

## EXERCISES for LECTURE 5

1. Declare the benchmark prices as scalars in the EXAMPLE 2 to allow for changes in the counterfactual models

```
SCALAR
X          QUANTITY OF X FOR WHICH THE MRS IS TO BE EVALUATED /1/
Y          QUANTITY OF Y FOR WHICH THE MRS IS TO BE EVALUATED /1/
BPX       BENCHMARK PRICE OF X /0.25/
BPY       BENCHMARK PRICE OF X /1/
MRS       COMPUTED MARGINAL RATE OF SUBSTITUTION;
```

\*The rest of the model is simpler than first example.

```
$ONTEXT
```

```
$MODEL:MRSCAL
```

```
$COMMODITIES:
```

```
PX      ! PRICE INDEX FOR GOOD X
PY      ! PRICE INDEX FOR GOOD Y
```

```
$CONSUMERS:
```

```
RA      ! REPRESENTATIVE AGENT INCOME
```

```
$DEMAND:RA
```

```
s:1
D:PX    Q:1    P:BPX
D:PY    Q:1    P:BPY
E:PX    Q:X
E:PY    Q:Y
```

```
$OFFTEXT
```

```
$$SYSINCLUDE mpsgeset MRSCAL
```

```
$INCLUDE MRSCAL.GEN
```

```
SOLVE MRSCAL USING MCP;
```

\* Following the solution, we compute a function of the solution values

\*(the ratio of the PX to the PY and storing this result in the scalar MRS).

```
MRS = PX.L / PY.L;
```

```
*precision of MRS
```

```
OPTION MRS:8;
```

```
DISPLAY MRS;
```

```

          LOWER    LEVEL    UPPER    MARGINAL
---- VAR PX      .      0.400    +INF     .
---- VAR PY      .      1.600    +INF     .
---- VAR RA      .      2.000    +INF     .

PX  PRICE INDEX FOR GOOD X
PY  PRICE INDEX FOR GOOD Y
RA  REPRESENTATIVE AGENT INCOME

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

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General Algebraic Modeling System
Execution

---- 183 PARAMETER MRS = 0.25000000 COMPUTED MARGINAL RATE OF SUBSTITUTION
```

**Conclusion:** benchmark values can be declared directly in the core model (not a good idea if the model is big) or via scalars (or parameters).

## lecture5.2

Use modified EXAMPLE 2 to make exercises 2a and 2b from the Lecture 3. Please allow GAMS to run the solutions for all three exercises in one file as we done in the EXAMPLE 3a.

```
*Example 2
SCALAR
X QUANTITY OF X FOR WHICH THE MRS IS TO BE EVALUATED /1/
Y QUANTITY OF Y FOR WHICH THE MRS IS TO BE EVALUATED /1/
QX BENCHMARK QUANTITY OF X /1/
QY BENCHMARK QUANTITY OF Y /1/
BPX BENCHMARK PRICE OF X /0.25/
BPY BENCHMARK PRICE OF X /1/
MRS COMPUTED MARGINAL RATE OF SUBSTITUTION;

$ONTEXT
$MODEL:MRSCAL
$COMMODITIES:
PX ! PRICE INDEX FOR GOOD X
PY ! PRICE INDEX FOR GOOD Y
$CONSUMERS:
RA ! REPRESENTATIVE AGENT INCOME
$DEMAND:RA s:1
D:PX Q:QX P:BPX
D:PY Q:QY P:BPY
E:PX Q:X
E:PY Q:Y
$OFFTEXT
$SYSINCLUDE mpsgeset MRSCAL
$INCLUDE MRSCAL.GEN
SOLVE MRSCAL USING MCP;
MRS = PX.L / PY.L;
DISPLAY MRS;
```

```
*Exercise 2A
X=2;
Y=2;
$INCLUDE MRSCAL.GEN
SOLVE MRSCAL USING MCP;
MRS = PX.L / PY.L;
DISPLAY MRS;
```

```
*Exercise 2B
QX=4;
QY=1;
BPX=0.25;
BPY=1;
X=1;
Y=1;
$INCLUDE MRSCAL.GEN
SOLVE MRSCAL USING MCP;
MRS = PX.L / PY.L;
DISPLAY MRS;
```

\*\*\*\*\*in the same file, we can see 2 solution\*\*\*\*\*

### SOLUTION 2A

	LOWER	LEVEL	UPPER	MARGINAL		LOWER	LEVEL	UPPER	MARGINAL
--- VAR PX	.	0.400	+INF	.	--- VAR PX	.	1.000	+INF	-7.959E-8
--- VAR PY	.	1.600	+INF	.	--- VAR PY	.	1.000	+INF	-7.959E-8
--- VAR RA	.	4.000	+INF	.	--- VAR RA	.	2.000	+INF	1.5917E-7
PX PRICE INDEX FOR GOOD X					PX PRICE INDEX FOR GOOD X				
PY PRICE INDEX FOR GOOD Y					PY PRICE INDEX FOR GOOD Y				
RA REPRESENTATIVE AGENT INCOME					RA REPRESENTATIVE AGENT INCOME				
**** REPORT SUMMARY :	0	NONOPT							
	0	INFEASIBLE							
	0	UNBOUNDED							
	0	REDEFINED							
	0	ERRORS							
GAMS 24.7.4 r58773 Released Sep 19, 2016 WEX-WEI x86 64bit/MS Windows 12/09/16 22:04:10 F					234 PARAMETER MRS	=	1.000	COMPUTED MARGINAL RAT	
General Algebraic Modeling System								E OF SUBSTITUTION	
Execution									
---	190	PARAMETER MRS	=	0.250	COMPUTED MARGINAL RAT			E OF SUBSTITUTION	

**Conclusion:** There is no need to repeat the core model when benchmark assumptions are changed.

## lecture5.3

Modify the EXAMPLE 1 by using GAMS statements in the MPSGE model as we done in the EXAMPLE 2.

Hint: (i) declare the benchmark values as scalars to allow for changes when we would change a calibration point and  
(ii) adjust the rest of the model to these scalars.

```

SCALAR
  QX      BENCHMARK QUANTITY OF X /1/
  QY      BENCHMARK QUANTITY OF Y /1/
  BPX     BENCHMARK PRICE OF X  /0.5/
  BPY     BENCHMARK PRICE OF X  /1/;

$ONTEXT

$MODEL:DEMAND

$SECTORS:
  X      ! ACTIVITY LEVEL FOR X = DEMAND FOR GOOD X
  Y      ! ACTIVITY LEVEL FOR Y = DEMAND FOR GOOD Y

$COMMODITIES:
  PX     ! PRICE OF X WHICH WILL EQUAL PL
  PY     ! PRICE OF Y WHICH WILL EQUAL 2 PL
  PL     ! PRICE OF THE ARTIFICIAL FACTOR L

$CONSUMERS:
  RA     ! REPRESENTATIVE AGENT INCOME

$PROD:X
  O:PX   Q:QX
  I:PL   Q:1

$PROD:Y
  O:PY   Q:QY
  I:PL   Q:2

$DEMAND:RA
  S:1
  E:PL   Q:120
  D:PX   Q:QX      P:BPX
  D:PY   Q:QY      P:BPY

$OFFTEXT
$SYSINCLUDE mpsgeset DEMAND

$INCLUDE DEMAND.GEN
SOLVE DEMAND USING MCP;

```

	LOWER	LEVEL	UPPER	MARGINAL
--- VAR X	.	40.000	+INF	.
--- VAR Y	.	40.000	+INF	.
--- VAR PX	.	1.000	+INF	.
--- VAR PY	.	2.000	+INF	.
--- VAR PL	.	1.000	+INF	.
--- VAR RA	.	120.000	+INF	.

```

X  ACTIVITY LEVEL FOR X = DEMAND FOR GOOD X
Y  ACTIVITY LEVEL FOR Y = DEMAND FOR GOOD Y
PX PRICE OF X WHICH WILL EQUAL PL
PY PRICE OF Y WHICH WILL EQUAL 2 PL
PL PRICE OF THE ARTIFICIAL FACTOR L
RA REPRESENTATIVE AGENT INCOME

```

**Conclusion:** benchmark quantities in total production activity (output) and households activity (demand) must be the same

## lecture5.4

Use modified EXAMPLE 1 to make exercises 1a, 1b, and 1c from the Lecture 3. Please allow GAMS to run the solutions for all three exercises in one file as we done in the EXAMPLE 3a.

```
*Example1
SCALAR
  QX      BENCHMARK QUANTITY OF X /1/
  QY      BENCHMARK QUANTITY OF Y /1/
  BPX     BENCHMARK PRICE OF X /0.5/
  BPY     BENCHMARK PRICE OF X /1/
  PFACTORX production FACTOR in sector X /1/
  PFACTORY production FACTOR in sector Y /2/;

$ONTEXT

$MODEL:DEMAND

$SECTORS:
  X      ! ACTIVITY LEVEL FOR X = DEMAND FOR GOOD X
  Y      ! ACTIVITY LEVEL FOR Y = DEMAND FOR GOOD Y

$COMMODITIES:
  PX     ! PRICE OF X WHICH WILL EQUAL PL
  PY     ! PRICE OF Y WHICH WILL EQUAL 2 PL
  PL     ! PRICE OF THE ARTIFICIAL FACTOR L

$CONSUMERS:
  RA     ! REPRESENTATIVE AGENT INCOME

$PROD:X
  O:PX   Q:QX
  I:PL   Q:PFACTORX

$PROD:Y
  O:PY   Q:QY
  I:PL   Q:PFACTORY

$DEMAND:RA      s:1
  E:PL          Q:120
  D:PX          Q:QX      P:BPX
  D:PY          Q:QY      P:BPY

$OFFTEXT
$SYSINCLUDE mpsgeset DEMAND

$INCLUDE DEMAND.GEN
  SOLVE DEMAND USING MCP;

*Exercise 1a
  QX=2;
  BPX=0.25;

$INCLUDE DEMAND.GEN
  SOLVE DEMAND USING MCP;

*Exercise 1b
  PFACTORX=2;

$INCLUDE DEMAND.GEN
  SOLVE DEMAND USING MCP;

*Exercise*1c
  PY.FX = 1;

$INCLUDE DEMAND.GEN
  SOLVE DEMAND USING MCP;
```