UNIVERSITY OF LONDON | INTERNATIONAL PROGRAMMES

Course information 2015–16
EC3115 Monetary economics

This course introduces the concept of money; what it is, why we use it and how it is created. It examines monetary policy in a closed economy, considering a number of models that allow real effects of monetary policy, ranging from new-Classical to Keynesian. Specific models will be introduced and solved, allowing students to see exactly how these models work and what differentiates one from another. It then studies Dynamic Stochastic General Equilibrium Models which brings together insights from Real Business Cycle Models and Keynesian macroeconomics. Finally, it studies uncertainty in monetary economics that is pervasive in macroeconomic modelling and takes the form of data, parameter and model uncertainty and introduces students to the concept of robust monetary policy design.

Prerequisite

If taken as part of a BSc degree, courses which must be passed before this course may be attempted:
EC2065 Macroeconomics.

Aims and objectives

The aims of the course are to:

- develop understanding of the theories that relate to the existence of money, explaining why it is demanded by individuals and used in the trading process
- develop an understanding of the monetary transmission mechanism, whereby decisions made by the monetary authorities concerning money supplies or interest rates can have real effects on the economy
- develop a number of macroeconomic models through which monetary policy can be evaluated. Such models will include both Classical and Keynesian schools of thought and will consider why monetary policy matters and when monetary policy decisions may be impotent
- develop understanding of the uncertainties policy-makers face and how policy makers may deal with these

Essential reading

For sections 1 and 2 of this course, students are encouraged to buy:
Either Lewis, M.K. and P.D. Mizen Monetary Economics. (Oxford; New York: Oxford University Press)
Or Carlin,W. and D. Soskice Macroeconomics: Imperfections, Institutions and Policies. (Oxford: Oxford University Press)

Learning outcomes

At the end of this course and having completed the essential reading and activities students should be able to:

- ☑ explain and discuss why people hold money and why it is used in the trading process
- ☑ solve macroeconomic models and assess the role and efficacy of monetary policy for various types of models in both the Classical and Keynesian set-ups
- ☑ describe and explain the main channels of the monetary transmission mechanism, through which monetary policy can have real effects on the economy
- ☑ discuss the merits and disadvantages of different monetary policies used by Central Banks
- ☑ introduce the concepts of data and parameter uncertainty and discuss the policy under uncertainty

Throughout the course, students will be required to read a number of articles. These are primarily taken from the following journals. *Journal of Monetary Economics*, *American Economic Review; Journal of Political Economy; Quarterly Journal of Economics; Review of Economics and Statistics; Review of Economic Studies, Economic Inquiry.*

Assessment

This course is assessed by a three hour unseen written examination.

Syllabus

This is a description of the material to be examined, as published in the *Programme handbook*. On registration, students will receive a detailed subject guide which provides a framework for covering the topics in the syllabus and directions to the essential reading.

Section 1: Introduction to money and monetary economics

The nature of money: What constitutes money. Why people hold money; introduction to cash in advance

(CIA) and money in the utility (MIU) functions.

Money demand and supply: Microeconomic determinants of the demand for money and macroeconomic money demand functions. Financial intermediaries, banks and money creation.

The Classical school, neutrality of money and the quantity theory: The Classical dichotomy,Walras' and Say's laws, introduction to money in a general equilibrium setting.

Section 2: Monetary policy

Stylised facts and monetary policy: Trends and business cycles. Means, volatility, cyclicality and persistence in macroeconomic time series. Money and macroeconomic variables in the short and long-run. Empirical evidence for Phillips curves.

***The welfare effects of inflation and monetary policy*:** Neutrality and superneutrality of money, welfare costs, seigniorage and the inflation

tax.

The Classical model, flexible price economies and monetary policy: Rational expectations, representative agents and real business cycle theory. MIU, CIA, Lucas supply functions and the effects of monetary policy.

The Keynesian approach to monetary policy — nominal rigidities: Multi-period pricing and the persistence of monetary policy shocks. The Lucas critique.

The new Keynesian approach to monetary policy — nominal rigidities: New Keynesian Phillips curve, IS Curve, Taylor rules, financial accelerator models.

Section 3: Issues in monetary economics

Time inconsistency in monetary policy: Inflation bias, the central bank independence. Monetary policy rules: interest rate targeting and monetary targeting. (rules versus discretion).

Uncertainties in monetary policy design: News versus noise in data revisions. Brainard conservatism, certainty equivalence, interest rate smoothing.

Term structure of interest rates: Explanation of the yield curve: expectations hypothesis and the segmentation hypothesis.

Students should consult the *Programme Regulations for degrees and diplomas in Economics, Management, Finance and the Social Sciences* that are reviewed annually. Notice is also given in the *Regulations* of any courses which are being phased out and students are advised to check course availability.

Examiners' commentaries 2015

EC3115 Monetary economics

Important note

This commentary reflects the examination and assessment arrangements for this course in the academic year 2014–15. The format and structure of the examination may change in future years, and any such changes will be publicised on the virtual learning environment (VLE).

Information about the subject guide and the Essential reading references

Unless otherwise stated, all cross-references will be to the 2011 edition of the subject guide. You should always attempt to use the most recent edition of any Essential reading textbook, even if the commentary and/or online reading list and/or subject guide refer to an earlier edition. If different editions of Essential reading are listed, please check the VLE for reading supplements – if none are available, please use the contents list and index of the new edition to find the relevant section.

Important note: In the 2015–16 academic year,the new edition of the subject guide for EC3115 Monetary economics will form the basis of the examination.

Comments on specific questions – Zone A

Candidates should answer **ELEVEN** of the following **THIRTEEN** questions: all **EIGHT** from Section A (5 marks each) and **THREE** from Section B (20 marks each). **Candidates are strongly advised to divide their time accordingly.**

If more questions are answered than requested, only the first answers attempted will be counted.

Section A

Answer all **EIGHT** questions from this section.

Indicate whether the following statements are true or false, or uncertain and give a short explanation. Points are only given for a well reasoned answer.

Question 1

An advantage of indirect barter over fiat money is that indirect barter does not require trust between individuals.

Reading for this question

The subject guide, Chapter 1.

Kiyotaki, N. and J. Moore, 'Evil is the root of all money', *The American Economic Review* 92(2) 2002, Papers and Proceedings, pp.62–66.

Approaching the question

False.

Only direct barter does not require trust between individuals. The problem of trust in indirect barter is known as the Wicksell problem: as agents accept barter not only for consumption but also for further trade, the system can collapse into autarky without commitment. See p.16 of the subject guide for a worked-out example.

Question 2

The Baumol–Tobin model cannot realistically explain the demand for money.

Reading for this question

The subject guide, Chapter 2.

Baumol, W. 'The transactions demand for cash: an inventory theoretic approach', *Journal of Econometrics* 66, November, 1952, pp.545–56.

Tobin, J. 'The interest elasticity of transactions demand for cash', *The Review of Economics and Statistics* 38(3) 1956, pp.241–47.

Tobin, J. 'Liquidity preference as behaviour towards risk', *Review of Economic Studies* 25(1) 1958, pp.65–86.

Approaching the question

True.

The subject guide provides a description of the Baumol–Tobin model; the model vastly underestimates the empirical amount of money held by firms and individuals as it fails to take into account institutional factors and only focuses on the need of money for transactions.

Question 3

Under the assumption of neutrality of money, fully anticipated inflation has no welfare costs.

Reading for this question

The subject guide, Chapter 5.

Approaching the question

False.

Candidates are expected to provide a discussion on the difference between the superneutrality and neutrality of money; Figures 5.1a and 5.1c of the subject guide highlight the difference between the two assumptions. Under the assumption of superneutrality, real money demand is not impacted on by anticipated inflation, so there are no welfare costs. Under neutrality (but non-superneutrality) real money demand is reduced by higher inflation (see Figure 5.2b of the subject guide), leading to welfare costs.

Question 4

In Lucas' misperceptions model, unanticipated monetary policy shocks have real effects due to asymmetrical information.

Reading for this question

The subject guide, Chapter 6.

Lucas, R.E. Jr. 'Some international evidence on output-inflation trade-offs', *American Economic Review* 66(5) 1976, p.985.

Lucas, R.E. Jr. 'Nobel lecture: monetary neutrality', *Journal of Political Economy* 104(3) 1996, pp.661–82.

Approaching the question

True.

The asymmetric information causes the agents to confuse monetary shocks with demand shocks and thus respond to monetary shocks by changing their consumption by a fraction of the observed (but unidentified) shock. In the long run, agents find out about the true nature of the shock and the effect reverses. If information is symmetric, monetary policy would be ineffective in the Lucas' misperceptions model.

Question 5

Monetary policy makers only care about inflation.

Reading for this question

The subject guide, Chapter 8.

Barro, R.J. and D.B. Gordon 'A positive theory of monetary policy in a natural rate model', *Journal of Political Economy* 91(3) 1983, pp.589–610.

Goodhart, C.A.E. 'What should Central Banks do? What should be their macroeconomic objectives and operations?', *Economic Journal* 104(427) 1994, pp.1424–36.

Approaching the question

False.

Candidates are expected to answer this question by providing a brief discussion of the inflation bias (the political bias towards a higher output); excellent answers would also include a discussion on potential ways to resolve this tension.

Question 6

The Bretton Woods exchange rate mechanism can be thought of as a gold exchange standard.

Reading for this question

The subject guide, Chapter 14.

Krugman, P. and M. Obstfeld, *International economics: theory and policy.* (Pearson, 2008) 8th edition [ISBN 9780321488831] Chapter 19.

Approaching the question

True.

Under the Bretton Woods exchange rate system, all countries pegged their currencies to the dollar, which in turn was convertible into gold at a fixed dollar price. In principle this gave the Bretton Woods system many of the advantages of a pure Gold standard, while being more flexible in its operations. In the end, it turned out that the Bretton Woods system was still too rigid and became eventually undone in favour of floating exchange rates and free movement of capital.

Question 7

When in a liquidity trap, it is difficult for a country to affect the exchange rate using monetary policy.

Reading for this question

The subject guide, Chapter 13.

Krugman and Obstfeld (2008), Chapter 16.

Approaching the question

True.

In a liquidity trap, the central bank cannot further lower interest rates as they have hit the lower bound. As Krugman and Obstfeld Figure 16–19 'A low-output liquidity trap' shows, this leads to a horizontal segment of the AA curve in which temporary monetary policy is impotent in changing either output or the exchange rate. Note that it may still be possible to affect output and the exchange rate using unconventional monetary policy, such as QE.

Question 8

The Lucas critique implies that monetary policy is influential in all circumstances.

Reading for this question

The subject guide, Chapter 8.

Lucas, R.E. 'Econometric policy evaluation: a critique', in Brunner, K. and A.H. Meltzer (eds) *The Phillips curve and labor markets.* (Amsterdam; Oxford: North-Holland, 1976) [ISBN 9780444110077].

Approaching the question

False.

Lucas critique implies the opposite. If policymakers attempt to take advantage of statistical relationships, expectations adjust such that the statistical relationship collapses.

Section B

Answer **THREE** out of **FIVE** questions from this section.

Question 9

Suppose that the economy of Krugmania is characterised by the following Phillips Curve

$$\pi_t = y_t + a\pi_{t-1}$$

and the IS Curve

$$y_t = -bi_t + \epsilon_t$$

where y is the real output, π is the rate of inflation, i is the short term interest rate set by the Central Bank and ϵ are i.i.d. shocks with $\epsilon \sim N(0, \sigma_\epsilon^2)$. The Central Bank of Krugmania is aiming to stabilise inflation around a target inflation π^* of 0 percent. The quadratic loss function of the Central Bank (which aims to minimize this loss function) takes the following form:

$$L = E_t(\pi_t - \pi^*)^2$$

(a) Solve for the optimal interest rate under these conditions.

(7 points)

(b) Now suppose that there is parameter uncertainty, i.e. parameters a and b are time varying. The policymaker knows from which distribution these parameters are drawn. To capture this let $a \sim N(\overline{a}, \sigma_a^2)$ and $b \sim N(\overline{b}, \sigma_b^2)$. Now solve for the optimal interest rate setting rule.

(7 points)

(c) Compare your results in (b) with those in (a), highlighting the main effects of parameter uncertainty.

(6 points)

Reading for this question

The subject guide, Chapter 8.

Approaching the question

The problem has essentially two parts: candidates need to solve for cases with and without parameter uncertainty and discuss implications of such uncertainties.

Case without parameter uncertainty: Substitute the perceived structure of the economy into the objective function of the central bank.

$$L^e = E\left(a\pi_{t-1} - bi_t + \varepsilon_t - \pi^*\right)^2$$

or:

$$L^e = a^2\pi_{t-1}^2 + b^2 i_t^2 + \underbrace{E\left(\varepsilon^2\right)}_{\sigma_\varepsilon^2} + \pi^{*2} - 2a\pi_{t-1}bi_t + 2a\pi_{t-1}\underbrace{E(\varepsilon_t)}_{0}$$

$$-2a\pi_{t-1}\pi^* - 2bi_t\underbrace{E(\varepsilon_t)}_{0} + 2bi_t\pi^* - 2\underbrace{E(\varepsilon_t)}_{0}\pi^*.$$

The job is to minimise the loss with the use of the monetary policy instrument i_t, so:

$$\frac{\partial L^e}{\partial i_t} = 2b^2 i_t + 2b\pi^* - 2a\pi_{t-1}b = 0$$

$$i_t = \frac{-\pi^* + a\pi_{t-1}}{b}.$$

That is the certainty equivalence result a la Brainard. That means additive shocks do not affect the way monetary policy is conducted. The best the policymaker can do is to ignore them.

Case with parameter uncertainty:

Now, include a bit of complication. The economic environment is the same except that the parameters of the structural equations exhibit some uncertainty. Specifically,

$$\begin{aligned} \pi_t &= y_t + a\pi_{t-1} \\ y_t &= -b_t i_t + \varepsilon_t \end{aligned}$$

with:

$$\begin{aligned} \varepsilon &\sim (0, \sigma_\varepsilon^2) \\ b &\sim (\widehat{b}, \sigma_b^2). \end{aligned}$$

Therefore:

$$\pi_t = a\pi_{t-1} - b_t i_t + \varepsilon_t.$$

The problem of the central bank is:

$$\begin{aligned} L^e &= E\left(a\pi_{t-1} - b_t i_t + \varepsilon_t - \pi^*\right)^2 \\ &= a^2\pi_{t-1}^2 + E(b^2)i_t^2 + \underbrace{E\left(\varepsilon^2\right)}_{\sigma_\varepsilon^2} + \pi^{*2} - 2a\pi_{t-1}E(b)i_t + 2a\pi_{t-1}\underbrace{E(\varepsilon_t)}_{0} \\ &\quad +2a\pi_{t-1}\pi^* + 2E(b)i_t\underbrace{E(\varepsilon_t)}_{0} - 2E(b)i_t\pi^* - 2\underbrace{E(\varepsilon_t)}_{0}\pi^* \\ &= a^2\pi_{t-1}^2 + E(b^2)i_t^2 + \sigma_\varepsilon^2 + \pi^{*2} - 2a\pi_{t-1}E(b)i_t - 2a\pi_{t-1}\pi^* + 2E(b)i_t\pi^* + \cdots . \end{aligned}$$

Remember that you can write the variance of b as $\sigma_b^2 = E(b-\widehat{b})^2 = E(b^2 - 2b\widehat{b} + \widehat{b}^2)$. Given that $E(b) = \widehat{b}$ that is equal to $\sigma_b^2 = E(b^2) - E(\widehat{b}^2)$. That allows us to rewrite the L^e as:

$$\begin{aligned} L^e &= a^2\pi_{t-1}^2 + E(b^2)i_t^2 + \sigma_\varepsilon^2 + \pi^{*2} - 2a\pi_{t-1}E(b)i_t + 2a\pi_{t-1}\pi^* + 2E(b)i_t\pi^* \\ &= a^2\pi_{t-1}^2 + \left(\sigma_b^2 + \underbrace{E(\widehat{b}^2)}_{\widehat{b}^2}\right)i_t^2 + \sigma_\varepsilon^2 + \pi^{*2} - 2a\pi_{t-1}\underbrace{E(b)}_{\widehat{b}}i_t + 2a\pi_{t-1}\pi^* + 2\underbrace{E(b)}_{\widehat{b}}i_t\pi^* \\ &= a^2\pi_{t-1}^2 + \sigma_b^2 i_t^2 + \sigma_\varepsilon^2 - 2a\pi_{t-1}\widehat{b}i_t + 2a\pi_{t-1}\pi^* + \widehat{b}^2 i_t^2 + \pi^{*2} + 2\widehat{b}i_t\pi^*. \end{aligned}$$

Now solve the optimisation problem that is:

$$\begin{aligned} \frac{\partial L^e}{\partial i_t} &= 2\sigma_b^2 i_t - 2a\pi_{t-1}\widehat{b} + 2\left(\widehat{b}i_t + \pi^*\right)\widehat{b} = 0 \\ i_t &= \frac{\left(a\pi_{t-1} - \pi^*\right)\widehat{b}}{\left(\sigma_b^2 + \widehat{b}^2\right)}. \end{aligned}$$

The optimal interest rate reaction under parameter uncertainty is moderate as compared to the case without uncertainity. The reason is that by reacting strongly to deviations from the target, the central bank would induce uncertainty to the future course of target variables. Therefore, parameter uncertanity calls for caution, sometimes referred as Brainard conservatism.

Question 10

In an economy with n households, assume a household's utility depends on the quantity of goods consumed, X, and on real money balances, M/P.

$$\boldsymbol{U = X^{1/a}(M/P)^{1/a}}$$

Let the household have initial endowments X_0 of goods and M_0 of nominal money balances. The budget constraint faced by the household is then, in nominal terms:

$$PX + M \leq PX_0 + M_0.$$

(a) What is a potential justification of the inclusion of money in the utility function?

(7 points)

(b) Is money neutral in this economy? Discuss analytically.

(7 points)

(c) If the economy was characterised by limited participation in financial markets would your results change? Provide intuition without deriving the model.

(6 points)

Reading for this question

The subject guide, Chapter 4.

Approaching the question

(a) Assume that individual's utility depends also on the level of real money balances and consumption. The justification, according to Patinkin, is that even if households plan to balance their budgets so that planned purchases are equal in value to planned sales, it may be convenient to buy and sell goods at different times. The more money they hold, the greater the extent to which they can purchase goods ahead of making sales. Money holdings stand as a proxy for the more convenient sequence of transactions they make possible. Thus, money is in the utility function.

(b) Assume a household's utility depends on the quantity of goods consumed, X, and on real money balances, M/P. Let the household have initial endowments X_0 of goods and M_0 of nominal money balances. The budget constraint faced by the household is then, in nominal terms:

$$PX + M \leq PX_0 + M_0.$$

So that the nominal expenditure on goods, PX, plus the holdings of nominal money balances, M, must not be greater than the nominal value of the endowments of goods and money. Writing the budget constraint in real terms (dividing by the price level) gives:

$$X + \frac{M}{P} \leq X_0 + \frac{M_0}{P}.$$

The household's utility function takes the specific form $U = X^{1/2}(M/P)^{1/2}$. In order to determine the demands for goods and real money balances, we maximise the utility function subject to the budget constraint. To do this we form the Lagrangian (we also impose an equality in the budget constraint as this implies no wastage of goods or money):

$$L = X^{1/2}\left(\frac{M}{P}\right)^{1/2} + \lambda\left(X_0 + \frac{M_0}{P} - X - \frac{M}{P}\right).$$

Differentiating with respect to the two choice variables, X and M/P, gives the first order conditions of:

$$\begin{aligned}\frac{\mathrm{d}L}{\mathrm{d}X} &= \frac{1}{2}X^{-1/2}\left(\frac{M}{P}\right)^{1/2} - \lambda = 0\\ \frac{\mathrm{d}L}{\mathrm{d}(M/P)} &= \frac{1}{2}X^{1/2}\left(\frac{M}{P}\right)^{-1/2} - \lambda = 0\end{aligned}$$

from which we obtain:

$$X = \frac{M}{P}.$$

Substituting into the budget constraint will give solutions for the demands for goods and nominal money balances of:

$$X = \frac{X_0 + M_0/P}{2} \qquad \text{and} \qquad M = \frac{PX_0 + M_0}{2}.$$

Assume now that the economy consists of n households each identical to the one described above. The market clearing condition in the goods market then becomes:

$$n\left(\frac{X_0 + M_0/P}{2}\right) = nX_0.$$

In other words, total demand equals total supply. Solving for the price level gives:

$$P = \frac{M_0}{X_0}.$$

Alternatively, we can write down the market clearing condition for the money market:

$$n\left(\frac{PX_0 + M_0}{2}\right) = nM_0.$$

If we solve for the price level here, we obtain:

$$P = \frac{M_0}{X_0}.$$

In this economy, money is neutral. Real output per household is fixed at X_0 as it depends on endowments. From the solution of the price level, a change in the money supply will only lead to a proportional increase in prices. Real money balances and 'production' of goods do not change. An increase in money, M_0, will shift the demand function for good X outwards in Figure 4.2 of the subject guide but this simply causes the price level to increase.

(c) Monetary policy may have real effects if there are a limited number of agents participating in financial markets. If the monetary authorities decided to increase the money stock, such policy actions would be made through banks and other financial intermediaries with whom the open market operations were conducted. Now faced with a glut of liquid assets, banks wish to lend out some of these in order to maintain their desired reserve ratio. The increase in the supply of loans will cause the interest rate charged on these loans to fall (the liquidity effect) and since firms borrow from financial intermediaries to finance investment projects, this makes investment cheaper. Cheaper investment causes investment to increase, which therefore causes output, and employment if labour and capital are complementary inputs, to increase.

Question 11

Consider the yield curve depicted in Figure 1, where the maturity of a range of bonds, expressed in years, is given on the x-axis and their respective redemption yields on the y-axis.

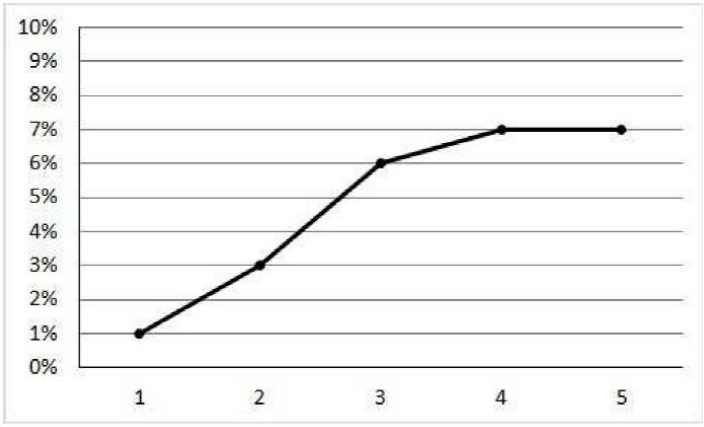

Figure 1: Yield curve

Assume that term premia are present and take the form $k_1 = 0$, $k_2 = 0.5\%$, $k_3 = 1\%$, $k_4 = 1.25\%$, and $k_5 = 1.5\%$, where k_i represents the term premium (per annum) for a bond with a maturity of i years.

(a) Calculate the implied expected 1-year interest rates for the next 5 years.

(5 points)

(b) Explain how the yield curve can be used to extract information about expected inflation. Outline the assumptions you would need to make.

(5 points)

(c) Assume expected 1-year real interest rates will be constant at 1.5%, calculate expected inflation.

(5 points)

(d) Explain what the economic interpretation is of a sudden inversion of the yield curve.

(5 points)

Reading for this question

The subject guide, Chapter 9.

Approaching the question

(a) Subtracting the yield premia leaves a 'pure' expected interest rates of adapting equation (9.4) from the syllabus:

$$n(r_{0,n} - k_n) \approx \sum_{s=0}^{n-1} r^e_{s,s+1}$$

$$r^e_{n-1,n} \approx n(r_{0,n} - k_n) - \sum_{s=0}^{n-2} r^e_{s,s+1}$$

$$r^e_{n,n+1} \approx n(r_{0,n} - k_n) - (n-1)(r_{0,n-1} - k_{n-1}).$$

Note: Dropping the log approximation, the exact formula would be:

$$(1 + r_{0,n}) = [\prod_{s=0}^{n-1}(1 + r^e_{s,s+1})]^{1/n} + k_n$$

which can be rewritten as:

$$r^e_{n,n+1} = \frac{(1 + r_{0,n} - k_n)^n}{(1 + r_{0,n-1} - k_{n-1})^{n-1}} - 1.$$

Calculating the 'pure' interest rates $\rho_i = (r_{0,n} - k_n)$ we obtain $\rho_1 = 1\%$, $\rho_2 = 2.5\%$, $\rho_3 = 5\%$, $\rho_4 = 5.75\%$, $\rho_5 = 5.5\%$.

Applying the approximation above gives us expected short term interest rates equal to $r_{0,1} = 1\%, r^e_{1,2} = 4\%, r^e_{2,3} = 10\%, r^e_{3,4} = 8\%, r^e_{4,5} = 4.5\%$.

(b) Using either the expectations hypothesis or, as in the previous part, the preferred habitat hypothesis, the yield curve can be used to extract expected short term interest rates. Coupled with the Fisher equation, $r^e_{real} \approx r^e - \pi^e$, and some assumption about the path of the real exchange rate, this gives us enough information to back out expected inflation.

(c) If the real interest rate is equal to 1.5%, then expected inflation will be approx. $r_{0,1} = -0.5\%, r^e_{1,2} = 2.5\%, r^e_{2,3} = 8.5\%, r^e_{3,4} = 6.5\%, r^e_{4,5} = 3\%$.

(d) A good answer would point out that inverted yield curves are indicative of an expected reduction of inflation and are often taken as predictors of turning points of business cycles and upcoming recessions and explain the linkages between inflation and recessions.

Question 12

(a) Briefly explain the real business cycle (RBC) model. In particular discuss the type of shocks that drive business cycles and how these shocks propagate through the economy.

(7 points)

(b) Discuss to what extent the RBC model is able to explain the stylized facts of the macro economy and the business cycle.

(7 points)

(c) Contrast and compare the predictions of the RBC model regarding monetary policy and cyclicality of wages and prices to those of the Keynesian model with sticky nominal wages.

(6 points)

Reading for this question

The subject guide, Chapters 6 and 7.

Plosser, C. 'Understanding real business cycles', *Journal of Economic Perspectives*, 3(3) 1989, pp.51–77.

McCallum, B. *Monetary Economics.* (New York: Macmillan, 1989) [ISBN 9780023784712] Chapters 9 and 10.

Approaching the question

(a) See Chapter 6 of the subject guide, in particular Figure 6.2 and the following text. RBC states that real shocks (instead of nominal shocks) are the main driver of real output. It can explain a number of stylised facts; however, contrary to empirical evidence it predicts that price levels are anti-cyclical instead of pro-cyclical, indicating a negative relation between output and prices. Example: The positive shock leads to an increased demand for labour, thus higher real wages and higher labour supply. The latter leads to a higher real output, making output pro-cyclical. The outward shift of the AS curve, leads to a drop in prices, making prices counter-cyclical.

(b) RBC can explain many stylised facts, including the procyclicality of employment, labour productivity, and wages plus the fact that investments are more volatile than consumption. However, it predicts a steeper aggregate labour supply curve than found empirically and predicts prices to be anticyclical, while they are pro-cyclical. It can also generally predicts the neutrality of money, even in the short run, which many economists feel is implausible.

(c) Whereas in a RBC model real wages are cyclical, in a Keynesian model with sticky wages, real wages are strongly counter cyclical. This counter cyclicality is in conflict with empirical observations. Take for example an expansionary monetary policy (see Figure 7.1 of the subject guide): in the Keynesian model it causes the LM and AD curve to expand outward, leading to a short run increase in output and an increase in price levels. The increase in the price level (and sticky wages), reduces real wages. Thus, higher levels of output are associated with lower real wages $\rightarrow$ real wages are countercyclical. The Phillips curve addresses this problem by modelling wages as a function of unemployment levels.

The above example also highlights the fact that in the Keynesian model money is not neutral, but in the RBC model it is neutral. Also, in the Keynesian model, prices are procyclical vs the countercyclical prices of the RBC model.

Question 13

In answering this question use the AA–DD model of the open economy. Assume the Central Bank is committed to maintaining full employment and natural output.

(a) When there is a temporary increase in the domestic propensity to consume explain

(i) how output and the exchange rates are affected by the shock.

(3 points)

(ii) how monetary policy can be used to restore output to its original equilibrium.

(3 points)

(iii) whether monetary policy is the optimal policy to restore equilibrium for this shock.

(2 points)

(b) When there is a temporary decrease in the foreign interest rate explain

(i) how output and the exchange rates are affected by the shock.

(3 points)

(ii) how monetary policy can be used to restore output to its original equilibrium.

(3 points)

(iii) whether monetary policy is the optimal policy to restore equilibrium for this shock. **(2 points)**

(c) Explain how temporary monetary policy is different from permanent monetary policy in the AA–DD model; provide a diagrammatic analysis to support your argument.

(4 points)

Reading for this question

Krugman and Obstfeld (2008).

Approaching the question

(a) A temporary increase in the propensity to consume will cause the DD curve to shift to the right, causing a temporary appreciation of the currency and an increase in output above full-employment levels. The graphical representation of this is equivalent to that of a temporary fiscal expansion. This also strongly hints at the optimal policy: a temporary contraction in fiscal policy will restore the initial equilibrium. A contractionary monetary policy would also work, but would appreciate the currency even further.

(b) A temporary decrease in the foreign interest rate will shift the AA curve to the left. This leads to a temporary appreciation of the currency and a decline of output below full-employment levels. The graphical representation of this is equivalent to that of a temporary contraction in money supplies. This suggest that the optimal policy response is a temporary expansion of the domestic money supply to shift the AA curve back rightwards and restore the initial equilibrium.

(c) Permanent monetary policy also affects exchange rate expectations, shifting the AA curve further in the short run and thus creating a larger shift in output and the exchange rate. In the long run, output reverts back to its natural rate, but the exchange rate will reach a new equilibrium as prices change to reflect the permanent change in the supply of money. See Krugman and Obstfeld (2008) for a complete discussion and the relevant diagrams.