

Instructions on how to implement Models in Excel, and GAMS

An economic model is a set of relationship among economic variables. Three kinds of modelling software (programmes) will be used for economic modelling module.

- 1) Excel based model
- 2) OX-GiveWin-PcGive-STAMP based time series and cross section model
- 3) GAMS (generic algebraic modelling system) based models
- 4) Getting the right set of data ([www.bankofengland.co.uk](http://www.bankofengland.co.uk), [www.archive.ac.uk](http://www.archive.ac.uk), [www.oecd.org](http://www.oecd.org), [www.imf.org](http://www.imf.org), [www.economic.com](http://www.economic.com), [www.worldbank.org](http://www.worldbank.org), [www.statistics.gov.uk](http://www.statistics.gov.uk), Worldbank CD-at Hull network).

NB: get a good editor like PFE or Epsilon to write a programme. Some of these editors are available free to students or academics.

#### 1) Excel based models

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Excel Spreadsheets are very user friendly and could be used to calculate many of simple models required for economic modeling.

First it is important to solve a model analytically by hand. Then Excel formula/optimiser like goal.

For instance

Study Keynesian1: Index of spreadsheets in this file

Consumption function

Investment function

Tax revenue

Imports

Keynesian model- various scenarios

Demand for Money

Quantity Theory of Money

Macroeconomic Indicators of the UK-IMF data

Macroeconomic Indicators of the UK-World Bank

Each of these spreadsheet can be invoked by clicking in the index part.

Various Scenarios of the Solow Model (check the index first)

Basic Solow Model

Calculation of Steady State in the Solow model

Steady State with a higher saving rate

Three difference calculations for Golden Rule of Saving

Steady state with low population growth rate

Steady state with medium population growth rate

Steady state with high population growth rate

Summary of growth calculations

AK type Endogenous Growth Model

2) OX-GiveWin-PcGive-STAMP based econometric model on time series and cross section data  
 This software is available in all labs (Start/applications/economics/givewin).  
 They can be used for estimation, forecasting and graphics either using menu driven commands or writing a batch file.

- a. save the data in a standard excel file
- b. start give win at start/applications/economics/givewin
- c. open the data file using file/open datafile command
- d. choose PcGive package among the modules for econometric analysis
- e. select the package such as econometric modelling
- d. choose dependent and independent variables as asked by the menu
- e. do the estimate

You get following type of results for data file groecdpanel.xls

	Coefficient	Std.Error	t-value	t-prob	Part.R <sup>2</sup>
Constant	4.10674	1.934	2.12	0.034	0.0117
sy	0.240140	0.04493	5.34	0.000	0.0697
iy	0.0525029	0.03872	1.36	0.176	0.0048
xmy	0.0874911	0.01441	6.07	0.000	0.0882
popg	-1.94795	0.3233	-6.03	0.000	0.0870
govy	-0.171486	0.08498	-2.02	0.044	0.0106
txy	-0.0651878	0.04330	-1.51	0.133	0.0059
Australia	-0.0869844	0.7075	-0.123	0.902	0.0000
Austria	-3.11969	0.5986	-5.21	0.000	0.0666
Belgium	-3.36907	0.6740	-5.00	0.000	0.0615
Canada	-0.850445	0.2505	-3.40	0.001	0.0294
Denmark	-0.709816	0.2663	-2.67	0.008	0.0183
Finland	-0.552662	0.1672	-3.31	0.001	0.0279
France	-0.285746	0.1639	-1.74	0.082	0.0079
Germany	-0.597067	0.1088	-5.49	0.000	0.0732
Greece	-0.787228	0.08243	-9.55	0.000	0.1931
Iceland	-0.401901	0.09980	-4.03	0.000	0.0408
Ireland	-0.702339	0.1416	-4.96	0.000	0.0607
Italy	-0.270829	0.08561	-3.16	0.002	0.0256
Japan	-0.454042	0.06758	-6.72	0.000	0.1059
Luxembourg	-1.15646	0.2083	-5.55	0.000	0.0748
Netherlands	-0.522529	0.1275	-4.10	0.000	0.0422
New Zealand	-0.282268	0.06053	-4.66	0.000	0.0540
Norway	-0.322642	0.07267	-4.44	0.000	0.0492
Portugal	-0.341485	0.05629	-6.07	0.000	0.0881
Spain	-0.190213	0.03873	-4.91	0.000	0.0595
Sweden	-0.141440	0.06927	-2.04	0.042	0.0108
Switzerland	-0.420349	0.04277	-9.83	0.000	0.2022
United Kingdom	-0.114585	0.04201	-2.73	0.007	0.0191
United States	0.000000	---			
sigma	1.6788	RSS		1073.79874	
R <sup>2</sup>	0.427182	F(29, 381) =	9.798	[0.000]**	
log-likelihood	-780.539	DW		1.35	
no. of observations	411	no. of parameters		30	
mean(Grpercap)	1.87164	var(Grpercap)		4.56105	
Normality test:	Chi <sup>2</sup> (2) =	12.365	[0.0021]**		
hetero test:	F(34, 346) =	1.3294	[0.1091]		
RESET test:	F(1, 380) =	3.0492	[0.0816]		

$$\text{Grpercap} = + 4.107 + 0.2401*sy + 0.0525*iy + 0.08749*xmy - 1.948*popg$$

(SE)           (1.93)   (0.0449)   (0.0387)   (0.0144)   (0.323)

- 0.1715\*govy - 0.06519\*txy - 0.08698\*Australia - 3.12\*Austria  
(0.085)           (0.0433)           (0.708)                   (0.599)

- 3.369\*Belgium - 0.8504\*Canada - 0.7098\*Denmark - 0.5527\*Finland  
(0.674)           (0.25)                   (0.266)                   (0.167)

- 0.2857\*France - 0.5971\*Germany - 0.7872\*Greece - 0.4019\*Iceland  
(0.164)           (0.109)                   (0.0824)                   (0.0998)

- 0.7023\*Ireland - 0.2708\*Italy - 0.454\*Japan - 1.156\*Luxembourg  
(0.142)           (0.0856)                   (0.0676)                   (0.208)

- 0.5225\*Netherlands - 0.2823\*New Zealand - 0.3226\*Norway  
(0.127)                   (0.0605)                           (0.0727)

- 0.3415\*Portugal - 0.1902\*Spain - 0.1414\*Sweden -  
0.4203\*Switzerland  
(0.0563)                   (0.0387)                   (0.0693)                   (0.0428)

- 0.1146\*United Kingdom + 0\*United States  
(0.042)                                   (0)

f. analyse these results and state whether they are according to economic theory discussed in economic modelling. Compare these estimates with other studies in the literature.

g. the STAMP program can similarly be used for business cycle analysis.

In stead of menu driven programmes a Batch programme all instructions can be written and implemented.  
It gives more control for the researcher. Batch file can be loaded and run in give win using tools/batc editor  
command in the PcGive.

An example of the Batch file to process a growth panel estimation using data in groecdpanel.xls looks like this. Be careful in giving accurate path for files in use.

```

module("PcGive");
package("Panel");
usedata("groecdpanel.xls");
system
{
  Y = Grpercap;
  X = sy, iy, xmy, popg, govy, txy, Australia, Austria, Belgium,
      Canada, Denmark, Finland, France, Germany, Greece, Iceland,
      Ireland, Italy, Japan, Luxembourg, Netherlands, "New Zealand",
      Norway, Portugal, Spain, Sweden, Switzerland, "United Kingdom",
      "United States";
  R = Year;
}
setdummy("constant");
settest(1, 2);
option("robust", 1);
estimate("OLS", 1, 1, 961, 1);

```

More detailed information about OX-GiveWin-PcGive-STAMP software is available [www.oxmetrics.net](http://www.oxmetrics.net).

3) GAMS (generic algebraic modelling system) based models ([www.gams.com](http://www.gams.com))  
GAMS is good in solving linear, non-linear or discrete programming models that involve  
constrained optimisation. In economics consumers and producers choices are explained well

by solving a model for a decentralised (micro-founded) markets using constrained optimisation technique. This software can solve a very large scale model using detailed structure of consumption, production and trade for single, multiple or global economy.

It is very easy to formulate and solve a model in GAMS. The basic steps writing a GAMS programme involve (study ISLM.gms for example):

- a. declaration of model, set, parameters, variables, equations and model
- b. solving the model using linear or non-linear or discrete programming techniques. Solvers are available in GAMS
- c. Solving the model and analysing the solution.

You may use pfe32.exe editor to write a gams programme. Students can get a free copy of GAMS from [www.gams.com](http://www.gams.com) (you need to fill a form on-line).

To run GAMS in the Hull university network

\*make a directory called models in G:drive

\*G:\> md Models

\* G:\> cd Models

\*copy a GAMS om G:\models\islm.gms

Type following to execute the programme in the network

\* N:\special\ec\gams\gams islm.gms

Results and scenarios of the programme are given in the list file ISLM.LST

\*check this list file and analyse the result.

\*Are the results consistent with the macroeconomic thory as analysed using a standard ISLM

\*diagram for exapnsionary fiscal and monetary policies. If not you need to adjust the programme

\* and exectute again.

Do the same for the Solow.gms.

An example of the ISLM model in GAMS

\$Title A simple IS-LM open economy model of income and interest rate determination

\*@Keshab Bhattarai, University of Hull, UK.

parameter

c0	autonomous consumption
b	marginal propensity to consume
g	government expenditure
mu0	autonomous imports
mul	propensity to import
i0	autonomous investment
i1	slope of investment function
mp	real money balances
t1	tax rate
f	transaction demand for money
k	interest demand for money
eta	sensitivity of export to the exchange rate
meta	sensitivity of import to the exchange rate
ka	capital inflow
v	velocity of circulation

;

\*assign values to the parameters of the model

c0 = 200;  
b=0.75;  
g= 100;  
i0= 50;  
mu0 =20;  
mul =0.2;  
mp =100;

\*x=100;

f=0.2;  
k=-60;  
i1=-5;  
t1=0.3;  
eta=50;  
meta=-30;

\*er=2;

KA =-150;  
v=5;

variables

c consumption  
y income  
I investment  
M imports  
T taxes  
r interest rate  
tb trade balance  
bd budget deficit  
si saving investment gap  
x exports  
er exchange rate  
p price level

;

equations

ec Consumption function  
et tax function  
ei investment function  
em import function  
ey goods market equilibrium  
emm money market equilibrium  
etb trade balance condition  
ebd government dudget devicit  
esi private sector saving investment identity  
err exchange rate  
ex export equation  
eprice price equation

;

\* Structural model

\*consumption function

ec..

c =e= c0+b\*(y-t1\*Y);

\*tax function

et..

T =e= t1\*Y;

```

*investment function
ei..
    i =e= i0+i1*r;

*import function
em..
    M=e= mu0 + mul*Y+meta*er;
*export function
ex..
    X=e= eta*er;
*nationa income identity (IS curve)
ey..
    y=e= c+i+g+x-M;

*money market equilibrium (LM curve)
emm..
    mp =e= (f*y +k*r);

*trade balance
etb ..
    tb=e=X-m;
*government budget balance
ebd..
    bd =e= T-g;

*private sector saving
esi..
    si =e=y-c-t-i;

*BOP condition
err..
    tb+ka =e=0;
eprice..
    P*y=e=(mp*v);

*declaration of fix price model

model ISLM /ec,et, ei, em,ex,ey,emm,etb, ebd,esi,err/;

*GAMS solver MCP stands for mixed complementarity solver.

solve ISLM using mcp;

* Handling of solutions of the mdoel: results in readable format based on model
solution

parameter
result    basic solution
result1   expansionary fiscal policy
result2   expansionary monetary policy
result3   expansionary fiscal and monetary policies
result4   flexible price model
;

result("consum")=c.l;
result("income")=y.l;
result("intrest")=r.l;
result("imports")=m.l;
result("taxrev")=T.l;
result("invest")=T.l;

```

```

result("trade-gap")=tb.l;
result("budget-gap")=bd.l;
result("s-invgap")=si.l;
result("exrate")=er.l;

*counterfactual experiment 1
* impact of expansionary fiscal policy

G = 200;
t1=0.15;
solve ISLM using mcp;

result1("consum")=c.l;
result1("income")=y.l;
result1("intrest")=r.l;
result1("imports")=m.l;
result1("taxrev")=T.l;
result1("invest")=T.l;
result1("trade-gap")=tb.l;
result1("budget-gap")=bd.l;
result1("sav-invgap")=bd.l;
result1("exrate")=er.l;

*counter factual experiment 2
*expansionary monetary policy

G = 100;
t1=0.2;
mp =300;

solve ISLM using mcp;

result2("consum")=c.l;
result2("income")=y.l;
result2("intrest")=r.l;
result2("imports")=m.l;
result2("taxrev")=T.l;
result2("invest")=T.l;
result2("trade-gap")=tb.l;
result2("budget-gap")=bd.l;
result2("sav-invgap")=bd.l;
result2("exrate")=er.l;

*expansionary monetary and fiscal policies
G = 200;
t1=0.2;
mp =300;

solve ISLM using mcp;

result3("consum")=c.l;
result3("income")=y.l;
result3("intrest")=r.l;
result3("imports")=m.l;
result3("taxrev")=T.l;
result3("invest")=T.l;
result3("trade-gap")=tb.l;
result3("budget-gap")=bd.l;
result3("sav-invgap")=bd.l;
result3("exrate")=er.l;

```

```
display result, result1, result2, result3;
```

Economic modelling will use above three ways modelling economic theories and applying them for policy analysis. How much we get into it depends on your interest.