



THE BUSINESS SCHOOL

Research Methods (26343) (Economics Subject Group) **(2004-05)**

Level: 5
Semester: 2
Credits: 20

Lecturer: Dr. Keshab R Bhattarai

Research Method (26343)
(B. Sc. or BA in Economics Programme, 2nd Year)

The major objective of Economics Subject group activities of the Research Method module is to acquaint students with quantitative and analytical tools required for research projects for independent study and the dissertation modules in economics in the third year and to teach skills that can help them to prepare research proposals and execute the research programs as a professional economist taking account of the most relevant economic theory and available dataset. Students in B.Sc. (Econ.) who have already done Empirical and Micro Economics in the first semester are expected to do extra amount of tutorials and assignments than students in BA (Econ.) programme.

Tentative Teaching Plan for Economics Subject Group

Lecture	Week	Lecture topics
1	Jan 24	Questions about markets: Models of demand and supply and strategic decisions
2	Jan 31	Summarising the data: mean and variance, covariance and correlation, Frequency distributions, Test of stationarity of time series.
3	Feb 14	Testing the properties of a random variable: Use of Normal, Standard Normal, t, F and chi-square distributions in decision making. Properties of an estimator: unbiasedness, consistency and asymptotic efficiency
4	Feb 21	Errors in statistical decisions: Type I and II errors, Interpreting regression results: slopes and elasticities Transformation of variables for analysis.
5	Feb 28	Heteroscedasticity and autocorrelation.
6	March 7	Questions about the Economy: Introduction to the Input-Output and general equilibrium models for an economy.

Class #	Week	Tentative Topics for Tutorials
1	Jan 24	Analysis of markets: demand and supply with perfect and imperfect competitions.
2	Jan 31	Analysis of cross section (mean, variance, correlation, tests of Normality).
3	Feb 14	Time series (unit root test for stationarity), forecasts and Gini Coefficient.
4	Feb 21	Estimation, hypothesis testing and confidence intervals.
5	Feb 28	Problems in regression estimation: heteroscedasticity and autocorrelation.
6	Mar 7	Input-output and general equilibrium model for multisectoral analysis.

Day, Time, Rooms and Groups will be announced in the lecture.

Economics subject group accounts for 40% of the RM module marks and will be assessed by one in class quiz (8%), one in class test on preparation and use of data (24%) and one short essay (8%) based on data analysis. The quantitative skills learnt here could be used in writing proposals that counts another 50% of the module marks. The in class quiz will be held in the **Week of February 1, 2005**. Assignment for class test on preparation and use of data and the short essay are given at the end of this handbook and both are due on April 12, 2005.

Textbook:

Research requires **thinking and solving problems** more than reading books. Text books, nevertheless, can expose one to popular tools used by professional researchers. **Koop (2000)** brilliantly shows how to use **Excel** for data analysis. Dougherty (2002), Hill-Griffith and Judge (2001) and Studenmund (2001) are good introductory texts in econometrics, any one of these is enough this module. **Excel**, **GiveWin**, **PcGive**, **STAMP** and **Shazam** are very useful software for handling data and economic analysis. They are available through the **Start and Applications/Economics menu** in the university network. The GAMS is useful for solving general equilibrium or linear and non-linear programming models. Texts in **micro** and **macro** economics are helpful in generating ideas about economic issues.

- Koop G. (2000) Analysis of Economic Data, Wiley, UK.
- Dougherty C. (2002) Introduction of Econometrics by, Second Edition, Oxford University Press.
- Hill, Griffiths and Judge (2001) Undergraduate Econometrics, Second Edition, John Willey and Sons, 2001.
- Studenmund A.H. (2001) Using Econometrics: Practical Guide, Pearson Education.

Softwares:

- Doornik J A and D.F. Hendry ((2003) PC-Give Volume I-III, GiveWin Timberlake Consultants Limited, London.
- Shazam (1997) User's Reference Manual, Version 8.0. <http://shazam.econ.ubc.ca/>
- GAMS Users Manual, GAMS Development Corporation, Washington DC. www.gams.com.

Problem 1

Models of demand and supply and strategic decisions

1. Market demand and supply for a normal good are $D = a - bP$ and $S = -c + dP$ respectively, where D and S are quantities demanded and supplied and a, b, c and d are parameters representing the behaviour of buyers and suppliers in the market.
 - a. What are theoretical assumptions about the sign of parameters a, b, c and d in this model? How would you obtain their numerical values? How demand and supply elasticities can be calculated with knowledge of b and d respectively?
 - b. The demand for and supply of surfing boards in a market were given by $D = 300 - 3P$ and $S = -5 + 5P$ respectively. Determine the price and quantity in equilibrium.
 - c. Show demand and supply schedules and equilibrium in a properly labelled and scaled diagram.
 - d. The government introduces a 20 percent sales tax rate on sale of surfing boards. Show equilibrium prices and quantities before and after this sales tax in another diagram.
 - e. Calculate the deadweight loss of taxes to consumers, to producers and to the entire economy using partial equilibrium analysis contained in this model.

2. There are two cinema halls in Hull. Objective of each is to maximise profit. The market demand curve for movies is given by $Q = 50 - 2P$, where Q is demand and P is the price. The price per ticket depends on total sales $P = 10 - (q_1 + q_2)$, where q_1 and q_2 are quantities sold by each hall. The cost function for hall i is $C_i = 2q_i$ for $i = 1, 2$.
 - a) How many tickets does each hall sell to maximise its profit taking sales of another hall as fixed and how much should has one to pay to go to a movie? (hint: Cournot model).
 - b) Calculate the consumers' surplus at that price.
 - c) How big is the producers' surplus?
 - d) What is the size of welfare to the entire economy at those prices and quantities?
 - e) Answer questions (a) to (d) when Hall 1 acts as a Stackleberg leader in the market.
 - f) Answer questions (a) to (d) when both of these halls collide to maximise joint profits.
 - g) Put results on sales, price, profit and welfare for all three markets in one table.
 - h) Make a pay-off matrix of profits in all three strategic markets for Cinema 1 and Cinema 2.
 - i) What price would have prevailed if this market was perfectly competitive? What would have been the value of welfare then?

3. Two firms are in the telecom market. Their pay-offs by advertising or not advertising are as listed in the following matrix.

		Firm 2	
		Adv	DnotAdv
Firm 1	<i>ADV</i>	(10,5)	(15,0)
	<i>DnotAdv</i>	(6,8)	(10,2)

Solve this game using a dominant strategy what are the pay-offs for firm 1 and firm 2?

4. (B.Sc.) Consider a zero sum game for a competitive market where one can benefit only at the expense of another.

		Player 1	
		S1	S2
Player 2	<i>S1</i>	(10,-10)	(-10,10)
	<i>S2</i>	(-10,10)	(10,-10)

The probability of player 2 playing S1 strategy is given by π . Represent expected pay-off of this game in a diagram. Find the optimal mix of strategies for this player, i.e. find the optimal value of π under the mixed strategy.

Problem 2
Cross Section Analysis

1. The marks scored by students in two exams and their monthly earnings from part time jobs are as reported in the following table.

Scores in Exams and Earnings

Observation	Exam 1	Exam 2	Earning	observation	Exam 1	Exam 2	Earning
1	0	5	248	25	5.2	45	196
2	6	55	161	26	4.8	55	208
3	5.6	60	213	27	7	63	245
4	5.6	54	222	28	7.5	62	155
5	4	56	180	29	5.2	65	168
6	6	65	184	30	5.2	66	211
7	6	58	249	31	6.4	60	208
8	5.2	61	191	32	4	58	238
9	3.2	30	213	33	6	68	172
10	6.5	61	186	34	5.2	64	172
11	7.5	65	232	35	6	57	219
12	4	30	235	36	7	60	202
13	5	58	231	37	5.6	63	178
14	7	68	242	38	5.6	61	175
15	6.5	68	209	39	7	62	163
16	4.5	60	230	40	6.5	65	193
17	8	71	238	41	6.5	53	200
18	6	62	150	42	7.5	62	206
19	6.5	55	237	43	5	58	241
20	6	50	227	44	6	63	227
21	5.2	51	184	45	6	58	245
22	5.2	55	229	46	5	57	161
23	4	64	205	47	3	38	213
24	4	51	221	48	4.8	60	227

- a. Represent the data on scores in exams and earning using marginal and cumulative frequency diagrams.
- b. What are means and variances of scores in exam 1 and exam 2?
- c. What are the coefficients of variation of scores in exams1 and exam 2?
- d. What is the covariance of marks in exams 1 and 2?
- e. What is the correlation coefficient of scores between exam 1 and 2?
- f. If exam 1 weighs 100 percent but the scores in exam 2 weigh only 10 percent what would be the weighted aggregate mean score in these two exams?
- g. What would be the variance of weighted scores?
- h. Exam 1 took place before exam 2. Test whether scores in exam 1 can predict scores in exam 2?
- i. Predict scores in exam 2 for students who scored 6 and 8 in exam 1.
- j. Test hypothesis whether scores in exam 1 and exam 2 are significant determinants of earning. Why may earnings be negatively related with their score in the exams for full times students?
- k. How can behaviours of teachers and students change the distribution of marks?
- l. If the true mean was 6 for score 1 and 58 for score 2 find whether the current sample reflects the population using t-test.
- m. Derive the standard normal distribution for score 2 and construct a 99 percent confidence interval for it.

2. (B.Sc.) Numbers of years of work among employees in a local labour market is assumed to be normally distributed. The mean years of work was found to be 25 with a standard deviation 2 in a survey of 200 individuals. Using this information construct 90, 95 and 99 percent confidence intervals for years of work among employees in this market (Hints, $Z = 1.645$, $Z = 1.960$, $Z = 2.576$ for 10, 5 and 1 percent level of significance respectively).

Problem 3
Time Series Analysis

1. Study monthly data on unemployment, retail price index and value of transactions in the stock market as contained in stocksandprice.xls file for the UK economy from 1973:4 to 2004:8. It is taken www.statistics.gov.uk using the Navidata. Answer following questions using PcGive.

- a. Represent unemployment, retail price and value of stock transactions using line graphs.
- b. Check whether these series are stationary using the unit root test. What will be the consequence of running a regression if variables are non-stationary?
- c. Use GiveWin calculator to compute the first difference of the unemployment rate, retail price index and value of stocks.
- d. Test for unit root in the first differences. Are they stationary?
- e. Determine whether volume of transaction in stocks can be explained by retail prices and unemployment rates. Do all this using first differences.
- f. Fit an autoregressive model to forecast volume of stocks in for next twenty months.
- g. Write 95 percent confidence intervals for these forecasts.

2. There is a concern about the disparity of income among rich and poor households in the UK. Study the distributions on income and consumption by deciles of households for 2003 as given below.

	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	Total
Gross income	2587	3803	6699	11796	18627	26837	36106	46189	60047	111296	323987
Consumption	10286	15935	18247	18395	18631	21032	25662	31639	39886	72299	272012

Source: Economic Trends, 2003.

- a. Use Excel to plot consumption and income in (i) a pie chart and (ii) a column or a bar chart.
- b. Compute means and variances of income and consumption.
- c. Calculate the individual and cumulative shares of income deciles of households.
- d. Represent this income distribution using a Lorenz curve.
- e. What is a Gini (G) coefficient? Which values of G represent perfect equality and which one represents perfect inequality?
- f. Calculate the Gini-coefficients for above distribution of income and consumption. (hint: area of a triangle = $0.5 \times \text{base} \times \text{height}$).
- g. Calculate the benefit and transfers implicit in the above table. Briefly explain how such redistribution of income occurs in the real world situation.

3. (B.Sc.) Study the income distribution pattern of the United States as given in the following table and answer b-d of parts of the above questions.

Average income	Population Quintile	Income share
10186	1st (lowest)	0.035
25321	2nd	0.087
42492	3rd	0.146
66939	4 th	0.23
145811	5 th (highest)	0.501

Source: DeNavas-Walt and Cleveland (2002) and Weal (2005) Economic Growth, p. 366.

How much difference do you observe in Gini coefficients between the US and the UK? Why?

Problem 4
Estimation, Hypothesis Testing and Confidence Intervals

1. Formulate a hypothesis regarding possible relation between consumption, income and the interest rate. Regression estimate of consumption on income generated slope coefficient 0.95 and its standard error was 0.33 in a survey of 40 students.

- i) Do you accept or reject your hypothesis with 1 percent level of significance?
- ii) Construct 90, 95 and 99 percent confidence intervals for this slope coefficient.
- iii) What are type I and type II errors in this example?

2. Suppose you have the following data set on number of tickets sold in a football match (Y), price of tickets (X_1) and income of the customers (X_2) as given in the following table. X_2 and Y are measured in 10 thousand pounds. You want to find out the exact relation between tickets sold and prices and income of people watching football games.

Observations	Y	X_1	X_2	YX_1	YX_2	X_1X_2	X_1^2	X_2^2	Y^2
n1	1	11	2	11	2	22	121	4	1
n2	2	7	2	14	4	14	49	4	4
n3	3	6	4	18	12	24	36	16	9
n4	4	5	5	20	20	25	25	25	16
n5	5	3	6	15	30	18	9	36	25
n6	6	2	5	12	30	10	4	25	36
n7	7	1	4	7	28	4	1	16	49
Total	28	35	28	97	126	117	245	126	140

- (a) Write a simple regression model to explain the number of tickets sold in terms of the price of the ticket. Explain briefly underlying assumptions and expected signs of the parameters in this model.
- (b) Estimate the slope and intercept parameters. Use cross products and squared terms provided for you in the above table.
- (c) Using your estimates in (b) find the explained squared sum $\sum_i \hat{Y}_i^2$, $\sum_i \hat{e}_i^2$ and the R^2 and \bar{R}^2 .
- (d) Estimate the variance of the error term and the slope coefficient. Explain its importance.
- (e) Test whether the slope term is significant at 5% confidence level.
- (f) Build 95 percent confidence interval for estimate of slope and intercept terms.
- (g) Discuss how reducing type I error may cause increase in type II errors.
- (h) Calculate the elasticity of demand for football around the mean of Y and X_1 .
- (i) Write a multiple regression model to explain the number of tickets sold in terms of the price of the ticket and the income of individuals going to the football game. What additional assumption(s) do you need while introducing an additional variable.
- (j) Estimate the parameters of that multiple regression model.
- (k) What is your prediction of the number of tickets sold if $X_1 = 5$ and $X_2 = 4$?
- (l) Introduce dummy variables in your multiple regression model to show differences in demand for football ticket based on gender differences (1 for male and 0 for females), four seasons (autumn, winter, spring and summer) and interaction between gender and income. (i-1 are for B.Sc.).

Problem 5
Heteroscedasticity and Autocorrelation

1. Take a simple linear regression model of the following form.

$$Y_i = \beta_1 + \beta_2 X_i + e_i \quad (4)$$

Where the variance of the error term differs for different observations of X_i .

- (a) Discuss how the graphical method be used to detect the heteroscedasticity?
 - (b) Analyse consequences of heteroscedasticity on the BLUE properties of the OLS estimators.
 - (c) Discuss how the Goldfeld and Quandt and Glesjer tests can be used to determine existence of the heteroscedasticity problem?
 - (d) Illustrate any two remedial measures of removing the heteroscedasticity when the variance $\sigma_i^2 = \sigma^2 X_i$ and σ is known and when it is unknown.
 - (e) From a sample of 6772 observations on pay work-hours and taxes contained in PAYHRTX.XLS determine whether heteroscedasticity exists or not on the basis of cross section estimates from the the PcGive. Feel free to use Shazam if you know and prefer it.
- (B.Sc.) Suggest remedial measures to remove heteroscedasticity in a model like above.

2. Consider a simple linear regression model.

$$Y_t = \beta_1 + \beta_2 X_t + e_t$$

Now assume that errors are correlated to each other over time with AR(1) process as:

$$e_t = \rho e_{t-1} + v_t$$

where v_t is identically and normally distributed error term with zero mean and constant variance,

$$v_t \sim N(0, \sigma^2).$$

- (a) Illustrate how the graphical method can be applied to detect autocorrelation in a simple regression model like above?
- (b) What are consequences of autocorrelation in a regression model? Show how the existence of such autocorrelation among the error terms affects the BLUE properties of the OLS estimators.
- (c) Define and derive the Durbin-Watson test statistics. Show how it can test for existence or non existence of autocorrelation in a given estimation?
- (d) How the autocorrelation can be removed if the ρ is known?
- (e) What is a spurious regression? Why does it arise and how does it affect the usefulness of estimation from an OLS regression? What can be done to correct it?

Application:

Read data on growth rate of per capita GDP, exchange rate and inflation rates from the www.imf.org for year 1980 to 2003 for China, India, South Africa, UK, USA and Brazil as contained in PERCAP6.GLS. Test whether inflation and the exchange rate are the significant variables in explaining the growth rate of per capita output (in PPP) in these economies. Determine whether heteroscedasticity and autocorrelation exist in this regression using PcGive. Feel free to use Shazam if you know and prefer it.

- (B.Sc.) suggest remedy for autocorrelation in a model like this.

Problem 6

Demand and Supply analysis Using Input Output Table for a Hypothetical Economy

1. Find the determinant and inverse of matrix $A = \begin{bmatrix} 5 & 4 \\ 7 & 8 \end{bmatrix}$.

2. An economy, with two sectors, X_1 and X_2 , has following input-output table.

	X_1	X_2	F	Total
X_1	10	20	70	100
X_2	30	20	150	200
Labour input	40	50		90
Capital input	20	110		130
Total	100	200	220	

Where X_1 is the gross production of sector 1 and X_2 is the gross production of sector 2, F is the final demand that includes consumption, investment, government spending and net exports.

- Write equations to represent demands by sector for two sectors of the economy.
- Check how demand and supply, income and expenditure accounts are balanced for this economy.
- Find technical coefficients, $a_{i,j} = X_{i,j} / X_j$ and share of primary inputs for both sectors.

Here $X_{i,j}$ represents intermediate demand for sector i good by sector j ; $X_{1,1} = 10$

$X_{1,2} = 20$ $X_{2,1} = 30$ and $X_{2,2} = 20$ represent intermediate inputs.

- Put the technological coefficients in a Leontief matrix $A = \begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{bmatrix}$.
- Propose an input-output model for this economy (using the matrix format).
- With an identity matrix $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $(I - A)$?
 - Express gross output in terms of final demand and inverse of $(I - A)$ matrix.
 - Find out the impact of a 30 percent increase in the final demand of sector 2 outputs of sector 1 and sector 2.

Problem 7 (B.Sc. Econ)
Additional Problems in General Equilibrium Model and Matrix Algebra

General Equilibrium in Markets

1. An economy produces two goods; apples and oranges and has two households, $h = \{A, B\}$. Household A owns the apple farm and produces 100 quintals of apples and household B owns the orange farm and produces 200 quintals of oranges. Both households like to consume apples and oranges. Their consumption preferences are given by Cobb-Douglas Utility functions, $U^h = X_{1,h}^{\alpha_h} X_{2,h}^{(1-\alpha_h)}$ where U^h is the utility to household h , $X_{1,h}$ and $X_{2,h}$ are consumptions of apples and oranges and α_h represents the weight of each good in the utility functions, $0 < \alpha_h < 1$. Household A spends 40 percent of income in apple and 60 percent in oranges and household B spends 60 percent in apples and 40 percent in oranges. Market structure is competitive.

- a. Represent the supply of goods using an appropriate Edgeworth box diagram.
- b. Find the relative price in this economy that is consistent with maximization of utility (satisfaction) by both households. Choose price of commodity 1 as a numeraire.
- c. Determine the income for each household.
- d. What are demands for apples and oranges by households A and B ?
- e. Check whether the market clearing conditions for equilibrium are fulfilled. Find their levels of utility at equilibrium
- f. Represent both consumption and supply and relative price of goods in equilibrium using an appropriate Edgeworth box diagram.
- g. How would you estimate α_h in a real world situation?

2. Matrix for Econometrics

Find the determinant of the following matrix.

a) $A = \begin{bmatrix} 50 & 40 \\ 70 & 80 \end{bmatrix}$ b) $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ c) $B = \begin{bmatrix} -7 & 0 & 3 \\ 9 & 1 & 4 \\ 0 & 6 & 5 \end{bmatrix}$

1. Find the inverse of the following matrix

$$A = \begin{bmatrix} 4 & 1 & -1 \\ 0 & 3 & 2 \\ 3 & 0 & 7 \end{bmatrix}$$

2. Prove that following matrix is a positive definite matrix

$$A = \begin{bmatrix} 3 & 1 & -3 \\ -4 & 2 & 2 \\ 6 & -4 & 7 \end{bmatrix}$$

3. Solve following equations system using Cramer's rule

$$x_1 + 2x_2 + 2x_3 = 1 \quad (1)$$

$$2x_1 + 2x_2 + 3x_3 = 3 \quad (2)$$

$$x_1 - x_2 + 3x_3 = 5 \quad (3)$$

Research Method Short Essay Project

Quantitative Analysis using a model and your own data (8 percent)

Do all questions of the Essay Project and the Class Test if you are in the B.Sc. (Econ.) program. You are required to do question 1 of the Essay Project and questions 1, 3, 5 and 6 of the Class Test if you are in BA (econ.) degree.

1. An economic advisor in the Ministry of Economic Affairs is asked to evaluate impacts of expansionary fiscal and monetary policies that the government is proposing in the parliament considering a Keynesian macroeconomic model of the economy as following. (6 percent).

Consumption: $C = 200 + 0.8(Y - T)$

Investment: $I = 20 - 5R$

Tax and Spending: $T = 80 \quad G = 80$

National income identity: $Y = C + I + G$

Money demand: $\frac{M}{P} = 0.5Y - 20R$

Money supply: $M = 500$

where C is consumption, Y the income, T the tax revenue, G the government spending, R the interest rate, M the money supply and P the price level. For a baseline model the price level is assumed to equal to one, i.e. $P = 1$.

- What is the supply function implicit in this model and why is it a demand determined model?
- Determine the interest rate and the level of income that are consistent to the equilibrium in both goods and the money markets in this model. What are the levels of consumption and investment in equilibrium? How much will income change if the government spending rises by one unit?
- The government aims to stimulate the economy by increasing spending from 80 to 100 but leaving the amount of tax revenue at the same level as above. Determine the new level of output and the interest rate that would prevail after that increase in the public spending. Compare results here to those in (b) using an IS-LM diagram.
- In addition to the expansionary fiscal policy introduced above suppose that the central bank raises money supply from 500 to 600. What would be the level of output and the interest rate after this expansion in money supply? Compare these results to those in (b) and (c) above using another IS-LM diagram.
- Solve the model as in (b) again if the price level rises from 1 to 2 due to an external shock such as increase in oil or energy price. Compare results another ISLM and an aggregate demand diagrams.
- Estimate parameters using PcGive and time series data on C, I, R, T, Y, M and P for the UK economy. Use graphics to represent predicted and actual values of these variables.
(use Navidata software to get monthly, quarterly and annual data series for the UK economy <http://www.statistics.gov.uk/statbase/tsdlistfiles.asp>)

2. (B.Sc.) Output of a tire factory is given by a Cobb-Douglas technology $y = k^{\frac{1}{3}}l^{\frac{2}{3}}$, where k and l give the capital and labour inputs to production (y). Wage rate in the market is 10 and rental rate of capital is 4 and this tire company would not spend more than 1200 in capital and labour inputs. What values of k and l would maximise output subject to the resource constraint of this tire firm? What is that level of production? How much will be the profit if this firm can sell each tire at 30? Can such production function be used to represent the supply side in the model contained in (1)? (2 percent)

Research Method Class Test Term Project
Building your own data set and doing a quantitative research (24 percent)

This exercise has three parts- preparation of data set using the World Bank CD and the database of Food and Agricultural Organisation; statistical analysis using frequency distributions and descriptive statistics to represent the data set; and testing of economic hypotheses regarding the signs and expected values of unknown parameters. You should submit print-out and diskettes with data to the undergraduate school office by on **April 12, 2005**.

1. Use World Development Indicators 2002 in Applications/Economics in the Hull University network (4 percent)
 - I. Prepare cross section data set in Excel on macroeconomic variables of any 40 economies (you can do for more countries if you wish) around the globe for year 1999.
 - a. GDP (constant 1995 \$)
 - b. Consumption (Household Final Consumption Expenditure 1995 \$)
 - c. Gross capital formation (constant 1995 \$)
 - d. General government final consumption (constant 1995 \$)
 - e. Export of goods and services (constant 1995 \$)
 - f. Imports of goods and services (constant 1995 \$)
 - g. Government revenue
 - h. GDP deflator
 - i. Annual growth rate of GDP
 - j. population
 - k. Gross national saving (constant 1995 \$)
 - l. Official exchange rate (local currency per US \$ period average)
 - m. Real interest rate (%)
 - II. Represent data on GDP, consumption, annual growth rate and population in frequency distributions of ten intervals.
 - III. Determine the mean and variance of GDP, Consumption, imports, exports and population, interest rate and growth rates.
 - IV. Calculate correlations between the GDP, consumption, investment government spending.
2. (B.Sc.) Prepare time series data on above variables for any two economies (e.g. the UK and the US) from 1960 to 2000. (4 marks)
 - a. Use line graphs to compare per capita consumption and per capita income, investment and saving, government revenue and spending, imports and exports for both countries.
 - b. Express ratios of consumption, investment, government spending and net exports by the line graphs.
 - c. Calculate growth rates of consumption, population and per capita consumption.
 - d. Test whether the growth rate of population significantly determines the growth rate of output.
3. Estimate consumption, investment, tax and import functions using (4 percent)
 - a. using the cross section data.
 - b. time series data.

You must provide functional form of these equations and comment on reliability parameters.
4. (B.Sc.) Construct a time-series data (years may vary) on production, yield, area and price for any one agricultural commodity such as apple, banana, wheat, rice and sugar for any two country of your choice using data in the following web page of the **Food and Agriculture Organisation** <http://faostat.fao.org/faostat/collections?version=ext&hasbulk=0>; daily price and stocks of metals from the web page of the London Metal Exchange (LME) or monthly or annual price of prices and supplies of electricity, oil and gas from www.iea.org. (4 percent)
 - a. Summarise data using frequency distributions and other appropriate charts.
 - b. Investigate whether the production depends on producer price and the area of production.

5. Study 3 sector input-output table of the UK Economy as contained in IO_3UK.xls. Use Excel to do following calculations. (4 percent)
- Calculate the Leontief technology coefficient matrix $a_{i,j}$ and matrix $(I - A)$
 - Find the Lontief inverse $(I - A)^{-1}$ using Excel's 1-2-3 matrix inversion routine in (in Excel use help/Lotus 1-2-3 help/ data/matrix).
 - What is the impact in the gross output of all other sectors of the economy of
 - A simultaneous increase of 15 and 30 percent the final demand in distribution and financial services sector.
 - A 20 percent increase in the exports of financial services.
 - A 30 percent increase in the final demand in the tele-communication sector.
 - A 10 percent increase in the consumption of distribution sector.
6. Report on your important finding and experiences in constructing and using your own data for economic analysis. (4 percent)

End

References:

Hammond Christopher J (2004/05) Research Methods: Module Handhook, Hull University Business School.