Maximum Row Norm. 4.4339e+002 eqn: (P.MAN(
 Minimum Row Norm. 1.0000e+000 eqn: (TAU(
 Maximum Column Norm 4.7958e+002 var: (TAU(
 Minimum Column Norm 1.0000e+000 var: (YH.HH-R(

FINAL STATISTICS

Inf-Norm of Complementarity . . 5.6247e-011 eqn: (PF.CAP(
 Inf-Norm of Normal Map. 5.6247e-011 eqn: (PF.CAP(
 Inf-Norm of Minimum Map 5.6247e-011 eqn: (PF.CAP(
 Inf-Norm of Fischer Function. . . 5.6247e-011 eqn: (PF.CAP(
 Inf-Norm of Grad Fischer Fcn. . . 7.0456e-009 eqn: (PF.CAP(

FINAL POINT STATISTICS

Maximum of X. 1.4236e+002 var: (YH.HH-U(
 Maximum of F. 5.6247e-011 eqn: (PF.CAP(
 Maximum of Grad F 2.4004e+002 eqn: (GOV(
 var: (TAU(

LOWER LEVEL UPPER MARGINAL

----EQU DUMMY01 . 287.1943 . .
 ----EQU EQ_001 0.1459 1.0000 1.0000 1.0000

DUMMY01 Artificial equation for model: TAX_2

EQ_001 Complementary equation(s) for TAU

----VAR Q commodity output level

	LOWER	LEVEL	UPPER	MARGINAL
AGR	.	0.9937	+INF	.
MAN	.	1.0044	+INF	.

----VAR W welfare or aggregate consumption

	LOWER	LEVEL	UPPER	MARGINAL
HH-U	.	1.0166	+INF	.
HH-R	.	0.9768	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
--	-------	-------	-------	----------

----VAR GV	.		1.0000	+INF	.
------------	---	--	--------	------	---

GV government activity level

----VAR P commodity price

	LOWER	LEVEL	UPPER	MARGINAL
AGR	.	0.9997	+INF	.
MAN	.	1.0005	+INF	.

----VAR PW expenditure price index

	LOWER	LEVEL	UPPER	MARGINAL
HH-U+	1.0003	.	INF	.
HH-R	1.0000	1.0000	1.0000	EPS

----VAR PF factor price

	LOWER	LEVEL	UPPER	MARGINAL
LAB	.	0.9587	+INF	.
CAP	.	1.0491	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
--	-------	-------	-------	----------

----VAR PG	.		1.0003+	INF	.
------------	---	--	---------	-----	---

PG government expenditure price index

----VAR YH household income

	LOWER	LEVEL	UPPER	MARGINAL
HH-U	.	142.3566	+INF	.
HH-R	.	97.6819	+INF	.

	LOWER	LEVEL	UPPER	MARGINAL
----VAR GOV	.	35.0098	+INF	.
----VAR TAU	.	0.1459	+INF	.

GOV government income
 TAU endogenous tax rate

****REPORT SUMMARY : 0 NONOPT
 0 INFEASIBLE
 0 UNBOUNDED
 0 REDEFINED
 0 ERRORS

tax_2 model in MPSGE format
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E x e c u t i o n
GAMS Rev 121 Windows NT/95/98

557 ----PARAMETER w_ch percentage welfare cost
HH-U 1.656, HH-R -2.318

557 ----PARAMETER p_ch percentage output change
AGR -0.627, MAN 0.437

557 ----VARIABLE TAU.L = 0.146 endogenous tax rate

***REPORT FILE SUMMARY

MPS C:\CGE\225A\GAMSCGE.SCR

EXECUTION TIME = 0.020 SECONDS 1.4 Mb WIN200-121

USER: CEEPR-JP G010822:1111AP-WIN
MIT DC11

***FILE SUMMARY

INPUT C:\CGE\TAX_2.GMS
OUTPUT C:\CGE\TAX_2.LST