



# THE BUSINESS SCHOOL

**10240**

## **Macroeconomic Analysis (2003)**

**Level: 2**

**Semester: 1**

**Credits: 15**

**Module Leader: Dr. Keshab Bhattarai**



THE  
UNIVERSITY  
OF HULL

*THE UNIVERSITY OF HULL*  
*Cottingham Road*  
*Hull, HU6 7RX*

<b>Module Staff</b>	<b>Office No. and Location</b>	<b>Tel. Ext.</b>	<b>e.mail</b>
Dr. Keshab Bhattarai	369 Wilberforce Building	6483	K.R.Bhattarai@hull.ac.uk

## Macroeconomic Analysis

**Additional Notes**

## **Introduction**

Macroeconomic Analysis aims to show how the economic activities of millions of households and firms and economic policies of the government can influence the aggregate output, employment and price level and the rate of economic growth in an economy. It consists of models and empirical facts that help explain how a higher rate of economic growth can be achieved over a period and how the internal and external stability can be maintained in the short run. It will be based on ideas of many influential Classical, Keynesian, Monetarist, New Classical or New Keynesian economists that have shaped the structure of macroeconomics over the years.

Despite wide disagreement about the role of economic policy in the short run almost all macroeconomists agree on what determines the economic growth rate in the long run. All of the above schools have emphasised on the role of capita accumulation in economic growth. Human capital, better skills in production and research, technology and innovation have received more attention in the economic growth literature in recent years. Advancement in the computational technology and the flow of information through the internet has made it possible to spread knowledge quite quickly and effectively in recent years. Economists are able to build a large scale economic models that can analyse the more detailed interaction between demand and supply through the price system based on economic decisions of households, firms and the government and the Rest of the World. These models can contain a more realistic structure on consumption, production and trade in the small open economy or the interdependent economies in the global economy.

The major difference among macroeconomists is due to variation in their assumptions about the flexibility of the price system. Classical economists such as Adam Smith (1776), Ricardo (1817), J. B. Say (1817), Malthus (1790) Mill (1844), Marshall (1922) and Pigou (1925) believed that markets were perfect and stable. They thought that the demand equals supply in every individual market as well as at the national level. This implied that the aggregate demand can never be different than the aggregate supply. There is no gap between the savings and investment. Economy always remains in the full employment in such competitive market because of perfect flexibility in prices and wages and full information among buyers and sellers both in the products and factor markets. Foreign trade and payment were arranged under the self-correcting mechanism of the gold standard system. Quantity theory of money postulated a direct and proportional link between money supply and price level leaving no role for a monetary policy in determining real output, employment and income. Money was neutral. Persistent unemployment and inflation were impossible in the classical analysis. They favoured free, open and liberal market policy and in which the main objective of the government was to keep law and order leaving the rest of the things to the invisible hand of the price system that allocates resources efficiently and effectively. Increasing level of investment activities, made possible by higher rate of saving, contributed towards capital accumulation and to the higher growth rate as seen throughout the 19<sup>th</sup> century in the majority of western countries.

The great depression of 1930s, with high level of unemployment rate and deflation, exposed serious limitations inherent in the classical system. John Maynard Keynes published the “General Theory of Employment, Interest and Money” in 1936 and argued that self-correcting mechanism propounded by the classical economist had serious flaws. He argued that the aggregate demand is not always equal to aggregate

supply, high rate of unemployment may persist for a long time if government does not step in for stabilising the economy. As the market fails to guarantee the full employment it is possible for the economy to remain under full employment if not corrected by an active policy intervention. He strongly argued that it is important and often necessary to fine-tune the economy using the monetary and the fiscal policy whenever output and employment remain out of their potential levels. Hicksian (1936) IS-LM model that formalised the Keynesian idea remained the most popular tool for macroeconomic analysis from 1940s to early 1970s. It was believed to be one of the major factors for correct policy actions taken by governments that led to an unprecedented growth and stability in all western countries. Initially the Keynesian model mainly focused only on the real side of the economy as it assumed price to remain constant in the short run. This could have been true when economy was under full employment but not when it was in the full employment. Phillips curve (1956) provided the missing link between the real and nominal sectors of the economy. It shows a trade off between unemployment and inflation as shown that policy makers can choose according to the circumstances of an economy. It stated that the higher level of output and employment were achievable by expansionary monetary policy. Keynesian economists emphasised on the effectiveness of fiscal policy in achieving higher level of output and employment in the economy. Macro models were built to quantify the impacts of various policies in target variables such as output, employment and prices.

The predictions of Keynesian model and belief on demand management policy gradually met with many more sceptics in 1970s. On theoretical side Friedman (1968) and Phelps (1968) were claiming that the trade-off between the unemployment and inflation is very short lived and the Phillips curve is vertical in the long run. They argued that economy tend to return to the natural rate of unemployment no matter how much demand is created by means of an expansionary monetary policy. More ambitious expansionary monetary policy only result in higher rate of inflation.

After hikes in oil prices in early 1970s one after another economies entered in stagflationary period. Both unemployment and inflation were high and no trade-off appeared between inflation and unemployment during this period. The forecasts of the Keynesian models became questionable. Its unrealistic assumptions on the supply side of the economy was seriously attacked by Lucas, Sargent, Prescott who believed prices and wages to be perfectly flexible as claimed by the classical economists. They started the rational expectation or the new classical school to the macroeconomics and were very critical about the economic policy prescription derived from the Keynesian analysis. Based on micro-foundation, they brought together both the supply and the demand side of the macro economy under the market clearing general equilibrium hypothesis. They like the classical economists argued for minimal role of the government earning the name the New Classical school. They used the representative household and firms, emphasised on the dynamics and business cycle in an economy in response to technology and productivity shocks.

Though the New Classical school was very elegant in analytical school not all macroeconomists were happy with their conclusions. The adherents of the Keynesian school, Mankiw, Ball and Taylor and others, thought them to be dangerous as they argued for no role of government even in a serious recession. New Keynesian economists cleverly defended Keynesian active policy hypothesis using more advanced tools developed by the New Classical economists. They argue that the prices and wages are sticky because of the staggering wage contracts and union bargaining, menu cost, real rigidity, market imperfections and information

asymmetry. They proved propositions showing that the demand management policy were still relevant for stabilising the economy by containing the undesirable effects of its business cycles. The big controversy still remains and is far from settled. The second part of this module will focus on these issues of economic fluctuations.

### **Module Outline**

The major objective of this module is to deepen the understanding of basic tools used for macroeconomic analysis based upon the foundation laid in the Macroeconomic Models. It will focus on analysis of economic growth, causes of unemployment and inflation, role of fiscal and monetary policy in containing unemployment and inflation, role of expectation on economic decisions, role of macroeconomic policies in consumption, production and trade in the short-run and the long-run. It will analyse macroeconomic fundamental conditions required for good policies and distortions that may cause economic crises. It is expected that upon completion of this module students will have a solid understanding of tools to analyse macroeconomic issues.

Lectures in this module will illustrate theories and empirical facts underpinning monetary, fiscal and trade and exchange rate policies aimed to control the negative impacts of economic fluctuations in the short run and achieve a higher rate of economic growth in the long run. Tutorials will enforce learning of those concepts among students. By developing understanding of the basic analytical tools this module will lay a firm foundation for option modules in macroeconomics to be taught in the third year.

### **Aims**

This module aims to consolidate understanding of standard techniques used to analyse economic growth in the long run and fluctuations of output employment and price level in the short run. It will analyse the role of fiscal and monetary policy by influencing the consumption and investment decisions of households and firms in an economy in containing these fluctuations. It will assess the views of Classical, Keynesian, monetarist, new classical and new Keynesian economists for analysing the impacts of policies designed to contain the demand and supply shocks in the economy in the short run and to promote the economic growth in the long run. Teaching activities in this module will demonstrate

- (a) how to choose an appropriate theory to analyse a macroeconomic question such as economic growth and fluctuations.
- (b) how to formulate a macroeconomic question with due appreciation of different points of views on the functioning of the economy particularly regarding the importance of the behaviour of the households, firms and the government and the external sector in determining the macroeconomic equilibrium.
- (c) how to select key macroeconomic variables and formulate a model for analysing cause and effect.
- (d) how to be able to diagnose a problem and analyse it critically.
- (e) how to follow key articles in applied journals and be able to read more advanced text-books in the macroeconomics.

## **Learning Outcomes**

After the successful completion of this module students should be able to

- (a) assess the determinants of economic growth rate across countries.
- (b) appreciate the major differences among macroeconomists on effectiveness of demand management and supply oriented policies in an economy.
- (c) explain wage and price setting process, unemployment and the financial markets and trade balance.
- (d) use the structural model to do comparative static analysis using the tax, government expenditure and money supply multipliers.
- (e) be able to find out the price system that is consistent with balances between the demand and supply in goods, labour, capital markets and where the both government and balance of payment condition are satisfied.
- (f) choose appropriate model to analyse the impacts of fiscal, monetary, exchange rate and trade policies in the economy.
- (g) be familiar with the more decentralised structure of the economy.

## **Skills**

Module requires understanding of the theory, analytical approach using some basic mathematics, using the relevant macroeconomic facts for analysis. Students will use constrained optimisation or solve the simultaneous equation system for macro policy in practical situation. They will use the first order difference equations to explain capital accumulation or the business cycle in an economy.

## **Significance of the Module**

This module fits well with other modules in the economics B.A./B.Sc.(Econ) degree programme. It builds on the knowledge that students have from their Macroeconomic Models in the previous semester. It will focus on new analytical techniques for economic growth, unemployment, inflation and trade gap analysis. This module aims to provide a solid foundation for understanding the macroeconomic events and discussions.

## **Structure of Teaching & Learning Activities**

The module will be delivered by two 50 minutes lecture sessions each week ( 22 lectures in total) and by 10 problem based tutorial sessions. Topics for lectures and tutorials are included at the end. Students will be invited to solve more problems either through a mock test or from the end of chapter problems in the book. Attendance on both lectures and classes is compulsory barring exceptional circumstances.

## **Assessment**

The module will be assessed by following **three** components

- One examination (80%). The examination will be an unseen paper and will be of 2 hours duration, in which 40 minutes will be for the multiple choice questions and remaining 80 minutes for two essays out of at least six possible choices. An example of a past examination for this module is included at the end of this Handbook.
- One one-hour mid-term exam (10%). It will be based on the material covered until the mid-term exam. It will consist of 30 minute of multiple choice and one essay out of at least five possible choices.
- One written essay in about 2000 words (10%). It will consist of growth and fluctuation parts. Topics for each part are listed below. Select one topic that appeals more to you for each section. This should be word-processed and submitted by the due date.

**Instruction for the essay:** For each part of the essay motivate the problem stating why the issue is important for public or the policy makers. Then provide a few empirical facts. Choose a relevant macroeconomic model to explain causes and effects behind the analysis. Use graphs, equations or both as necessary. End your essay with a conclusion based on your analysis. Length of each part should not be less than 800 words and not more than 1200 words. Both parts of the essay need to be typed in double space. Each part of the essay is worth 5 percent of the aggregate marks for the module. Please pay some attention to the depth of analysis, organisation, use empirical facts and style of presentation. Site your references appropriately. You should read pages 8-12, 15-18 and 38-42 regarding criteria for the assessment, policy on the use of unfair means and style and structure of writing an essay. You may use materials contained in lecture notes or tutorials but should provide proper references to other sources that have been used while developing ideas for the essay.

### **Essay Part A: Analysis of Economic growth**

1. Why there is a disparity of economic growth rates among various regions in a very advanced economy such as the United Kingdom? Assess this issue with a particular focus to the economic growth rates in the Yorkshire and Humberside region relative to the national growth rates since 1982 using information on regional growth data set in the Blackboard which was received from the UKDA data base in the [www.archive.ac.uk](http://www.archive.ac.uk). Analyse how far the fiscal, monetary and exchange rate policies have been helpful in enhancing a uniform growth rate across regions or reducing the gap in economic growth rates across various regions in the UK.
2. Compare the economic growth rate in the UK relative to that of her major trading partners such as Germany, France and USA and Japan. Examine how far the economic growth in the UK has been driven by the advancement in the production technology and how far by an improvement in the operation of fiscal and monetary policy policies adopted by various governments. You may use macroeconomic information from the growth on exchange rate, interest rate, trade

flows and growth rate data set from “Targets 2 point5: Bank of England/Times interest challenge” to provide empirical support for your arguments.

3. A strong consumer confidence makes economy grow. Evaluate this statement with a focus on recent economic events that includes a dent in the investor confidence due to Enron/Andersen and the Worldcom type big corporate scandals in the world economy. Observe that despite a 25 percent decrease in FTSE, 17 percent decline in Dow Jones Stock Index and an increase of 25 percent in house prices in 2002, major economies around the world still continued to grow though mildly following recession in 2001. Notice how the central banks and governments steered these economies during such turbulent time.
4. Will the disparity of income between the richest and the poorest countries decrease, remain the same or increase in the next 100 years? Analyse this issue using knowledge of growth theory and the experiences of various economies around the globe.

### **Essay Part B: Stabilisation policy**

1. Should increased pay come from modernisation or by a rise in the wage rates? Discuss this issue using the macroeconomic theory.
2. Macroeconomic mismanagement is the source of financial and exchange rate or BOP crisis. Examine this issue with some reference to the current and past case studies.
3. Is having the independent central bank like the Bank of England better than the joining the European union? Can fiscal policy, such as an increase in public borrowing to stimulate the economy as announced by the Chancellor of Exchequer this year, still remain independent even after getting into the EMU? How far the Euro system can be stable if many countries face a rising deficit problem as that by Germany at the moment.
4. What sort of policies are necessary to mitigate the adverse consequences of a supply shock that may hit an economy due to a rise in the oil prices either due to a war with Iraq or due to a cut down in oil supply by other major oil producers?
5. An essay to the Bank of England’s under the “Targets 2 point5: Bank of England/Times interest challenge” competition. Rules and information about this competition is available at <http://www.bankofengland.co.uk/target2point5/index.htm>.

#### Assessment Criteria for Coursework:

Bear in mind that essays differ in style, motivation, originality, organisation, depth of analysis, clarity of presentation and facts and figures used to support the arguments. Essays that provide a good motivation, use one or two models (graphical and algebraic version as necessary) thoroughly to analyse the issue, present few empirical facts and relate them to the theory, provide a good conclusion and are original in their presentation may get first class marks. An essay based on secondary rather than original thinking gets second class marks. Sloppy, incoherent and inconsistent presentation may lead to a low pass or a failing grade. Full citation and

references should be provided whenever any idea is borrowed from the literature. Copying without citation will be considered academic dishonesty and leads a failing grade (see below).

Submission of the coursework:

A Business School Cover Sheet must be attached to all Coursework and must be completed legibly and in full. Coursework must be submitted by the date and time in the undergraduate school office.

Submission date(s) for Coursework: 4:00 PM on the April 4, 2003.

### **Academic Dishonesty and Plagiarism**

All work which is submitted for assessment must be your own work. Academic dishonesty is an attempt to engage in deception or fraud and will be penalised accordingly. It is a **very serious** offence.

\* It is important that you have read and thoroughly understood the section entitled 'Plagiarism' in the *'University of Hull Business School Student 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

### Lecture Topics, Schedule and Readings

Lecture #	Week	Day	Lectures: Wed. 11:15 (WI-S28) and Fri. 9:15 (WI-S28) Topics	Miles & Scott	Blanchard	Mankiw
1	1	Feb-05	Major Approaches to Macroeconomics	1-4	1, 28	1-3
2	1	Feb-07	Long run: Growth facts and Solow Growth Model	5	10	7
3	2	Feb-12	Steady State in the Solow Growth Model	5	11	7
4	2	Feb-14	The Golden Rule of Saving Complementarity between Human and Physical Capital	6	12	8
5	3	Feb-19	Endogenous growth: Lucas Model	7	13	8
6	3	Feb-21	Endogenous growth: Romer Model	7	13	8
7	4	Feb-26	Conditional Convergence or Divergence in the Global Economy: Economic Growth Policy	7	13	8
8	4	Feb-28	Phillips curve and the natural rate of unemployment hypothesis	8	14	9-11, 6
9	5	Mar-05	An Example of a stabilisation programme	16	7-9	14
10	5	Mar-07	Financial Markets: Value of Stocks, Bonds and Consol	21-24	15	17
11	6	Mar-12	Consumption	13	16	16
<b>12</b>	<b>6</b>	<b>Mar-14</b>	<b>Mid-Term Exam</b>			
13	7	Ma-19	Investment	14	16	17
14	7	Mar-21	Fiscal Policy: tax and spending multipliers and automatic stabilisers	11	26	15
15	8	Mar-26	Fiscal Policy: Ricardian Equivalence	11,16	26	15
16	8	Mar-28	Monetary Policy: transmission mechanism	12	27	18
17	9	Apr-2	Monetary rules: Interest rate determination	17	27	18
18	9	Apr-4	Exchange Rate Policy: PPP-UIP-CIP	9, 18	18	12
<b>ESSAY DUE BY 4 PM OF APRIL 4, 2003</b>						
19	10	Apr-30	Competitiveness	9, 19	19-20	12
20	10	May-02	Theories of Unemployment	8, 14	22	13
21	11	May-07	Theories of Inflation		23	13
22	11	May-09	BOP crises and Economic policy	20	20	4
23	12	May-14	Micro founded macro equilibrium: graphical illustrations	Notes	6	19
24	12	May-16	Micro founded macro equilibrium: role of price system	Notes	7	19

### Tutorial Schedule

Class no.	Day	Week of	Time and rooms: <i>Topics</i>	Analytical Questions from <b>M &amp; S</b>
1		Feb 18	Growth facts and time taken for convergence	4.1-4.6
2		Feb 25	Solow model: steady state and golden rules	5.1-5.5
3		March 4	Human capital, technology and economic growth	7.1-7.6
4		March 11	Consumption and investment	13.1-13.5; 14.1-14.6
5		April 8	Unemployment and inflation	8.1-8.6
6		April 15	Financial Markets	21.1-21.6, 22.1-22.6; 23.1-23.6;
7		April 22	Fiscal policy	11.1-11.5
8		April 30	Monetary policy	12.1-12.5; 17.1-17.5
9		May 6	Exchange rate and trade policy	18.1 19.1-19.5; 20.1
10		May 13	Micro foundation and Economic crises	Notes

## Study Programme

I will follow the lecture and tutorial schedule listed above as far as possible. The first part contains economic growth and the second part deals with economic fluctuations. There may be short mock exam to understand how the material is received by the students. My lecture notes will contain some technical materials but student should read the text to cover the material.

### Readings:

1. Lecture notes
1. Blanchard, Oliver (B) Macroeconomics, Third Edition, Prentice Hall, Chs. 3-24. 2003. ISBN 0-13-033772-2; <http://www.prenhall.com/blanchard>
2. Mankiw, G. N.(2003) Macroeconomics, Fifth Edition, Worth Publishers, New York.
3. David Miles and Andrew Scott(MS) Macroeconomics: Understanding the Wealth of Nations, John Wiley and Sons, Inc, 2002. ISBN 0-47084288-1; <http://www.wiley.com/college/miles>.

### **Other references that you might find useful**

- Jones C (2002) Introduction of Economic Growth, 2<sup>nd</sup> edition, Norton.
- Burda and Wyplosz (2002) Macroeconomics: A European Text, 3rd edition Oxford Univ. Press.
- HM Treasury (2002) Reforming Britain's Economic and Financial Policies, Palgrave.
- Gathner Manfred (2003) Macroeconomics, Prentice Hall.

### Tutorial 1: Growth Facts

1. What are stylised growth facts according to Kaldor (1960) regarding per capita output  $\left(\frac{Y}{L}\right)$ , per capita capital  $\left(\frac{K}{L}\right)$ , output capital ratio  $\left(\frac{Y}{K}\right)$ , share of capital in income ( $\alpha$ ), share of labour in income ( $\beta$ ), interest rate and the wage rate. Prove that the Cobb-Douglas production function of the form:  $Y = K^\alpha L^\beta$  has a constant return to scale when  $\alpha + \beta = 1$  and the elasticity of substitution between capital and labour equals one. Use this model to analyse how a firm changes its capital labour ratio when a central bank changes the rate of interest in a representative economy using a diagram.
2. Ten new countries from the Eastern Europe are joining the European Union (EU) from the next year. The average per capita income in these new member countries is roughly one third of that in the existing 15 members of the EU. The average annual growth rate of per capita income in those ten Eastern European countries is around 5 percent in contrast to an average growth rate of 2 percent among the existing 15 members which permitted ten new members in their club in their December 2002 Summit. As a result of increased integration with the prosperous nations the new members expect to raise their own level of per capita income after joining the EU.
  - (a) If those growth rates of per capita income continue in coming years how many years will it take for the new members to catch up with other EU members in per capita income?
  - (b) Entry into the European union will reduce the technological gap because of improved flexibility in the mobility of labour and capital. If we assume that such improved technological transfers raises the growth rates in the new member states on average by 2 percent, how long will then take them to catch up with the rest of the EU?
3. Consider the GDP per head in PPP, the growth rate of real GDP and population for a number of countries as given in the following table.

Real GDP per head and growth rates of GDP and population in a number of countries

	China	India	UK	USA	Japan
GDP per head in PPP in 2000	3920	2340	23550	34100	27080
Population growth rate (1990-2000)	0.9	1.69	0.27	1.05	0.26
GDP Growth Rate (1990-2000)	9.6	5.5	2.1	3.1	1.8
Growth rate of real GDP per head	8.7	3.81	1.83	2.05	1.54

Source: World in Figures 2002, Economist.

- (a) If the growth rates listed in the above tables continue, how long will it take for
  - i. China to catch up with the UK and the USA in per capita income?
  - ii. What would be the income difference between the UK and the USA when China catches up to the UK?
  - iii. What would be the income difference between the India and China when China catches up to the US?
  - iv. Why is growth rates in the UK and USA are now not as high as in China? Can China continue to grow like this or are there some limitations to it?
4. How fast the poorest country that has about 5 percent of the per capita income of the richest country should grow to catch up in per capita income with the richest country in 50 years?

Tutorial 2  
Steady State and the Golden Rules

1 Consider a version of Solow Model

Production function with capital and labour as its inputs:  $Y_t = A_t K_t^\alpha L_t^\beta$

Market clearing:  $Y_t = C_t + I_t$

Saving:  $S_t = sY_t$

Investment requirement:  $I_t = (n + \delta)K_t$

Saving investment identity:  $S_t = I_t$

Capital accumulation:  $K_t = (1 - \delta)K_{t-1} + I_t$

where  $Y$  = output  $A$  = technology,  $L$  = Labour input,  $K$  = Capital input ;  $\alpha$  share of capital in output ;  $\beta$  share of labour in output,  $s$  is the saving rate,  $I$  is the investment requirement,  $n$  is the population growth rate,  $(\delta)$  is the depreciation rate. Assume that  $\alpha + \beta = 1$ . Drop the time subscripts for simplicity.

- (a) Write the production function in intensive form. For simplicity assume  $A=1$  for this sub-question. Represent the above model using appropriate diagrams.
- (b) Find the steady state value of per capita capital and per capita output in terms of the saving rate ( $s$ ), the depreciation rate ( $\delta$ ) and population growth rate ( $n$ ).
- (c) What will be the value of per capita capital and per-capita output if the savings rate was 32%, the depreciation rate was 8%, the population was growing at 2% per annum and  $\alpha = 0.3$  ?
- (d) If the technology grows by 2 percent per year what will be the growth rate of per capita output in the steady state?
- (e) Now assume that the computer hackers, terrorists or any other natural disaster destroys computing system and other infrastructure. The effective capital stock is virtually reduced to half of its previous stock. How does this affect the steady state obtained in (c) above?
- (f) Global warming causes floods that contaminates all food stocks and brings wide spread diseases. Many people die. As a result the labour force reduces by one quarter. How does this affect the income and capital stock in the steady state? Assume  $\beta$  to be 0.7 as above.
- (g) Show how the growth rate in output can be decomposed into the growth rate of technology, and the growth rates of labour and capital inputs. Also show how the growth rate of per capita income only depends on technical progress but not in the saving rate on the balanced growth path for this economy. What prevents a higher saving rate from leading to a higher growth rate in the model?
- (h) What is the golden rule of savings and consumption in the Solow model? How does it differ from the steady state?

2. Show possibility of an unbounded growth with higher rate of savings when an economy has “AK” production technology:  $Y = AK$ . How may such technology develop?

### Tutorial 3

#### Human Capital, Endogenous Growth Model and Technology

1. Modify the production function used in the previous tutorial by including human capital as following:  $Y = AK^\alpha L^\beta H^\gamma$  where  $Y$  = output,  $A$  = technology,  $L$  = Labour input,  $K$  = physical capital,  $H$  = human capital and  $0 < \alpha < 1$ ,  $0 < \beta < 1$  and  $0 < \gamma < 1$ ; assume that  $\alpha + \beta + \gamma = 1$ . Show how the growth rate of output can be decomposed into the growth rate of technology and the growth rates of labour, capital and human capital inputs in this case. Also show that a higher saving rate can generate a higher growth rate of output in the balanced growth path if one considers the complementarity between human and physical capital as in the human capital augmented Solow model. Which of these elements are more important for the higher growth rate of your country.
  
2. One stylised fact according to Robert Lucas is that both skilled and unskilled labour tends migrate from a low-income countries to high-income countries. Suppose country-1 represents high-income economies and country-2 represents low income economies. Country-1 has more capital stock than that in country-2. Again take a generic production function  $Y_i = A_i K_i^\alpha L_i^\beta$ . What would happen to stock of capital, labour, interest rate, real wage rate and output across these two countries if (a) capital is mobile but labour is not (b) labour is mobile but capital is not in each of the following three parametric specifications. Demonstrate results using diagrams and equations.
  - I.  $\alpha + \beta = 1$  and  $0 < \alpha < 1$  and  $0 < \beta < 1$
  - II.  $\alpha > 1$  and  $0 < \beta < 1$
  - III.  $0 < \alpha < 1$  and  $\beta > 1$
  
4. Paul Romer suggests a three sector (final goods sector, intermediate goods sector and the research sector) endogenous growth model to explain economic variation in growth rates across economies. Total labour resource of the economy can be either used in the research sector (think of researcher, scientists and engineers working in research labs or workshop) or in the final goods sector. Researchers find out new formula, better design or process of doing things and state provides patent rights to them for inventions. These researcher do not apply knowledge directly in producing goods themselves but sell their patent rights to intermediate sector which embodies new technical knowledge new vantage of capital goods. Thus intermediate sector translates new ideas to newer and better tools. They operate in imperfectly competitive markets because of increasing returns to knowledge. Final goods sector buys new capital equipment from these intermediate firms and uses them in producing final goods to consumers in perfectly competitive markets as there are no barriers to entry and exit in it (Jones (2002) has more on this type of model).
  - a. How are wage rates and prices of intermediate capital goods determined in the final goods sector?
  - b. Prove that price of intermediate goods  $p = \frac{1}{\alpha} r$  and  $\pi = \alpha(1 - \alpha) \frac{Y}{A}$ .
  - c. Given the production function for knowledge:  $\dot{A} = \delta L_A^\lambda A^\phi$ , prove that economy grows faster higher is the fraction of population working in the research sector.
  - d. Demonstrate graphically that there will be “too little research” and lower growth rate if the state does not secure patents through copy right laws.

Tutorial 4  
Consumption and Investment

1. Discuss the absolute income, permanent income and life-cycle income hypothesis of consumption using simple diagrams. Compare the average propensity to consume and consumption smoothing concepts using these models.
2. Suppose that you are 21 years old now and take up a job with a starting salary of £20,000 next year after graduation. Earning grows by 5 percent every year until you retire at 65. You expect to live till 90 years. For simplicity assume that the nominal interest rate equals the inflation rate and the real interest rate is zero.
  - (a) What is your annual income when you retire? What is your life time income?
  - (b) You want to smooth out consumption over time, by borrowing when your income is less than the consumption and by saving when your income is more than the consumption. What will be your consumption spending in each year?
  - (c) When will your annual income exactly match your consumption expenditure. Construct saving and borrowing profile based on this information.
  - (d) Now consider that the retirement age rises to 75. How will it affect your life time income and consumption per year?
  - (e) Using an excel spreadsheet calculate income, saving or borrowing and outstanding amount of debts for each year of your life.
3. A car manufacturer sells each car at 8000 and pays 2000 for capital equipment per car. The nominal interest rate is 6%, appreciation of value of capital stock (capital gain) is 3% and the depreciation of capital stock is 3% per year. The production function for this company is given by  $Y = K^\alpha$  with  $\alpha = 0.75$ . What is the optimal capital stock for this manufacturer? (hint  $P.F'(K_1) = P_1^k(r + \delta)$ ). Show how the investment tax credit affect the optimal capital stock employed by a firm using an appropriate diagram.
4. A commercial bank encourages borrowing by people who have skills but do not have finance to start the business. It charges less interest rate for larger amount of loans. For financial stability it requires its customers to repay their loans in regular monthly instalments. The instalment is equal for each month and should cover both the principal and the interest. Using a spreadsheet calculate the amount of instalment that the borrower need to pay per month to the bank for given interest rate and the amount of the loan.

APR	Loan amount	12 months	24 months	60 months
8.9%	20000			
9.9%	14000			
10.5%	10000			
11.9%	5000			
15.9%	2000			

5. Consider a two period economy in which preferences of households, endowments and government policy is given by the following set of equations.

Preference:  $U(C_1, C_2) = \ln C_1 + \beta \ln C_2$

Endowments:  $\{w_1, w_2\}$

Government policy:  $\{G_1, G_2, \tau_1, \tau_2, B\}$

where  $C_1$  and  $C_2$  are consumption in period 1 and period 2;  $G_1$  and  $G_2$  are government expenditure in period 1 and period 2;  $w_1$  and  $w_2$  are endowments in period 1 and period 2;  $\tau_1$  and  $\tau_2$  are tax rates in period 1 and period 2 and  $B$  is the borrowing by government in period 1.

- Provide a graphical explanation of inter-temporal optimisation process for a representative household in this economy. Indicate choices between current and future consumption for this representative consumer who faces inter-temporal budget constraint using correctly labelled diagrams.
- What is the role of parameter  $\beta$  in the utility function and how would the point of inter-temporal choice that you showed in (a) change if rate of interest rises?
- Construct inter-temporal budget constraints for a representative household and the government in real terms for this economy. Explain in simple word what do two sides of this budget constraint represent for the household and for the government?
- Given government policy  $\{G_1, G_2, \tau_1, \tau_2, B\}$  and endowments  $\{w_1, w_2\}$  and preference  $U(C_1, C_2) = \ln C_1 + \beta \ln C_2$ , what are the conditions for optimal choices for the representative household? Solve for optimal choices available to this representative consumer in period 1 and period 2 in terms of endowment, interest rate and model parameters.
- Find the equilibrium rate of interest and consumption choices  $C_1$  and  $C_2$  using the market clearing condition if  $\{w_1, w_2\} = \{100, 150\}$  and  $\{\tau_1, \tau_2\} = \{0.2, 0.2\}$  and  $\{G_1, G_2\} = \{20, 30\}$ ,  $\beta$  is 0.95 and there is no borrowing by the government,  $B = 0$ .
- Using the same equilibrium interest rate find the value of equilibrium choices if  $\{w_1, w_2\} = \{100, 150\}$  and  $\{\tau_1, \tau_2\} = \{0, \tau_2\}$  and the government finances all its expenditure  $\{G_1, G_2\} = \{20, 30\}$  by borrowing in period 1 to be paid by taxes,  $\tau_2$ , in period 2. What is value of government revenue in terms of tomorrow's income and what is the tax rate  $\tau_2$ ?
- Prove that consumption choices of households are not affected whether the government pursues a (i) tax only policy as in (e) or (ii) borrowing only policy as in (f) above. What is the popular name given to this result in macroeconomics?
- How would your result in (d) change if the representative household faced a borrowing constraint such that she will not be able to borrow more than 10 in period 1?

## Tutorial 5

### Unemployment and Inflation

1. Use the Phillips curve and the aggregate supply and aggregate demand diagrams to illustrate
  - a. natural rate of output, unemployment and core inflation for an economy.
  - b. impact of adverse demand shock in output employment and prices.
  - c. impact of a positive supply shocks in output prices and employment.
2. Fire fighters were on strike demanding for higher wage rate and government argued for modernisation and reluctant to accept their demands. Discuss how four theories of unemployment can be used to analyse this issue more critically.
  - a. efficiency wage theory.
  - b. insider-outsider and wage bargaining theory.
  - c. monopoly firms and monopoly union (double mark up) theory.
  - d. Frictional unemployment.
3. An economy is experiencing a relatively high inflation, which is reported to be 11 percent per year. It is creating uncertainty and is signalling towards a serious macroeconomic instability if it remains unchecked. Government is keen to bring a programme to assure macroeconomic stability by reducing inflation at 2% annual rate until it comes down to 3% annual rate. Once inflation reaches 3% annual rate the government would like to stabilise it at 3% rate for all following years. The current unemployment rate is at 6 percent per year. Econometric estimates suggest that this is also the natural rate of unemployment,  $u_n$  for this economy. Productivity is growing by 2% annually and labour force is growing at 1% per year. The basic economic relations between unemployment rate, inflation and growth rates of output and money supply that describe this economy are given by the following set of equations.

$$\begin{array}{ll}
 u_t - u_{t-1} = -0.4(g_{yt} - \bar{g}_{yt}) & \text{Okun's law} \\
 \pi_t - \pi_{t-1} = -(u_t - u_n) & \text{Phillips curve} \\
 g_{yt} = g_{mt} - \pi_t & \text{aggregate demand}
 \end{array}$$

where  $g_{yt}$  is an actual growth rate of output,  $\bar{g}_{yt}$  is a trend growth rate of output,  $u_t$  is unemployment rate in period  $t$ ,  $\pi_t$  is inflation in period  $t$ ,  $g_{mt}$  is growth rate of money supply in period  $t$ .

- a. Provide a brief graphical illustration on how inflation, unemployment rate and growth rates of output and money supply are related to each other in this economy in the short run and in the medium run.
- b. From the information given above find the inflation rate before one year,  $\pi_{t-1}$ . Also find the growth rates of output and money supply given this inflation for the current year (the benchmark year of the inflation reduction programme). How far was the inflation last year away from the target inflation of 3%?
- c. Calculate  $u_t$ ,  $g_{yt}$ ,  $\pi_t$  and  $g_{mt}$  for all following years until the economy reaches 3% inflation rate if government is strict in its policy of reducing inflation by 2% annually. What are the values of  $u_t$ ,  $g_{yt}$ ,  $\pi_t$  and  $g_{mt}$  when the economy becomes stabilised after a successful implementation of the inflation reduction programme. What is the growth rate of money supply consistent with the target inflation and the trend growth rate of output in the long run?
- d. What is the meaning of sacrifice ratio in macroeconomics? What is its value for different years of the inflation reduction programme in (c)?
- e. Justify the required path of money growth in the inflation reduction programme that you have outlined in (c).

Tutorial 6  
Financial markets and Investment

1. An energetic young man likes to start a fishing firm. His reservation wage is 25000. Fishing boat costs 20000 and lasts for 24 months. He expects to catch 400 kilos of fish per month and sell them at 5.40 per kilo in the market. He has no personal saving to purchase the boat but can borrow from a commercial bank at 8.9 APR if he promises to repay the loan per month in equal instalments. There are four types of risks in this business (a) the bank may change the interest rate according to the interest decisions of the central bank (b) market prices of fish may fluctuate (c) catch per month may vary according to fishing conditions (d) taxes in income may change.
  - a. What is the total profit from this project? What is his gross income per month? How much is the instalment of payment per month for the bank?
  - b. The Finance Act requires him to pay tax from 2003 according to the following schedule:

Starting rate	10%	for 0 to 1920
Basic rate	22%	for 1921 to 29,900
Higher rate	40%	for over 29,900

What is his disposable income ?

- c. What would be his profit if the commercial bank raises the interest rate to 11 percent? Should he take this project if the interest rate rises to 15 percent?
  - d. Market price of fish drops to 4.50. What would be the profit and income per month? What if prices rise to 6?
  - e. If catch per month decreases to 300 but the market prices goes up to 6.50, can he still make any profit by starting this project?
2. Study the stock market profile of any three of the following firms.

Average change in share prices (in pence)

Name of Firms	Dec 16, 02	Jan16,03
Kingston Communication	58	78
Barclays	167	165
ICM	185	189
GEEST	446	385
Tesco	197	192
British Airways	148	138
Manchester United	100	106
Marks & Spencer Group	325	305

You may study the prices of shares, volume of trade in more details in

<http://www.londonstockexchange.com/INVREL/DEFAULT.ASP>

- (i) Why do share prices fluctuate so much? Use an economic model to analyse the ups and downs in the stock prices that you observe.
  - (j) Analyse how a small volatility of the stock prices may result in a large volatility of aggregate investment in the economy.
  - (k) Analyse how a change in the interest rate affects the prices of these shares in the London Stock Exchange.
3. Construct yield to maturity line for January 2000, January 2000 and December 2002 using yields on bonds in ukblc002.xls file. Why was the long run interest rate lower than the short run interest rate in 2000 and quite opposite in 2002? You may get more information in <http://www.bankofengland.co.uk/Links/setframe.html> or in the <http://www.londonstockexchange.com/trading/bonds.asp> .

Tutorial 7  
Fiscal Policy

1. Illustrate impacts of additional borrowing by the government on output and interest using an IS-LM model. Show the amount of crowding out of private investment if the government finances deficit by borrowing from the private sector. Show consequences on output and interest rate if the increased spending is financed by borrowing from the central bank. Derive conditions for sustainable debt.

2. You are posted as an economic advisor in the Ministry of Economic Affairs. You are asked to evaluate impacts of expansionary fiscal and monetary policies that the government is proposing in the parliament. From the training of macroeconomics you are considering a Keynesian macroeconomic model as following.

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 is income, T is tax revenue, G is government spending, R is the interest rate, M is the money supply and P is the price level. For a baseline model you assume price level to be a constant, equal to one, i.e.  $P = 1$ .

- a) Show how could you determine the interest rate and the level of income that are consistent with the equilibrium in both goods and the money markets in the above model. What are the levels of consumption and investment in equilibrium? How much will income change if the government spending rises by one unit?
- b) Now you want to analyse the impact of the proposed fiscal policy. The government likes to stimulate the economy by raising spending from 80 to 100 but leaving the amount of tax revenue at the same level as above. Show how would you determine the new level of output and the interest rate that would prevail after the increase in the public spending. Compare your results here with those in (a) using a IS-LM diagram.
- c) In addition to the expansionary fiscal policy introduced in (b) above suppose that you want to analyse the impacts of a rise in the money supply from 500 to 600. What would be the level of output and the interest rate in the new equilibrium that emerges after the implementation such an expansionary monetary policy? Compare this result with those that you had in (a) and (b) above using a IS-LM diagram.
- d) Now you relax the assumption of a constant price level. You want to consider a scenario in which the price level rises from 1 to 2 for external economic reasons. How would such an increase in the price level change the equilibrium interest rate and income than that you had obtained in (a) above? Show your result in a nicely labelled aggregate demand diagram.

Tutorial 8  
Monetary Policy

1. Explain the transmission mechanism of the monetary policy according to the Bank of England. How does monetary policy choices of a central bank affect the real sector of the economy. Make a special reference to the impact of an increase or decrease in the interest rate on the resource allocation decisions by consumers, producers and traders of goods and services and the financial assets in an economy. Relate the relevant macroeconomic theory with a policy experiment in a particular country of your choice. You may like to participate in the interest setting exercise competition of the Bank of England. Following web page provides more information about this contest. <http://www.bankofengland.co.uk/target2point5/index.htm> .

2. Suppose that the policy makers in an economy have tied the interest rate to output gap and inflationary gap as following.

Taylor rule for interest rate:  $i_t = i_t^* + a(y_t - y_t^*) + b(\pi_t - \pi_t^*)$

Phillips' curve:  $\pi_t = \pi_t^* + c(y_{t-1} - y_{t-1}^*)$

Impact of interest rate on output:  $y_t = d(i_{t-1} - i_t^*)$

Where  $i_t$  is the actual rate of interest in period t,  $i_t^*$  is the interest target of the monetary authority,  $y_t$  and  $y_t^*$  are actual and natural level of output and  $\pi_t$  and  $\pi_t^*$  are actual and target inflation rates.

Trace out the output gap ( $y_t - y_t^*$ ), inflation rate ( $\pi_t$ ) and interest ( $i_t$ ) for six years if

(a)  $a=0.75$ ,  $b=1$ ,  $c=0.5$  and  $d=-0.5$  and  $i_t^*=5\%$ .

(b)  $a=0.25$ ,  $b=2$ ,  $c=0.5$  and  $d=-0.5$  and  $i_t^*=5\%$ .

Explain why there is a difference in your results.

4. Explain how a dynamic inconsistency may arise when policy makers prefer low unemployment rate rather than low inflation rate and public prefers low inflation rate rather than low unemployment rate using the following pay-off matrix of inflationary expectation (refer to pp. 421-423 of Miles and Scott).

.....	<i>Private Sector</i>	
	<i>H</i>	<i>L</i>
<i>Government Sector</i>	<i>H</i>	<i>L</i>
	-3,0	3,-3
	<i>L</i>	<i>H</i>
	-5,-3	0,0

3. Policy makers like stabilise the economy by managing aggregate demand and letting the economy grow at its natural rate as far as possible. Let their objective function take the following form

$$S(\pi) = b(y - y^*) - a\pi^2 \quad (1)$$

where  $y$  is actual output  $y^*$  is the natural level of output and  $(y - y^*)$  is the output gap and  $\pi$  is the actual inflation rate. Further suppose a simple aggregate supply function of the following form in which that output responds to higher level of inflation as below

$$y = y^* + c(\pi - E(\pi)) \quad (2)$$

Given the is inflationary expectation of people,  $E(\pi)$ , policy makers may choose inflation  $\pi$  either using a discretionary policy or by committing themselves to a policy rule (by fixing a target rate of inflation).

- Using both of above equations calculate the optimal inflation rate under the discretionary policy regime.
- If policy makers were committed to a target rate of inflation and people knew that they would stick to that target (such as 2% rate by the ECB and 2.5 rate by the MPC of Bank of England) what would be the optimal rate of inflation?
- Which one of the above regimes is Pareto efficient outcome?

## Tutorial 9

### Trade, Exchange Rate and International Financial Policy

- Should UK join the European Monetary Union? Argue in favour and against based on five economic tests proposed by the HM-Treasury. Are benefits of joining the Euro bigger for smaller countries?
- The US Dollar has depreciated significantly against the Sterling Pounds and Euro and Japanese Yen since summer 2002. Study the basic information about the budget deficit, inflation, interest rates, exchange rates, trade balance, growth rates of money supply and GDP in the following table.

Macro Economic Indicators for UK and her Trading Partners, 2002

Macro Economic Indicators	UK	EURO-Area	USA	Japan	
Budget deficit as % of GDP	-1.4	-2.2	-3.1	-7.9	
Inflation rate (% change in CPI)	2.1	2.2	2.6	-0.9	
Interest rate (% per year on 3-month money market)	3.97	2.94	1.34	0.02	
Trade balance (in billion US \$)	-49.0	95.6	-456.6	89.3	
Current Account balance (in billion US \$)	25.8	38.0	-462.2	113.9	
Exchange rate (per US \$)	0.63	0.98	1	121	
Growth rate of GDP (annual %)	1.8	0.8	3.2	1.3	
Growth rate of money supply (%)	5.8	7.0	6.6	3.2	

Source: Economist, December 21<sup>st</sup>, 2002.

Macro Economic Indicators for UK and her Trading Partners, 2001

Macro Economic Indicators	UK	EURO-Area	USA	Japan	
Budget deficit as % of GDP	1.1	-1.2	0.6	-6.0	
Inflation rate (% change in CPI)	1.6	2.1	2.2	-0.8	
Interest rate (% per year on 3-month money market)	3.97	3.35	1.84	0.02	
Trade balance (in billion US \$)	-47.2	24.9	-438.9	74.9	
Current Account balance (in billion US \$)	17.7	-31.2	-430.7	3.2	
Exchange rate (per US \$)	0.69	1.11	1	128	
Growth rate of GDP (annual %)	2.2	1.3	0.6	-0.5	
Growth rate of money supply (%)	8.2	8.0	14.0	3.2	

Source: Economist, December 21<sup>st</sup>, 2002, and January 2002.

- a. Calculate the appreciation rate of the sterling pounds, Euro and the Japanese Yen in year 2002? Has the Sterling Pound appreciated or depreciated against the Euro and Yen?
  - b. Are the exchange rate movements that you noted above according to the purchasing power parity hypothesis?
  - c. Does the above information support the uncovered interest parity theory of exchange rate? How much is the risk premium in the exchange rate market?
  - d. Is growth rate of money supply consistent with the growth rates of the GDP, inflation and interest rates?
  - e. Have the budget deficits caused higher money growth, inflation, appreciation and trade imbalances?
  - f. Present above information in a set of IS-LM and UIP diagram for an open economy.
3. Use IS-LM diagram and uncovered parity diagrams to show links between the fiscal and monetary policy and the exchange in an open economy.
4. Analyse how the fiscal policy affects the output, employment, investment and exports and imports in an economy. Explain when the effects of fiscal policy are more effective than that of the monetary policy in a small open economy. How do these effects spill over to other economies in an interdependent global economy ( for simplicity of analysis you may use a two country global economy model).
5. The change in the exchange rate between domestic and foreign currency is given by  $\frac{\dot{e}_t}{e_t}$ . What should be the relation between the domestic real interest rate ( $r$ ) and the foreign real interest rate ( $r^*$ ) if both the purchasing power parity (PPP) and uncovered interest parity (UIP) hold at the same time?
6. An economy devalues its currency by 50 percent, the elasticity of exports is 0.5 and the elasticity of imports is -0.3. What will happen to the net exports according to the Marshall-Lerner theorem?

Tutorial 10  
Five Schools of Macro, Economic Crisis and Micro Foundation

1. What are the Classical, Keynesian, monetarist, New classical, New Keynesian approaches to the general equilibrium in an economy. Provide intuitive and graphical explanations.
2. What are the fundamental macroeconomic conditions required for stability and growth? Give an example of a country where macroeconomic policy has achieved all of those fundamentals and has achieved stable economic environment and a higher growth rate. Contrast this case with another counter example, in which fundamentals have been wrong and produced economic crisis. Use illustrations from stable exchange rate mechanism under the gold standard or the Bretton Woods system and floating and unstable exchange rate regimes that emerged after the breakdown of the Bretton Woods system in early 1970s.
3. Consider an economy consisting of a representative household and a representative firm. A representative household tries to maximise utility by consuming goods and services and from enjoying leisure subject to his budget constraints. The producer wants to maximise profit by selling goods produced using the labour supplied by the household.

The household maximisation problem can be stated as the following:

$$\text{Max } U = c^\phi l^{1-\phi}$$

Subject to:

- i.  $l + h^s = 1$  time constraint
- ii.  $pc = wh^s + \pi$  budget constraint
- iii.  $c \geq 0; l \geq 0; h^s \geq 0$  non-negativity constraint

where  $c$  is consumption,  $l$  is leisure and  $h^s$  is labour supply,  $p$  is the price of the commodity,  $w$  is the wage rate  $\pi$  is the profit from owning the firm.

Maximisation problem for the representative firm can be stated as

$$\text{Max } \pi = py - wh^d$$

subject to :

- i.  $y \leq (h^d)^\alpha$  technology constraint
- ii.  $y \geq 0; h^d \geq 0$  non negativity constraint

where  $y$  is the output supplied by the firm and  $h^d$  is its demand for labour.

Illustrate this general equilibrium model using simple inter-linked diagrams in price and quantity space. Explain using the circular flow diagram how various sectors are linked to each other in an economy.

- ii. Form a Lagrangian maximisation problem for this household
  - a. Derive its demand for consumption goods
  - b. Derive its demand for leisure
  - c. Write the Lagrangian function for the firm's optimisation problem.
  - d. Derive firm's demand for labour
  - e. Define a competitive equilibrium for this economy
  - f. Compute the real wage that brings goods and labour market in equilibrium.
  - g. What is the equilibrium quantity of  $c$  or  $y$ ?
  - h. What is the equilibrium quantity of  $l$  and  $h^d$ ?

## **Other Reading and Resources**

### **Journal List**

The library keeps many Journals relating to the materials of this module such as *American Economic Review*, *Journal Political Economy*, *Journal of Economic Perspective*, *Journal Macroeconomics*, *Journal of Monetary Economics*, *Economic Journal*, *Journal of Money Credit and Banking*, *Economic Letters*, *Applied Economics*, *Applied Economics Letters* *International Economic Review*, *Journal of Policy Modelling*. You may find them useful if you like to further deepen your understanding in a particular topic particularly when writing your essay.

### **WWW Sites**

You will find these Web sites helpful for the module and are advised to consult them regularly. You may discover other Websites which are also helpful.

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

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

European Central Bank <http://www.ecb.int/>

International monetary fund: <http://www.imf.org>

Office of National Statistics: <http://www.statistics.gov.uk/economy/>

### **Other Sources:**

*For example: Econlit JSTOR databases through the electronic services in the library should be useful for the literature search. Financial Times has plenty of day to day news and story about the macroeconomic events in real life.*

The range of references and resources available throughout the University Library is increasing constantly on a daily basis. The list above should be thought of as an opening into the literature. You are strongly encouraged to browse through the stock and to pay particular attention to the New Periodicals shelves.

### **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.

### **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 LEA grant entitlement.

It is important that you have read and understood the section *entitled 'General Attendance'* in the Hull University Business School Student Handbook.

## **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 Student 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 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.

The Module Staff hope that you enjoy studying this module and that it makes a valuable educational contribution to your Course Programme.

## Macroeconomic Analysis (10240) Midterm Exam

March 12, 2002.  
Time: 11.15-12-05

Multiple Choice Section (Answer all 10 questions)

1. Suppose that the price setting process of the firm is given by  $P = (1 + \mu)W$  and the wage bargaining process by the unions is given by  $\frac{W}{P} = A - bu$ . If the mark up rate  $\mu$  is 10% and A equal 2 and union strength measured by b equals 0.22, what would the natural rate of unemployment approximately be in this economy?

(a) 7%    (b) 6%    (c) 5%    (d) 4%

2. If the monetary authority in an economy takes an interest rate decision according to a policy rule of the following form

$$i_t = i_t^* + \pi_t^* + a(y_t - y_t^*) + b(\pi_t - \pi_t^*)$$

where  $i_t$  is the actual rate of interest in period t,  $i_t^*$  is the interest target of the monetary authority,  $y_t$  and  $y_t^*$  are actual and natural level of output and  $\pi_t$  and  $\pi_t^*$  are actual and target inflation rates.

If the current output gap is 1.5%, inflation target is 2.5%, target interest rate is 5%, a equals 2 and b equals 0.75, what should the interest rate that the monetary authority would fix operating according to above rule?

(a) 6%                      (b) 8%                      (c) 10%                      (d) 12%

3. Suppose the link between inflation, unemployment and growth rate of output and money supply are given as following for an economy

Unemployment and output gap (Okun's law)  $u_t - u_{t-1} = -a(g_{y,t} - g_{y,n})$                       (1)

Phillip's curve (expectation augmented):  $\pi_t = \pi^e - b(u_t - u_n)$                       (2)

Relation between growth rates of money, output and inflation  $g_{y,t} = g_{m,t} - \pi_t$                       (3)

Where  $g_{y,t}$  is actual growth rate of output;  $g_{y,n}$  is natural growth rate of output  
 $g_{m,t}$  is growth rate of money supply,  $\pi^e$  is expected inflation rate,  $\pi_t$  is inflation rate;  
 $u_t$  is actual unemployment rate;  $u_n$  natural rate of unemployment.

If the trend growth rate of output is 3%, actual unemployment rate in last period  $u_{t-1}$  was 7%,  $\pi^e$  is 4%, natural rate of unemployment is 5%; a=2 and b=0.5 what would be the actual rate of unemployment, growth rate of output and money supply in period t in this economy in percentage terms.

(a) 4, 9, 15    (b) 6, 7, 10    (c) 3, 5, 8                      (d) 4, 6, 7

4. Consider the following form of preferences, budget constraints and endowments for a representative household in and economy

$$\text{Max } U(C_1, C_2) = \ln C_1 + \beta \ln C_2 \quad (1)$$

Subject to

$$\begin{aligned} C_1 + b &\leq W_1 : && \text{budget constraint in period 1} \\ C_2 &\leq b(1+r) + W_2 : && \text{budget constraint in period 2} \end{aligned} \quad (2)$$

where  $C_1, C_2$  are consumption in period 1 and period 2 respectively and  $W_1, W_2$  are endowments in period 1 and period 2, which were 100 and 150 respectively. Suppose the discount factor  $\beta = 0.9$ , and the consumer can borrow and lend at the interest rate of 5%. Given these features of the economy, what will be optimal consumption in period 1 and period 2 respectively.

- (a) 252, 133      (b) 243, 121      (c) 225, 150      (d) 210, 190

5. Take the economy described in 4 but now assume that there is a government which provides a fixed amount of public services by using instruments of fiscal policy. It has, tax and borrowing as two instruments in the first period. If it gives tax breaks to people in period one it needs to borrow from the private sector to finance public services to be provided for that period. In the past government was operating only tax rule and had collected taxes equal to 40 in each period and provides public services equal to 50 and 30 in period 1 and period 2 respectively. Election time is approaching and government promises full tax break to people in period 1. Learning from the Ricardian Equivalence Theorem you know that such promise do not make much difference in life time budget constraint of individuals as taxes are likely to go up in period 2 when government need to pay back its debt. Given above information by how much would tax increase in period 2.

- (a). 96.6                      (b)      82.5                      (c)      78.3                      (d) 81.7

6. Suppose that per capita output for an economy is given by a production function of the following form  $y = Ak^\alpha$ . The empirical estimates for a hypothetical economy suggest that value of  $\alpha$  equals 1 and  $A = 0.75$ , saving rate of 20%, depreciation rate of 5%, and labour force growth rate of 2%. Given this information and calculations using a Solow type model when do you think that this economy will reach to a steady state?

- (a) in 10 years      (b) in 100 years      (c) in 1000 years      (d) Never

7. The stock of human capital in is three times more in country 2 than in country 1 but the number of people in country 2 is two times more than in country 1. Assuming that the capital stock in country 2 is 4 times that of country 1 by how much will the marginal productivity of a representative worker will be higher (or lower) in country 2 than in country 1? Use a generic production function for both countries of the form  $Y = AK^\alpha L^\beta H^\gamma$  and assume and  $\alpha = \frac{1}{3}$ ,  $\beta = \frac{1}{3}$  and  $\gamma = \frac{1}{3}$  and  $A = 1$ .

- (a)  $5.5^{\frac{1}{3}} = 1.22$       (b)  $7.5^{\frac{1}{3}} = 1.16$       (c)  $6.2^{\frac{1}{4}} = 1.25$       (d)  $4.2^{\frac{1}{4}} = 1.39$

8. What would be the market price of a share that promises to pay a fixed return of 10,000 each year at the market place if the current interest rate is 5%, promise of dividend growth in that share is of 3% and the risk premium on that share is valued at 8%?

- (a) 10,000 (b) 20,000 (c) 100,000 (d) 150,000

9. Suppose that the monetary authority of an economy uses a rational expectation model of the economy of the following form:

- Aggregate supply

$$y_t^s = p_t - w_t = p_t - E_{t-1}^* p_t \quad (1)$$

Wage rate depends on future price, with conditional expectation:  $w_t = E_{t-1}^* p_t$

- Aggregate demand and a monetary shock:  $y_t^d = m_t - p_t - \theta_t \quad (2)$

Monetary shock defines as  $\theta_t = \lambda \theta_{t-1} + \mu_t \quad (3) \quad \mu_t \sim N(0, \sigma_\mu^2)$

From a formal derivation you came to a solution of the following form.

$$\begin{aligned} \text{var}(y_t) &= \text{var}(p_t - E_{t-1}^* p_t) \\ &= \left[ \frac{1}{2} \lambda \theta_{t-1} - \frac{1}{2} \lambda \theta_t \right] = \frac{1}{4} \sigma_\mu^2 \end{aligned}$$

Assume that the empirical estimation of the monetary policy error  $\sigma_\mu^2 = 4$ .

Using this information in the above model by how much can the monetary authority change output by using an unanticipated monetary policy from the trend output?

- (a) 1 percent (2) 2 percent (3) 3 percent (4) 4 percent

10. Suppose that initial income of a person is 20,000 and it grows annually at 1.03 percent. This person has to pay income tax at the rate of 15% and expects to work for another 40 years. This person does not have any non-human wealth. All wealth consists of labour income mentioned here. If this consumer smoothes out consumption evenly in each period of his/her life, how much should be the amount of consumption each year approximately around (100s)?

- (a) 22300 (b) 25200 (c) 26100 (c) 30,800

Macroeconomic Analysis  
Multiple Choice Mid-term Test 2

**April 23**  
**Time 11:15-12:05**

This test includes 20 multiple choice questions. Answer all questions by circling the most appropriate choice in a separate sheet. The answer will be invalid if you circle more than one choice. Each question carries equal weight.

1. Assume that there are only two countries in the world, Home country and the Foreign country. The inflation rate is 6 percent at Home country and 3 percent in the Foreign country. What should be the percentage change in the exchange rate according to the purchasing power parity (PPP) theory?
  - a. Home country currency should depreciate by 3 percent
  - b. Home country currency should appreciate by 3 percent
  - c. Foreign country currency should appreciate by 3 percent
  - d. Currencies of both Home and Foreign countries should depreciate by 3 percent
  
2. The basic interest rate in the UK is 4 percent. It is 2 percent in the USA. According to the uncovered parity condition what of the following should happen?
  - a. Pound Sterling should appreciate by 2 percent
  - b. The US dollar should appreciate by 2 percent
  - c. There should be no change in the exchange rate but only in the interest rate
  - d. Interest rate in the US should increase to the level that of UK
  
3. The current interest rate in the UK is 4 percent. It is 3 percent in the Euro area. You are able to buy 0.612 of Sterling Pound per Euro in the foreign exchange market. What should be the forward exchange rate (Sterling Pound per Euro) implied by these interest and exchange rate?
  - a. 0.612
  - b. 0.618
  - c. 0.556
  - d. 0.618
  
4. You want to calculate a trade balance for an economy using export function  $X = 200 + 200E$  and an import function  $M = 500 - 200E$ . The current exchange rate (E) is 0.612 and current trade balance is -55. If the currency of home country appreciates by 20% what will be the new trade balance?
  - a. 44
  - b. 66
  - c. 104
  - d. 0
  
5. From data on economic time series you find that money supply grew by 20 percent in the foreign country and by 25 percent at home whereas the money demand grew by 10 percent in the foreign country and 15 percent at home. Given these growth rates money supply and money demand at home and abroad how much should the domestic currency be devalued against the foreign currency according to the purchasing power parity theory?
  - a. 10%
  - b. 25%
  - c. 20%
  - d. 0%

6. The change in the exchange rate between domestic and foreign currency is given by  $\frac{\dot{e}_t}{e_t}$ . What should be the relation between the domestic real interest rate ( $r$ ) and the foreign real interest rate ( $r^*$ ) if both the purchasing power parity (PPP) and uncovered interest parity (UIP) hold at the same time?

a.  $r_t = r_t^*$       b.  $r_t = r_t^* + \frac{\dot{e}_t}{e_t}$       c.  $r_t + \frac{\dot{e}_t}{e_t} = r_t^*$       d.  $r_t = r_t^* + \pi_t^*$

7. According to the first generation theory of economic crisis the major reason for an economic crisis is

- floating exchange rate, high budget deficit and restriction in the capital mobility
- fixed exchange rate, monetary independence and restriction in the capital mobility
- flexible exchange rate, free capital mobility and monetary independence
- fixed exchange rate, free capital mobility and monetary independence

8. An economy devalues its currency by 50 percent, the elasticity of exports is 0.5 and the elasticity of imports is -0.3. What will happen to the net exports according to the Marshall-Lerner theorem?

- No change in net exports
- Devaluation is effective in promoting net exports
- Devaluation is ineffective in promoting net exports
- Nothing can be said about the effect of net exports with this information

9. Money multiplier in a given country is equal to 4, i.e.  $\left( m = \frac{1+c}{c+r} = 4 \right)$ . What

happens to the domestic money supply if a country has to finance its trade imbalance, which is 10% of its GDP, by running down the reserves of foreign assets?

- Money supply decreases by 40 percent
- Money supply increases by 40 percent
- There is no change in money supply
- Money supply increases by 20 percent

10. A study reports that the trade share of the UK with the US, Japan, Euro area and the ROW (Rest of the World) is 14%, 3%, 55% and 29% respectively. What is the effective nominal exchange rate of the Sterling Pound if the bilateral nominal exchange rates were 1.44, 190, 1.61 and 10 respectively?

a. 1.05      b. 3.12      c. 1.30      d. 1.95

11. The basic haircut in India costs 20 Rupees. It costs £5 in the UK. You can buy 70.2 Rupees per Sterling Pound in the foreign exchange market. What is the real exchange rate between Indian Rupees and the Sterling Pound based on this information?
- a. 70.2      b. 1.60      c. 17.55      d. 3.51
12. There are two countries in the world. The production function of each is given by  $Y_i = A_i K_i^\alpha L_i^\beta$  where  $i=1,2$  and  $0 < \alpha < 1$  and  $0 < \beta < 1$ . The Rich country has more capital stock than the Poor country. There is an increasing return to capital in production,  $\alpha > 1$ . What will happen to per capita income over time when there is no restriction on the mobility of capital but the labour is completely immobile across these countries?
- a. All capital stock will end up in the poor country  
b. All capital stock will end up in the rich country  
c. Income gap between poor and rich country will narrow down  
d. None of the above can be asserted definitely
13. There are two economies in the world, Rich and Poor. The production function is as in question 12 above but it follows a constant return to scale,  $\alpha + \beta = 1$ . Now assume that the labour is mobile but the capital is immobile across countries. Given this information, what will be the real wage rates across these countries in equilibrium?
- a. It will become equal in both countries  
b. It will be higher in the Rich country and lower in the Poor country than that in the current period  
c. The relative gap of income between the Rich and the Poor countries will remain the same despite an increase in the wage rate in the Poor country  
d. Cannot be said anything about this based only on this information.
14. The revenue from inflation tax in the steady state can be calculated as  $S = \frac{\Delta M}{M} \frac{M}{P} = g_m (\alpha - \beta g_m) = \alpha g_m - \beta (g_m)^2$  where  $g_m$  is the growth rate of money supply and  $\alpha$  and  $\beta$  are parameters of a money demand function. What will be the optimal growth rate of money supply that maximises revenue from the inflation tax if  $\alpha = 0.4$  and  $\beta = 1.5$  ?
- a. 40 percent    b. 13.33 percent    c. 100 percent    d. 10 percent
15. A small open economy has consumption function  $C = C_0 + c(Y - T)$  and its import function is  $M = M_0 + mY$ . Investment, public spending and exports are exogenous. The marginal propensity to consume is 0.8 and marginal propensity to import is 0.2. Tax is collected in a lump-sum manner and remains unchanged. What would be the effect of 100 units increase in the public expenditure in output ?
- a. 100      b. 200      c. 250      d. 300

16. There are two interdependent economies in the world, Home economy and Foreign economy. Both consumption and imports in Home economy depend upon domestic income. Assume that the consumption function is given by  $C = C_0 + cY$  and import function is given by  $M = M_0 + mY$ . Export of Home depends on Foreign income  $X = X_0 + m^*Y^*$ . National income of Home economy is  $Y = C + I + G + X - M$ . What will be impact of 10 percent increase in foreign income  $Y^*$  if the marginal propensity to consume 0.8 and marginal propensity to import 0.20 at home and marginal propensity to import in the Foreign economy is 0.50?
- a. 12.5 %      b. 5%      c. 1.25%      d. 1%
17. What will be the impact of monetary and fiscal policy under the fixed exchange rate regime under the Mundell-Flemming open economy model?
- a. Monetary policy will be effective and the fiscal policy will be impotent  
b. Fiscal policy will be effective and the monetary policy will be impotent  
c. Both policies will be effective because money matters  
d. Both policies will be ineffective because money does not matter
18. What will happen to money supply at home country under the flexible exchange rate regime if the domestic interest rate is higher than the foreign interest rate?
- a. Money supply will increase until the domestic interest becomes equal to the foreign interest rate  
b. Money supply will decrease  
c. There will be no change in money supply  
d. Monetary policy is ineffective and does not matter
19. In the Keynesian model net national saving function is given by  $NS - I = -500 + 0.2Y$  and the net export function is  $NX = 200 - 0.3Y$ . When the national income was 1400 the net exports and net saving were  $-220$ . Now government introduces an expansionary fiscal policy, which raises national income by 500 to 1900. What will be the new trade balance and net national saving?
- a. 100, 200      b.  $-370, -120$       c.  $-220, -370$       d.  $-370, -370$
20. Capital inflow or outflow for an economy is given by  $KA = 200 + 2000(i - i^*)$ , where  $i$  is domestic interest rate and  $i^*$  is the foreign interest rate. The current account balance for this economy is given by  $CA = 200 - 0.3Y$ . The balance of payment condition requires that  $BOP = KA + CA = 0$ . If the foreign interest rate is 2% and domestic interest rate is 4%, what should be the implied equilibrium income consistent with the balance of payment equilibrium, i.e.  $BOP=0$ ?
- a. 200      b. 400      c. 800      d. 1467

THE UNIVERSITY OF HULL

Department of Economics

Level 2 Examination

May/June, 2002

*MACROECONOMIC ANALYSIS*

Friday, 31 May, 9.30 am to 11.30 am

*This examination paper includes ten multiple choice questions in Section A and seven essay-type questions in Section B. Answer **ALL** the questions in Section A and **ANY TWO** questions from Section B. Section A is worth 30 marks and Section B is worth 70 marks. Within each Section, each question carries equal weight.*

*Do not open or turn over this exam paper, or start to write anything until told to by the Invigilator. Starting to write before being permitted to do so may be seen as an attempt to use Unfair Means.*

*This examination paper includes ten multiple choice questions in Section A and seven essay-type questions in Section B. Answer **ALL** the questions in Section A and **ANY***

*TWO* questions from Section B. Section A is worth 30 marks and Section B is worth 70 marks. Within each Section, each question carries equal weight.

## SECTION A

### Multiple Choice Questions (3 marks per question)

Indicate your answer in each case by putting a cross in the relevant box. If, for some reason, you put a cross in a box and wish to change your mind, fill in the crossed box and enter a new cross in the preferred box. Any answer in which two or more crosses appear will be awarded zero marks.

- 1 What is the ratio of saving to GDP ( $S/Y$ ) if the consumption ratio ( $C/Y$ ) is 0.6, the tax ratio ( $T/Y$ ) is 0.3, the investment ratio ( $I/Y$ ) is 0.15, the government expenditure ratio ( $G/Y$ ) is 0.35, and the net export ratio  $[(X-M)/Y]$  is  $-0.10$ ?
- (a) 0.10      (b) 0.45      (c) 0.25      (d) 0.15
- 2 *If the basic interest rate is 3% in the Euro Zone, 4% in the UK and 5% in the USA how should the value of the pound change according to the uncovered interest parity theory?*
- (a) The pound will appreciate by 1% against the Euro and depreciate by 1% against the dollar.  
(b) The pound will depreciate by 1% against the Euro and appreciate by 1% against the dollar.  
(c) There should be no effect on the exchange rate of differences in the interest rates either in the Euro Zone or in the United States.  
(d) You do not have enough information to make any statement like those above.
- 3 *The purchasing power parity theory implies that the nominal exchange rate between the UK pound and the Euro should change:*
- (a) According to the inflation rate in the Euro Zone;  
(b) According to the inflation rate in the UK;  
(c) According to the difference in the interest rates in the UK and the Euro zone;  
(d) According to the difference in the inflation rates in the UK and the Euro zone.

- 4 *Consider a version of the life cycle model in which a consumer lives for three periods. She has earnings of 300 in the first period, 1000 in the second period and -100 in the last period. If her consumption in each period is equal to 400, what does this imply for the rate of interest and the subjective discount factors in Periods 1, 2 and 3?*
- (a) 5%, 1, 0.90 and 0.95 respectively;  
 (b) 10%, 2, 0.8 and 0.9 respectively;  
 (c) 0%, 1, 1, and 1 respectively;  
 (d) 0%, 1, 0.95 and 0.9 respectively.
- 5 *A representative consumer has income equal to 500 in the first period and 1000 in the second period. If her consumption is equal to her permanent income, and the interest rate equals 5%, what will she consume in each period?*
- (a) 726.2    (b) 750.0    (c) 952.0    (d) 743.9
- 6 *Suppose that the expectation-augmented Phillips curve is given by  $\pi_t = \pi_t^e - 2(u_t - u_n)$ , the current rate of inflation  $\pi_t$  is 5%, the natural unemployment rate  $u_n$  is 6%, the actual unemployment rate  $u_t$  is 3.5%, and the relation between expected inflation and the past inflation rate is given by  $\pi_t^e = \pi_{t-1}$ . What does this imply for the expected rate of inflation  $\pi_t^e$  in periods  $t$  and  $t+1$ ?*
- (a)  $\pi_t^e$  is 1% and the Phillips curve will shift upward next period;  
 (b)  $\pi_t^e$  is -1% and the Phillips curve will shift downward next period;  
 (c)  $\pi_t^e$  will change by 5% next period;  
 (d)  $\pi_t^e$  is 0% and there will be no change in the Phillips curve next period.
- 7 *Suppose a share promises to pay a fixed dividend of 1000 each year. The market interest rate is 4.5 per cent, and the share has a risk factor of 7 per cent. What will be the price of this share in the market?*
- (a) 22,222    (b) 14,286    (c) 8,696    (d) 1,000

8 Suppose that an economy has a production function given by  $Y = AK^\alpha L^\beta H^\gamma$  and that output is growing by 5%, capital is growing by 3%, labour input is growing by 2% and human capital is growing by 2%. What is the rate of technological progress if  $\alpha = 0.2$ ,  $\beta = 0.6$  and  $\gamma = 0.2$ ?

- (a) 2.8 % (b) 3.6% (c) 1.0% (d) 1.7%

9 The *impossible trilog*y in an open economy implies:

- (A) A COUNTRY CANNOT IMPORT UNLESS IT IS ABLE TO EXPORT AN EQUAL AMOUNT BY CUTTING DOMESTIC CONSUMPTION.
- (b) A fixed exchange rate, free capital mobility and monetary independence cannot go together.
- (c) The Government cannot borrow from foreign financial market unless domestic supply and demand are unbalanced.
- (d) Investors risk their investment if they do not buy financial assets in the forward exchange market.

10 What is the percentage ratio of primary budget surplus (T-G) to GDP required to sustain a debt of 60 percent of GDP, if the real interest rate is 4% and the economy is growing by 3%?

- (a) 0.1% (b) 1% (c) 2% (d) 0.6%

### **SECTION B (35 marks per question)**

Answer **ANY TWO** questions from Section B. The arguments in your answers should be based on a macroeconomic model. Use graphical and algebraic tools of analysis as appropriate.

11 A comparison of international unemployment rate data shows wide variations across countries. What sort of theories do macroeconomists use to analyse differences that tend to persist over time? Based on the above analysis, what kind of labour market policies can you suggest for a country that wants to reduce its natural rate of unemployment?

- 12 Using a Cobb-Douglas version of the Solow growth model, demonstrate how the growth rate of per capita income in the steady state depends only upon the growth rate of technology and not on the rate of saving. Briefly discuss how the more recent growth models of Lucas and Romer introduce an endogenous process of technological advance in order to show a complementarity between physical and human capital in analysing the process of economic growth.
- 13 Illustrate a dynamic process of economic adjustment in response to a cut in deficit spending that reduces the money supply in an economy. Explain how your analysis varies when people and policy makers have rational expectations rather than adaptive expectations. [Use aggregate demand and aggregate supply analysis and the expectation augmented Phillips curves to answer this question.]
- 14 Suppose that a consumer lives for three periods. She receives bequests or gifts of 100 in the first period, earns 1500 while adult and leaves 200 to her children at the end of her life.
- Write an intertemporal budget constraint for this consumer.
  - If the preferences of this consumer are given by  $U(C_1, C_2, C_3) = \ln C_1 + \beta_2 \ln C_2 + \beta_3 \ln C_3$  derive the demand for consumption in each period in terms of  $\beta_2$ ,  $\beta_3$  and the interest rate,  $r$ .
  - Assuming that  $\beta_2 = 0.95$ ,  $\beta_3 = 0.90$  and the interest rate is equal to 5% in all periods, what will consumption and saving be in each period?
  - What is the lifetime utility of this consumer?
  - What would be the change in her lifetime utility from consuming private goods (without including public goods in the utility function) if the government were to collect a 20 percent tax from consumers in each period?

- 15 Suppose that the monetary authority of a certain country sets interest rates according to the following rules:

$$\text{Taylor rule for interest rate: } i_t = i^* + a(y_t - y^*) + b(\pi_t - \pi^*)$$

$$\text{Phillips' curve: } \pi_t = \pi^* + c(y_{t-1} - y^*)$$

$$\text{Impact of interest rate on output: } y_t - y^* = d(i_{t-1} - i^*)$$

where  $i_t$  is the actual rate of interest in period  $t$ ,  $i^*$  is the interest target of the monetary authority,  $y_t$  and  $y^*$  are the actual and natural levels of output, and  $\pi_t$  and  $\pi^*$  are actual and target inflation rates.

Suppose that  $i_0 = 7\%$ ,  $i_1 = 5\%$ ,  $i^* = 3\%$ ,  $\pi^* = 2\%$ ,  $a = 0.5$ ,  $b = 1.25$ ,  $c = 0.5$ ,  $d = -0.5$  and  $(y_0 - y^*) = 2\%$ .

Show how the interest rate will change from Period 2 to Period 5. Give an intuitive explanation for your results for each period.

- 16 *What is the meaning of sustainable debt? How does it relate to the growth rate of the economy, the real interest rate and the primary budget deficit if the government finances its deficit by borrowing from the private sector? What would be the optimal growth rate of the money supply if the government chose to finance the deficit by printing more money?*

- 17 *Use the Mundell-Fleming model to compare the impacts on the current and capital accounts of changes in monetary and fiscal policy under fixed and flexible exchange rate regimes under the interest parity condition. Use this analysis to argue for or against the membership of the European Monetary Union for a non-member country such as the United Kingdom.*