



# THE BUSINESS SCHOOL

**56184**

## Economic Forecasting (2005)

<b>Level:</b>	<b>7</b>
<b>Semester:</b>	<b>2</b>
<b>Credits:</b>	<b>20</b>

**Module Leader: Dr. Keshab R Bhattarai**

## Teaching Team

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## Economic Forecasting

Change of lectures or tutorial schedules.

# Economic Forecasting (56184)

## I. Rationale of the Module

Business economists have to make decisions in circumstances where the future values of many economic variables are unknown. These include income and consumption, saving and investment, government revenue and spending, imports and exports, sales revenue and profit, prices and supplies of goods and services and factors of production, interest rate and exchange rate, rates of growth of output, employment and the capital stocks, rates of inflation and unemployment, values of stock and bonds and financial and real assets. These uncertainties may partly arise due to changes in equilibrium in various markets due to changes in preferences of consumers, technology of producers and policies of the government or corporate sectors and strategies taken by them. Unpredictable natural factors such as climates, earthquakes or floods, outbreak of epidemics or the international factor such as wars, changes in the rules and regulations of trade and payment as well as in the mobility of factors of production may alter the probability distributions, the data generating processes, of these economic variables. Economic agents -households, firms, government and traders- nevertheless have to take decisions on the basis of forecasts or predication or simulations of those variables based upon available information though it is almost impossible to forecast values exactly beforehand.

The major objective of this module is to introduce students to well designed forecasting or modelling technique and procedures that can minimise the size of errors in predictions or simulations and reduce the risks involved in economic decisions due to such errors by narrowing down the gap between expected and actual values of these variables. Thus good forecasting techniques require clear understanding of the structure of the current market, proper assessments of various kinds of shocks in demand and supply, a careful analysis of quantitative information and good judgements about potential actions and reactions of economic agents. How to construct, estimate and calibrate models that can generate good predictions of unknown future values of those economic variables to compute the cost of risks and optimal insurance against them by obtaining a higher degree of accuracy of forecasts or model scenarios.

## II Aims and Distinctive Features:

The module aims to create confidence and competence among student in designing and implementing appropriate model for economic analysis by providing a firm background modelling and forecasting techniques used by economists. It has following more specific objectives:

1. To develop skills in analysing and presenting data sets required for economic decisions.
2. To develop analytical skills required for solving models that explain the structure of an economy.
3. To formulate and estimate economic models to explain behaviours of economic agents and the economy.
4. To use all available information to forecasts future values of variables and confidence on those forecasts for the future periods.
5. To teach how the adaptive and rational expectation techniques can be used in economic forecasting.
6. To provide students with analytical and quantitative tools required for dissertations.

### **III. Teaching and Learning Strategies**

This module will have four contact hours per week; three hours of lectures and one hour of tutorials. Lectures will demonstrate new materials theoretical derivations and analysis on economic modelling and forecasting. The tutorial sessions aim to provide practical and computer based skills to solve problems based on lecture materials.

#### **Contact Hours:**

**Monday 11:15-12:05** LO-SR209

**Tuesday 11:015-1:05** WI-S-24

**Wednesday 11:15-12:05** A3-PC3

### **IV. Arrangement of revision and private studies:**

The module expects 20 hours of work from each student per week in learning materials contained in the lectures and tutorial. About 10-15 minutes per lecture will be reserved to receive feedbacks or presentations from students and to review and clarify concepts and issues that they may have about the materials covered in the previous lectures. Students are encouraged to use reference materials, texts and articles reserved for them in the short loan section of the library. There will also be a session for overall review of the materials covered in the module.

### **V. Assessment and Reassessment Strategies:**

Academic achievement in the module will be **assessed** by three components:

- a piece of computer based modelling work (25%) due on **April 4**, 2005
- an essay (25%) due on **April 15**, and
- a two hours written final examination (50%)

The final exam will be between April 25 and May 20 (check the exam time table).

#### **Alternative Reassessment Strategy:**

Students will be reassessed only in the failed element of the module.

### **VI. Learning Outcomes:**

The major aim of the module is to provide sufficient confidence and ability among the students in using economic models for economic forecasting and analysis. More specifically students are expected to be able:

1. To develop skills in analysing and presenting data sets required for economic decisions.
2. to estimate, predict and forecast using simple and multiple regression models based on theory of probability, sampling and statistical analysis of time series and cross section data.
3. to demonstrate theoretical derivations and applications important in quantitative evaluation of economic policy such as simulation and forecasting based on economic models
4. to analyse economic impacts using input-output and applied general equilibrium models
5. to design, solve and use computer based models for analysing economic policy
6. to apply Excel, GiveWin-PcGive and GAMS for economic analysis.

These objectives are considered while designing lectures, assignments and tutorials.

### **VII. Module constraints:**

The module expects understanding of basic economics and simple numerical skills. Additions skill required will be discussed in the teaching sessions.

### VIII. Indicative Contents of Economic Forecasting Module

Lecture	Week	Lecture topics
1	Jan 10	Introduction to simulation vs. econometric models for forecasting
2		Basic skills required for economic models
3		Statistical analysis (mean, variance, Correlation, covariance of a RV)
4	Jan 17	Regression models for prediction and forecasting
5		Input output model
6		Introduction to applied general equilibrium analysis
7	Jan 24	Hypothesis test using normal, t,F, chi-square tests
8		BLUE properties and multi-nonlinearity in regression
9		Heteroscedasticity
10	Jan 31	Autocorrelation
11		Simultaneous equation model
12		Identification: rank and order conditions
	<b>Feb 7</b>	<b>Reading week</b>
13	Feb 14	Historical and ex-ante forecasts
14		Time Series (AR (1), MA(1), ARMA, ARIMA, Box-Jenkins)
15		Test for stationarity -unit root test and Intro to VAR Model
16	Feb 21	Introduction to general equilibrium model for tax policy
17		Computation procedure using general equilibrium-2
18		Use of econometric estimates in general equilibrium models
19	Feb 28	Cointegration and error correction (Engel-Granger and Johansen procedure)
20		Confidence Interval of forecasts
21		Impulse response analysis using a VAR model
22	March 7	Simulation versus impulse response analysis : comparison
23		Intro to GARCH(1,1) and EGARCH(1,1) models
24		Study of Volatility and Forecasting with EGARCH model
	March 14	<b>Easter Break March 14-April 3</b>
25	April 4	Application of Forecasting tools (Macro and Micro economic models)
26		Introduction to panel data models
27		fixed vs. time effects
28	April 11	Introduction to a dynamic general equilibrium model
29		Analysis of economic policy applied general equilibrium models
30		Limited Dependent Variable: Probit
31	April 18	Limited Dependent Variable: Logit
32		Limited Dependent Variable: Tobit

1. This is a tentative schedule. It might have to be changed according to circumstances in the class room. New materials will be covered without enough confidence in the current material.

### IX. Staffing

It is agreed that for year 2005, Bhattarai will delivers all above lectures and Swaray will do Tutorials in computer labs.

### Lab Sessions (RS) Wednesday 11:15-12:05 A3-PC3

Class #	Week	Class topics
1	Jan 17	Central tendency, Correlation and covariance
2	Jan 24	Regression analysis
3	Jan 31	Intro to Input-Output and General equilibrium analysis
4	Feb 7	Multicollinearity, Heteroscedasticity, Autocorrelation
5	Feb 14	Time series analysis and Co-integration
6	Feb 21	Forecasting and policy simulations
7	Feb 28	Impulse Response analysis
	<b>Mar 7</b>	Cross section analysis
8	April 4	<b>Review week</b>
9	April 11	Application of General equilibrium analysis
10	April 18	Panel data analysis

### X. Guidelines for Presentation of the Assignments:

The coursework for this module contains two computer-based economic modelling and forecasting assignments. The first is an econometric model which involves constructing simultaneous equation and vector autoregression model for macroeconomic forecasting for analysing impact of economic policy. The second assignment is on simulation using input-output and applied general equilibrium models for an economy. Benchmark data set will be provided for both assignments. Students should present their findings of these modelling projects in the class.

Each presentation should start by giving a brief outline of the model and illustrate how it can be used for policy analysis. A graphical or qualitative approach can be used both for micro or macro economic models, particularly to show economic policies affect demand and supply in goods, money, labour, financial, foreign exchange markets using either a demand and supply models of individual markets or is-lm and as-ad framework for the entire economy. Start with key indicators regarding competition and concentration in individual markets or the growth rate of GDP and its components, money supply, employment, inflation, interest rate and exchange rates, capital inflow and outflows over time and goals and objectives of fiscal, monetary, exchange rate and growth policies, and long term and short term targets and instruments in the economy.

For micro aspect consider the welfare, re-allocation and redistribution impacts of public policy using applied general equilibrium models. For macro base arguments favouring either a) active policy view, or, b) passive policy view, or c) intermediate view. These positions should be based on expected impacts of a particular policy on variables of the model such as a) output b) employment c) price levels d) capital accumulation e) foreign trade and f) savings g) financial markets. Then outline a prudent strategy with proper consideration of national and international macroeconomic situations and conclude presentation listing crucial factors that determine success or failures of the policy being proposed in the paper.

Students may work in groups while constructing the benchmark models. They should have their own version of models for scenarios to be reported in their essays. Provide a copy of the model programs, results and simulation files in diskette and a hardcopy of the report by **April 4, 2005** for the econometrics project and by April 12, 2005 for the general equilibrium project. Each of these projects **carries 25 percent** of the module marks and will be subject to a penalty for any late submission according to the rules of the exam board of the school.

Use Econlit and JSTOR databases in the library to literature relevant to above topics. The recent issues of journals such as American Economic Review, Journal of Economic Perspective, Journal of Economic Literature, Economic Journal, European Economic Review, Economics Letters, Applied Economics Letters, Journal of Development Studies, Macroeconomics Journal, National Institute's Bulletin of Economic Research, Oxford Economic Bulletin, Yorkshire Bulletin, Journal of Economic Development and Cultural Change, Journal of Finance are kept in the first floor in the library. Some other journals are available using Athens username and passwords. There is inter-library loan facility to borrow materials from other libraries in the UK and special EU section on materials relating to European economies.

## XI. Economic Forecasting using Econometric Methods

### Macroeconometric Modelling Project (25% of the module)

The main objective of this project is to construct a small macro-econometric model and implement it using time series data of the UK economy (or any other economy of your choice if you have data) with a focus on policies relating to public finance, monetary policy and international competitiveness and trade flows within Mundell-Fleming type open economy model. Policy scenarios should be analysed using ex-post forecasts from 1990 to 2001 and ex-ante forecasts for 2001-2020. Ex-ante forecasts generated by the model are more creditworthy when the model tracks the economy in well in ex-post forecasts.

1. Specify structural equations of a simple macro econometric model keeping in mind the data set that you can construct. Keep the model structure very simple, not more than six equations. Retrieving structural coefficients becomes more difficult as the order of the determinant of the coefficients becomes bigger. Keep some of the following relations in the model. (2 marks)
  - a. Consumption as a function of current and past values of incomes, lagged consumption, and prices.
  - b. Investment function that relates the level of investment to the interest rate, changes in the GDP (accelerator principle), depreciation rates, inflow and outflow of foreign capital.
  - c. Import function showing relation between the domestic output, nominal exchange rate, foreign prices and domestic prices.
  - d. Export as a function of foreign GDP, prices of exportable goods and the exchange rate.
  - e. Exchange rate that follows purchasing power parity condition between domestic and foreign price levels.
  - f. Tax function showing the amount of revenue collection as a function of past income, a given income tax rate and part level of government revenue.
  - g. Exogenous Government revenue.
  - h. Interest rate as a function of money demand and money supply and foreign prices.
  - i. Price level settings according to labour and non-labour costs.
  - j. Wage settings that is based on core inflation and productivity and cyclical component.
  - k. Unemployment and aggregate supply that relate with price levels.
  - l. Money demand as a function of income, interest rate, and exchange rates.
  - m. Exogenous money supply rule such as growth rate of money at the rate of 3 percent per year.

Identities:

  - n. GDP in terms of GDP components
  - o. Investment-savings gap plus the Budget gap = equals trade gap = capital inflow or outflows.
2. Write down the reduced form of the model that you have specified in question (1) above. Consider whether you will be able to retrieve the structural coefficients of the above model if you have estimates on the reduced form coefficients. Check the rank and order conditions of identification. (2 marks)
3. Using the data collected above estimate the parameters of the reduced form equations. You may consider using an appropriate method (ILS, 2SLS, 3SLS, SURE or GLS) to estimate the model equations. Use PcGive to generate estimates of parameters, and plot actual and simulated series. (2 marks)
4. Illustrate how you can retrieve structural coefficients using your estimates for the reduced form coefficients in one small model and write down key equations listed in question (1) above in terms of numerical values of the estimated parameters. Reduce the number of equations to be able to retrieve the structural parameters. (2 marks)
5. Do ex-post simulation for any six endogenous variables (output, consumption, investment, government revenue and imports, and the exchange rate). Plot the simulated values with the actual ones taken by these variables. Forecast exogenous or policy variables using AR or ARMA process for ex post simulation of the model. (2 marks)
6. Use those forecasts for ex-ante simulation of the model to study effects of policy on the growth path of the economy. You may have to turn to various economic theories in order explain model results in a more sensible manner.

**Fiscal Policy (2 marks)**

- (a) Fiscal policy: consider a growth in the revenue by a 5, 10, and 20 percent annually over 2000-2010 period. How does it affect growth path of forecasted series that you have generated.
- (b) Consider a cut in government expenditure by a 5, 10 and 20 percent annually over the period to generate simulated series. How do these reductions affect the economy?

**Monetary Policy (2 marks):**

- (a) In order to study the effects of inflation targeting policy of the Bank of England (or the central bank), provide a low, medium and high inflation scenarios of model simulation.
- (b) Check the effect of money supply rule according to the growth rate of GDP.

**Trade Policy Simulation (2 marks):**

- (a) The competitiveness an economy depends upon the real exchange rates between the sterling pounds and against foreign currencies. Provide scenarios for 10, 20 and 30 percent appreciation of pounds in the early three years of the ex-ante simulation period.
  - (b) Provide model scenarios if the pound depreciates by 10, 20 and 30 percent annually in the 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> years of the model simulation.
  - (c) Estimate a VAR model of income, consumption and investment and use it to study the importance of consumer confidence in the economy (impulse response to shocks in the consumption function).
7. Estimate a VAR model of income, consumption and investment and use it to study the importance of consumer confidence in the economy (impulse response to shocks in the consumption function).
  8. Write a report on macroeconometric modelling based on above calculations. (9 marks)

**References (read any five articles that appeal to you):**

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- Berndt Ernst R. (1996) The Practice of Econometrics: Classics and Contemporary, Chapter 10 pp. 507-592, Addison Wesley
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- Hendry D.F. (1997) The Econometrics of Macroeconomic Forecasting , *The Economic Journal*, Vol. 107, No. 444., pp. 1330-1357
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- Holly S and M Weale Eds.(2000) *Econometric Modelling: Techniques and Applications*, pp.69-93, the Cambridge University Press.
- Johansen Soren (1988) Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models, *Econometrica*, 59:6, 1551-1580.
- Johansen Soren (1988) Statistical Analysis of Cointegration Vectors, *Journal of Economic Dynamics and Control* 12 231-254, North Holland.
- Kontonikas, A. (2004) Inflation and Inflation Uncertainty in the United Kingdom, Evidence from GARCH Modelling, *Economic Modelling*, May 2004, v. 21, iss. 3, pp. 525-43
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- Leonard R.J. (1994) Reading Cournot, Reading Nash: The Creation and Stabilisation of the Nash Equilibrium *The Economic Journal*, Vol. 104, No. 424., pp. 492-511.
- MPC Bank of England ([www.bankofengland.co.uk](http://www.bankofengland.co.uk)) *The Transmission Mechanism of Monetary Policy*.
- Nelson C. R. and C. I. Plosser (1982) Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications, *Journal of Monetary Economics*.
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## XII. Essay Project for Economic Forecasting

### Project on the General Equilibrium Model for Tax and Trade Policy Analysis

This exercise counts for 25 percent of the course work and is due on April 15, 2005.

Consider the structure of consumption, production, trade, tax and spending as included in the 25 sector input output table for a developing economy using I\_O Table\_LDC.xls (use IO\_21.xls of UK if you wish).

- 1) Reduce this table to nine production sectors agriculture (1-6), manufacturing (7-13), Chemical (14), metals (15-20), gas, electricity and water(21), hotel (22) transport (23), banking and real estates (24) services (25) (number of sectors in the parenthesis). [For IO\_21.xls group sectors as Agriculture(1), manufacturing (2-6), utility(7-10), construction (11), Distribution (12) Transport and communication (13-14), Finance (15-16), Services (17) Public services (18-21)] (2 marks)
- 2) Calculate the Leontief coefficients for this economy. Interpret how these can be used for determining sectoral output and investment targets. (2 marks)
- 3) Evaluate the impacts of a 20 percent increase in the final demand of agriculture, manufacturing, chemical and services sectors in the gross output and employment of the rest of the sectors using the fixed coefficient technology contained in the input-output table. (2 marks)
- 4) Insure the micro-consistency of the data set in this table for the general equilibrium analysis. (2 marks)
  - a. Zero profit conditions among production sectors.
  - b. Income, consumption and saving of households.
  - c. Balance on revenue and spending of the government.
  - d. Balance between exports and imports .
- 5) Specify a static general equilibrium model with: (2 marks)
  - a. Cobb-Douglas (or CES) production function for each production sectors.
  - b. Cobb-Douglas (or, CES) preference for the households.
  - c. Armington specification for international trade.
  - d. Market clearing conditions in goods and factors markets.
- 6) Define a competitive equilibrium for the static economy. (1 mark)
- 7) Write a GAMS/MPSGE program to compute the general equilibrium in the static model. Replicate the benchmark economy as a solution of the model (calibration of the model from the benchmark dataset). (5 marks)
- 8) Use the model to evaluate the impacts of replacing taxes on consumption by taxes in labour income maintaining the equal yield constraint. (2 marks)
- 9) Write a policy evaluation report based on above calculations. (7marks)

#### Relevant literature on equilibrium analysis (read any five articles that appeal to you):

Auerbach, A.J. and L.J. Kotlikoff (1987) AK model: Its Past, Present and Future, NBER.

Bhattarai K and J Whalley (2003) Discreteness and the Welfare Cost of Labour Supply Tax Distortions *International Economic Review*

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Bhattarai K and J Whalley (1999) Role of Heterogeneity of Labour Demand in Tax Incidence Analysis, *Empirical Economics*

Devarajan, S and D.Go (1997) Simplest Dynamic General Equilibrium Model of an Open Economy, *Journal of Economic Policy Modelling*.

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- Shoven, J.B. and J. Whalley (1984) Applied General-Equilibrium Models of Taxation and International Trade: An Introduction and Survey, *Journal of Economic Literature* 22, 1007-1051.
- Bhattarai's working papers in <http://www.hull.ac.uk/php/ecskrb>.

#### **Steps for building a macroeconometric model for Forecasting:**

1. From review of theory determine endogenous and exogenous variables to be included in the model.
2. Determine functions to be included in the model and expected signs of coefficients in each equation.
3. Briefly check whether equations are under, over or exactly identified. Make sure that the model is not under-identified.
4. Prepare a macroeconometric time series in Excel file.
5. Load the dataset in GiveWin using File/open data file menu.
6. Study trends and variability of each of the variables plotting them against time.
7. Select the PcGive module among various modules available for computation.
8. Select Econometrics package/ multiple equation dynamic modelling system.
9. Choose regressors, identity, endogenous variables as necessary.
10. Select the sample period and the estimation method (FIML, 3SLS, 2SLS, 1SLS).
11. Estimate the model parameters.
12. Plot actual and predicted series and check the normality of residuals.
13. Forecast exogenous variable for the forecast horizon.
14. Forecast endogenous variables based on model calculations.
15. Study the reliability of forecast as given by confidence intervals of forecasts.
16. Revise the model until you get the best scenario.

#### **Steps for implementing an applied general equilibrium model using GAMS/MPSGE**

1. Formulate a precise research question.
2. Think about the basic analytical structure that can answer that question.
3. Prepare the input-output table to the dimension suitable for study.
4. Read the input-output transaction table, final demand, value added and the transfer parts.
5. Check consistency of benchmark data and tax rates. Normalise all prices to 1 in the benchmark.
6. Declare the model using the benchmark quantities, prices and tax rates.
7. Solve the model.
8. Insure that the benchmark economy is replicated as a model solution.
9. Do counterfactual analysis.
10. write a paper when you are happy with the results of the model

## XII. Recommended texts:

This is an introductory module in economic modelling and forecasting. Plenty of books are available in this subject but none of these books have all topics that will be taught in this module. Koop (2000) illustrates how economic data can be analysed using Excels, Harris and Solis (2003) gives some basic concepts using econometric forecasting, Shoven and Whalley (1992) has basic principles on general equilibrium analysis. Review articles in journals are sometimes provide excellent review of the subject such as Shoven and Whalley (1984) for general equilibrium analysis and Wallis (1989) for macroeconomic forecasting.

1. Harris R and R Solis (2003) Applied Time Series Modelling and Forecasting, John Wiley and Sons.
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3. Pyndick RS and DL Rubinfeld (1998) Econometric Models and Economic Forecasts, McGraw Hill.
4. Shoven JB and J Whalley (1992) Applying General Equilibrium, Cambridge University Press.
5. Stock JH and MW Watson (2003) Introduction to Econometrics, Addison Wesley.
6. Some relevant materials and readings are kept in <http://www.hull.ac.uk/php/ecskrb>.

Software: to be used in this module Excel, PcGive, Shazam and GAMS.

7. Doornik J A and D.F. Hendry ((2003) PC-Give Volume I-III, GiveWin Timberlake Consultants Limited, London.
8. Koopman SJ, AC Harvey, JA Doornik and N Shephard (1995) STAMP, TCL.
9. GAMS and GAMS/MPSGE User Manuals, GAMS Development Corporation, 1217 Potomac Street, Washington D.C.
10. Shazam (1997) User's Reference Manual, Version 8.0. <http://shazam.econ.ubc.ca/>

Other relevant software ( available but not supported at Hull University Network):

- MATLAB 6.5.1, the Mathworks Ink
- Greene W.H. (1998) LIMDEP Version 7: User Manual, Econometric Software Inc.
- Pesaran and Pesaran (1987) Microfit 4.0, Oxford University Press.

## Recommended texts (to be available from the Hull University Library)

11. Bhattarai KR (2004) Static and Dynamic Applied General Equilibrium Tax Models of the UK Economy, manuscript, University of Hull.
12. Enders W (1995) Applied Econometric Time Series, John Wiley.
13. Griffiths ,W.E., R.C. Hill and C. G. Judge (GHJ) Learning and Practicing Econometrics, John Wiley and Sons Inc. New York, 1993
14. Gujarati DN (2003) Basic Econometrics, McGraw Hill.
15. Harrison GW ed. (2000) Using dynamic general equilibrium models for policy analysis 2000, pp. xi, 411, Contributions to Economic Analysis, vol. 248 North-Holland.
16. Hamilton (1994) Time Series Analysis, Princeton.
17. Patterson K (2000) An Introduction to Applied Econometrics: A time series approach, McMillan
18. Wright G and P Goodwin (1998) Forecasting with Judgement, John Wiley.

## XIV. Resources

Get a good editor such as pfe32.exe or epsilon to write programs. OX-metrics, Givewin, PcGive, STAMP, GAMS, Shazam, Microfit and Limdep are available in the University Network. Student version of Consol OX is freely downloadable from [www.oxmetrics.net](http://www.oxmetrics.net). Similarly a student version of GAMS software is freely downloadable from GAMS site [www.gams.com](http://www.gams.com) or <ftp://allnew4u@ftp.gams.com>. Global data: [www.imf.org](http://www.imf.org), worldbank CD or [www.worldbank.org](http://www.worldbank.org) and <http://www.gtap.agecon.purdue.edu/>.

Following three manuals are available at the short loan section in the library

- GiveWin, PcGive, Ox ; Shazam User's Guide
- GAMS user guide and solver manuals the GAMS Corporation
- Economic equilibrium modelling with GAMS and Introduction of GAMS/MCP and GAMS/MPSGE

## Brief Instructions on softwares

1) **GAMS** is good particularly in solving a general equilibrium model with many linear or non-linear equations on continuous or discrete variables. It comes with a number of solvers that are useful for

numerical analysis. For economic modelling it can solve very large scale models using detailed structure of consumption, production and trade arrangements for single, multiple or global economy. The optimal choices of consumers and producers are constrained by resources and production technology or arrangements for trade. It is a user friendly software. Any GAMS programme involves declaration of set, parameters, variables, equations, initialisation of variables and setting their lower or upper bounds and solving the model using Newton or other methods for linear or non-linear optimisation and reporting the results in tables or graphs (e.g. ISLM.gms ). GAMS/MPSGE program is good for large scale standard general equilibrium models. GAMS programme is located at N:\special\ec\gams\gams in the university network can be used by going through following steps.

First, create a directory called models in G:drive G:\> md Models then G:\> cd Models. Then write or copy a GAMS program file in that directory such as G:\models\islm.gms .

Type following to execute the programme in the network N:\special\ec\gams\gams islm.gms. This invokes the program and results of the computations can be seen in the list file called ISLM.LST.

The check whether the results are consistent with the economic theory underlying the model such as ISLM-ASAD analysis for evaluating the impacts of expansionary fiscal and monetary policies. Use knowledge of growth theory to explain results of the Solow growth model from Solow.gms.

Consult GAMS and GAMS/MPSGE User Manuals, GAMS Development Corporation, 1217 Potomac Street, Washington D.C or [www.gams.com](http://www.gams.com).

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 by 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 estimation and analyse the results.

3) **Excel** Spreadsheets are very user friendly and could be used to calculate many of small and simple models required for economic modelling. First it is important to solve a model analytically by hand.

Then Excel formula/optimiser like goal seek or excel solver, e.g. Keynesian1.xls.

## WWW Sites

<http://rfe.wustl.edu/>; [www.oswego.edu/~kane/econometrics/resources.htm](http://www.oswego.edu/~kane/econometrics/resources.htm);

<http://www.bis.org/>; HM-Treasury UK <http://www.hm-treasury.gov.uk>;

Bank of England <http://www.bankofengland.co.uk>

NAVI-DATA from the <http://www.statistics.gov.uk>, [www.oecd.org](http://www.oecd.org),

European Central Bank <http://www.ecb.int/>; International monetary fund: <http://www.imf.org>

[http://www.mimas.ac.uk/macro\\_econ/](http://www.mimas.ac.uk/macro_econ/) ; <http://www.worldbank.org/research/growth/>

<http://www.imf.org/external/pubs/pubs/per.htm>; <http://www.nuff.ox.ac.uk/Economics/Growth> ;

<http://www.oecd.org/std/mei.htm>; <http://www.wiwi.hu-berlin.de/institute/wt2/>

A good web page for working papers is <http://netec.mcc.ac.uk/NetEc.html>

**Join the network :** [GAMS-L@listserv.gmd.de](mailto:GAMS-L@listserv.gmd.de) ; <http://shazam.econ.ubc.ca/>

Good information about conferences is available at <http://www.inomics.com/cgi/conference>.

Broad Outline of contents -1

I. Basics of Economic Forecasting	I. Problems in Regression Analysis
<p><b>Introduction to analysis of economic data</b>  <b>Simulation vs. econometric models for forecasting</b></p> <p>Time series: growth rates, trends and cycles and random            Cross section: cross tabulation, ANOVA analysis            Example of a simulation model: Impact of exogenous variables            Regression analysis            Example for a forecasting model: confidence Interval of a forecast            Introduction to Givwin-PcGIVE and Shazam</p> <p><b>Basic skills required for economic models</b></p> <p>Simultaneous equations            Four Rules of logs: illustrations from growth equations            Four rules of differentiation: power, product, quotient rules            Determinants and matrix inversion            Application: Input-output model</p> <p><b>Statistical analysis (mean, variance, Correlation, covariance of a RV)</b></p> <p>Frequency of distributions,            Mean median and mode            Variance and covariance            Correlation analysis            Application: Risk return analysis</p> <p>Lab 1 Introduction to Input-Output Table, time series and cross section analysis.</p>	<p><b>Heteroscedasticity</b>            Nature and causes            Consequences: unbiased but inefficient estimators            Tests: Goldfeld and Quadrt test, White test            Remedial measures, weighted least square technique            Application: labour supply and wage rate and earnings</p> <p>Lab 2: Normal, t, chi-square and F-tests            Confidence interval            Detection and remedial measures for heteroscedasticity</p> <p><b>Multicollinearity</b>            Causes, consequences and remedial measures</p> <p><b>Autocorrelation</b>            Nature and causes            Consequences: unbiased but inefficient estimators            Tests: Durbin Watson test            Remedial measures            Application: money demand function</p> <p><b>Simultaneous equation model</b>            Identification: rank and order conditions            Simultaneity bias            Identification using order and rank condition            Five equation simultaneous equation model            Prediction and forecasting using the simultaneous equation model</p>

Broad Outline of contents -2

III. Time Series models for Economic Forecasting	IV.
<p>Historical and ex-ante forecasts  Steps for forecast  Historical ex-post forecast  Ex-ante forecast and analysis  Confidence interval forecast</p> <p>Time Series (ARMA, ARIMA, Box-Jenkins)  Mean and variance of a distribution with  AR(1) process  MA(1) process  ARMA(p, q)  ARIMA(p,d,q)</p> <p>Lab 3: Autocorrelation  Simultaneous equation  ARMA, ARIMA models</p> <p>Test for stationarity -unit root test  Spurious regression  Unit root test  Examples from macroeconomic time series</p> <p>Cointegration and error correction (Engel-Granger and Johansen procedure)  Meaning  Test of cointegration in two variable model  Engel-Granger procedure  Johansen procedure</p>	<p>Forecasting and impulse response analysis using a VAR and EGARCH model  Specification of a VAR, GARCH and EGARCH models  Analytical solution of a VAR model  Forecasting using a VAR model  Impulse response analysis  Applications</p> <p>Lab 4: Unit root test  Cointegration analysis  Estimation of VAR, GARCH and EGARCH Models  Impulse response analysis  Volatility test</p> <p>Application of Forecasting tools (Macro and Micro economic models)</p> <p>A model for forecast of macroeconomic variables  A model for forecast of profits, revenue and cost of a firm  Application</p> <p>Introduction to panel data models  Specification  fixed effect model  random effects model  Application: Economic growth across countries</p> <p>Lab 5 : Macroeconometric model for forecasting  Forecasting model for a firm  Panel data model</p>

Broad Outline of contents -3

V. Introduction to Input Output Models and General Equilibrium Analysis	V. Dynamic General Equilibrium Analysis
<p>Introduction to general equilibrium model</p> <ul style="list-style-type: none"> <li>Preferences and demand</li> <li>Technology and production</li> <li>Markets</li> <li>Equilibrium prices and allocation of resources</li> <li>Sensitivity analysis</li> </ul> <p>Use of econometric estimates in general equilibrium Models</p> <ul style="list-style-type: none"> <li>Benchmark data set: input-output tables</li> <li>Social accounting matrix</li> <li>Share and shift parameters</li> <li>Elasticities on consumption and trade</li> <li>Calibration to the benchmark</li> </ul> <p>Lab 6: Input-output tables</p> <ul style="list-style-type: none"> <li>Writing models in Excels and in GAMS/MPSGE</li> <li>Exercises in GE models</li> </ul>	<p>Introduction to a dynamic general equilibrium model</p> <ul style="list-style-type: none"> <li>Investment and capital accumulation</li> <li>Benchmarking to dynamic reference path</li> </ul> <p>Studying impacts of change in capital or labour income tax in the economy</p> <p>Analysis of economic policy applied general equilibrium models</p> <ul style="list-style-type: none"> <li>Tax policy analysis</li> <li>Trade policy analysis</li> <li>Environmental policy analysis</li> </ul> <p>Lab 7: Analysis of forecast using a macroeconometric model</p> <ul style="list-style-type: none"> <li>Analysis forecast using a microeconomic model</li> </ul> <p>Limited Dependent Variable: Probit</p> <ul style="list-style-type: none"> <li>Nature of limited dependent variable models</li> <li>Interpretation of results</li> <li>Application</li> </ul> <p>Limited Dependent Variable: Logit and Tobit</p> <ul style="list-style-type: none"> <li>Censored and truncated distributions</li> <li>Estimates and applications.</li> </ul>

## **XV. “Business School Policies Regarding Academic Honesty and Safety**

### **Academic Dishonesty: Plagiarism**

All work submitted for assessment must be your own work and where necessary appropriately referenced. Academic dishonesty is a very serious offence and will be penalised accordingly. Being found guilty of academic dishonesty may have a serious effect on your academic progression, it may also result in a University Warning or it may result in your expulsion from the University.

If you are unsure about referencing or plagiarism please refer to the Business School Skills Handbook or seek advice from your module or programme leader or the University Study Advice Centre.

It is important that you have read and thoroughly understood the section on ‘Plagiarism’ in *The University of Hull Business School Programme Handbook* and that you have read and understood the ‘Code of Practice on the Use of Unfair Means’ which is published on the University of Hull website

### **Group Work**

Where a module is assessed by Group Work you must ensure that you accept collective responsibility and ownership for any work produced as part of that group.

### **Mitigating Circumstances**

If you have any mitigating circumstances (for example, illness, legal, social, economic or personal problems etc.) and you believe that these will, or have already, affected your academic performance then you are advised to complete a Mitigating Circumstances Form (available from the Undergraduate Office). It is very important to submit this form **before** the examination or assessment deadline and to provide as much documentary evidence as possible to support your case e.g. Medical note, Police Case note etc

Please note that IT problems on personal computers will not be accepted as a mitigating circumstance. All students are strongly urged to back up their work as they go along.

### **Attendance**

The University has an Attendance Policy, which requires all students to attend all timetabled sessions for their programme of study. An Attendance Register will be kept for tutorial sessions and students with unauthorised absence will be subject to School and University disciplinary procedures. You are reminded that unauthorised absence may affect your course progress and your LEA grant entitlement.

It is important that you have read and understood the section entitled ‘General Attendance’ in *The University of Hull Business School Programme Handbook*.

### **Module Evaluation**

The module will be evaluated by means of the Business School Module Evaluation Questionnaire (MEQ), which all students are required to complete at the end of the module. The results of this formal evaluation will be forwarded to Student-Staff Committees and to Undergraduate Committee and will be used to make alterations and improvements to the delivery and content of the module next year if these are deemed to be necessary. Additional module evaluation techniques may also be employed. Issues concerning the module can be forwarded to the School Student-Staff Committee. You may also have the opportunity to make informal comments and suggestions concerning the module in tutorial sessions.

Module evaluation is an integral part of the School’s Annual Reporting process, therefore, your input is highly valued and, as such, much appreciated.

### **Programme Changes**

Wherever possible, the programme timetables and content will be delivered as outlined in the Module Handbook. However, at times changes do have to be made but in the event of such changes occurring, every effort will be made to re-schedule the activity, or replace it with work of an equivalent nature. You are advised to consult regularly the Undergraduate ‘Blackboard’ website and to read the programme notice boards on the 3rd floor of the Wilberforce Building. It is your responsibility to keep abreast of the current information.

### **Health and Safety**

You are responsible for your own health and safety at all times. It is vitally important that you act sensibly and safely for both indoor and outdoor activities. You are required to follow all safety instructions and guidelines as laid down in your 'University of Hull Business School Programme Handbook'.

### **Student Support**

All modules are supported by tutorial assistance. A list of Module Staff and their office numbers, telephone extensions and email addresses is available on the inside front cover of this document. A specified time for Tutorials for this module can be seen in the Study Programme. Appointments may sometimes be made at other times but you are advised to contact your tutor to arrange an appointment. Arrange your tutorial by signing the Tutorial Sheet on your tutor's office door. This support is specifically for assistance with a named module upon which the tutor teaches.

Enquiries of a general educational nature, which may range over a number of modules, should be addressed to the Programme Leader of your registered degree.

If you are experiencing any other problems please see your Personal Supervisor who may direct you to a specialist university service.

### **Disability**

Students with a disability are reminded to make sure that they have registered with the University Disability Office. You should also contact the Business School Disability Officer (Graeme Reid) and inform your Module Leader especially if your disability impacts upon your ability to cope in lectures e.g. hearing/visual impairment

**The Module Staff hope that you enjoy studying this module and that it makes a valuable educational contribution to your chosen programme."**