## 3 Inflation, Unemployment and Monetary Rules

Solutions to questions set in the textbook

Please email <u>w.carlin@ucl.ac.uk</u> with any comments about the questions and answers. We would also be pleased to receive suggestions for additional questions (along with outline solutions), which can be added to the website resources.

## 1 Chapter 3. Inflation, unemployment and monetary rules

## 1.1 Checklist questions

 Use a diagram with the labour market in the upper panel and the inflation-output diagram beneath and show Phillips' long-run trade-off between inflation and unemployment. Explain what happens if the government decides to choose a lower unemployment rate on the basis that it is prepared to accept a higher rate of inflation.

ANSWER: The explanation can be found in Section 1.3–1.4 of Chaper 3.

2. Give two examples of behaviour that are consistent with the hypothesis of rational expectations but not with that of adaptive expectations and vice versa. How can one decide which hypothesis applies in a particular instance of behaviour?

ANSWER: One case would be where a chess-player is deciding what opening to play against a skilful opponent. By gathering all available information on his opponent and chess in general before every game he will rationally conclude what opening he should play. He may decide to play the same opening as last time even though it landed him in trouble if, say, he reads about an alternative strategy in the middle game. This would be consistent with rational expectations but not with adaptive expectations. Adaptive but not rational expectations would be where an opening wasn't repeated if it landed the player in trouble or at least where the opponent is expected to play the same (successful) defense in reply. Consistent with rational expectations are the inclusion of news in the formation of expectations and the absence of systematic mistakes. A decision about which type of hypothesis applies can be made by understanding what type of information is used in forming the expectations. Formally, one may define an act as consistent with rational expectations if all available and relevant information about some future event is used to maximize some future pay-off by acting accordingly. One should therefore decide whether all information has been used effectively to achieve what the agent set out to achieve. In contrast, adaptive expectations is where the agent decides to act only upon past information of some variable. This may be where someone invests in a company's shares based exclusively on past performance.

3. Explain carefully all the assumptions that are being made in the claim that 'disinflation is costly'. ANSWER: Disinflation is costly since in order to achieve a lower level of inflation an unemployment rate above equilibrium is necessary as in Fig. 3.5. The reason is that inflation is inertial, i.e. the Phillips curve that faces the policy maker is fixed by past inflation: if the economy is at equilibrium, inflation will remain unchanged unless output is reduced. This will push the econ-

omy down the Phillips curve as a slacker labour market reduces the expected real wage that can be set by wage-setters. However, disinflation is not costly at all if there are no nominal rigidities and agents have rational forward looking expectations. In this case, the policy maker simply has to announce a lower inflation target.

 Explain the Lucas supply equation stating clearly the role that is played by imperfect information. Contrast Lucas's model with Friedman's model in the Appendix where imperfect information also plays a role.

ANSWER: The Lucas Supply equation as in Equation 3.2 can be written as:  $y = y_e + \frac{1}{\alpha}(\pi - \pi^E)$  where the last term is the inflation surprise. Output only deviates from its equilibrium level in the case of an inflation surprise (or price level surprise). This is because firms might react to an increase in prices (inflation) believing that the rise is only due to an increase in the relative price of the good they produce and not a general increase in prices. Firms are not perfectly informed about the type of price increase they are facing. In Friedman's model, imperfect information affects workers who are not able to observe the actual price index for their consumption bundle and therefore base their labour supply on expected real wages where they use last period's price index to form their expectation. Whenever the ratio between prices and expected prices increases, the labour supply shifts to the right while labour demand increases because of the fall in real wages as shown in Fig. 3.14. In Friedman's model, workers use adaptive expectations and in Lucas's model, firms use rational expectations. Friedman's model is therefore subject to the Lucas critique.

5. Describe what happens in the economy following an inflation shock in the following cases: (a) the central bank cares only about avoiding increased unemployment; (b) the central bank cares only about its inflation target; (c) the central bank cares about both increased unemployment and about achieving its inflation target.

ANSWER: The three different scenarios can be discussed as three different MR function coming from three different types of preferences. (a) If the CB only cares about unemployment the MRwill be vertical ( $y = y_e$ ) since the CB is willing to have any high rate of inflation in order to keep employment fluctuations to zero. In case (b) the MR is horizontal so that the elimination of the inflation shock takes place in one period, irrespective of the cost in terms of lower output. (c) is in between (a) and (b) with the slope of the MR reflecting inflation aversion compared to unemployment aversion. See also Chapter 3 Section 2.6 on gradualism versus cold turkey.

6. Following a temporary negative aggregate demand shock, why does unemployment go below the

*ERU* before the economy returns to medium-run equilibrium?

ANSWER: Starting from an equilibrium, a negative demand shock will shift the IS curve to the left at the unchanged interest rate and reduce output. This implies that inflation will fall (the economy moves south-west down the original Phillips curve) since at the lower level of output real wages are above the level consistent with the WS curve. Therefore a new Phillips curve will emerge at a lower level of lagged inflation. Inflation is below the target. In order to get inflation back up to the target, the central bank must cut the interest rate so as to boost output *above* equilibrium: this level is shown by the intersection of the MR curve and the new Phillips curve to the *right* of equilibrium output. The central bank will then adjust the economy back to equilibrium along the MR curve to the north-east.

- 7. Make a case for the use of an interest-rate based monetary policy rule by evaluating the pros and cons of two other monetary rules:
  - (a) maintaining a constant nominal interest rate and
  - (b) maintaining a constant growth rate of the money supply.

ANSWER: (a) Maintaining a constant nominal interest rate is problematic: consider a positive aggregate demand shock. This raises output and inflation, and in turn, expected inflation, assuming adaptive expectations. Since the nominal interest rate is fixed, and  $r = i - \pi^E$ , a rise in  $\pi^E$  leads to a fall in r and hence a further increase in aggregate demand. This takes the economy further away from equilibrium. (b) A constant money supply means that the central bank does not react to shocks, it only keeps the money supply growth rate fixed to deliver a certain level of inflation in the medium run. Adjustment occurs as described in Section 4 and in the appendix. However, as we have learnt from the 3-equation model, the central bank could intervene to bring the economy back on track and guide it towards the medium run equilibrium by using the interest rate tool. This avoids the protracted and complex adjustment path under a constant growth rate rule.

Explain what is meant by the sacrifice ratio in general and rank the alternative policies in Question
5 in terms of the sacrifice ratio involved.

ANSWER: The sacrifice ratio is cumulative unemployment required to achieve a given reduction in inflation. (b) and (c) have the same sacrifice ratio (this derives from the linear Phillips relation as explained in Section 2.6). In case (a) the sacrifice ratio is not defined because no reduction in inflation occurs.

- 9. If the central bank's monetary policy is an interest rate-based rule, what determines the money supply? What happens to the economy if there is a sudden fall in the demand for money? ANSWER: Money demand. There will be an immediate fall in money supply.
- 10. What factors affect the speed with which the economy returns to medium run equilibrium following a negative aggregate demand shock in the IS/LM model?

ANSWER: There are a number of factors: expectations, weakness of the Keynes effect or the Pigou effect, nominal rigidities, labour market rigidities and so on. The process is explained in the appendix.

## 1.2 Problems and questions for discussion

- QUESTION A: What factors influence the change in the unemployment rate associated with a given fall in output below trend? If the economy is experiencing rapid structural change, with employment shifting to different sectors (e.g. from 'old economy' to 'new economy' ones), how would you expect this to affect your answer to the first question? Could this account for the so-called 'jobless recoveries' discussed in the United States following the recessions in the early 1990s and early 2000s? [Useful reference: Erica Groshen and Simon Potter (2003), 'Has Structural Change Contributed to a Jobless Recovery?' (New York: Federal Reserve Bank of New York website)]
- QUESTION A: ANSWER: The observation of falling unemployment when output is below average is a version of Okun's law — e.g. if output is 1% points below average for a year, Okun's law predicts an increase in unemployment of less than 1 percentage point, say  $\omega$  (called omega), which we can call the Okun coefficient. Elements that contribute to the muted response of unemployment to output fluctuations are the following:

a) due to the adjustment costs of hiring and firing labour, employment will be reduced less than in proportion to output (labour hoarding) — i.e. the reduction in employment will reflect both the technical features of the production function and the costs of adjustment. Increasing returns to labour and large adjustment costs mean that the unemployment response to output below average will be small and vice versa. There has been recent debate in the US that the early 1990s recovery and the most recent one in the early 2000s have seen a change in the behaviour of the economy that lies behind the Okun coefficient: namely the recovery has been "jobless" with the recovery of output driven by productivity growth rather than by increased employment or hours. In the recovery phase, the usual (Okun's law) pattern is for labour hoarding to be unwound so there is a delayed response of employment to the recovery of output but for laid off workers to then be recalled. The hypothesis is that the weight of structural change in the economy in each of the two most recent recessions in the US may have increased with the consequence

of both less labour hoarding and less re-call of laid-off workers to previous firms/ industries: i.e. jobs will be permanently lost in particular sectors. This was followed in the early 1990s recession later than was typically the case in previous upswings by robust employment growth, with jobs being created in different sectors.

b) the link between the fall in employment and the rise in unemployment depends on what happens to the third labour market state, i.e. inactivity. If a fall in employment leads some of the workers laid off to withdraw into inactivity, then the rise in unemployment will be less than the fall in employment and the Okun coefficient will be low. More generally, the more pro-cyclical is the labour force, the smaller is Okun's coefficient.

- QUESTION B: Would you attribute the disappearance of the original stable Phillips curve to a change in the behaviour of workers or of the government?
- QUESTION B: ANSWER: It is probably the result of interactions between the two. While governments tried to exploit such a trade-off by attempting to run the economy at lower unemployment than the equilibrium (or expressed in Lucas's terms by producing 'surprise inflation'), workers became acquainted with that mechanism and therefore changed their expectations accordingly.
- QUESTION C: "In medium run equilibrium, the real rate of interest depends on fiscal policy but not on monetary policy." Do you agree? Does your answer apply to the nominal interest rate?
- QUESTION C: ANSWER: One way to think about this is to use the *IS* diagram placed above the Phillips diagram. The medium-run equilibrium output level is fixed by the supply side and this determines the vertical Phillips curve: draw a vertical line at equilibrium output in both diagrams. Monetary policy fixes the medium-run rate of inflation either via an inflation target or via a money supply target. So we now have a vertical line at equilibrium output (supply side) and a horizontal line at target inflation (monetary policy) in the bottom diagram. Now go up to the *IS* diagram and ask what determines the real interest rate. It is the *IS* curve i.e. where the *IS* curve cuts the vertical line at equilibrium output fixes the medium-run stabilizing real interest rate. So it is fiscal policy that determines the real interest rate in the medium run equilibrium. Do the experiment of changing fiscal policy ... the *IS* curve shifts. This changes the real interest rate consistent with medium run equilibrium. If the central bank changes its inflation target, this does not change the medium-run real interest rate. Think also at the composition of output in medium run, if there is an increase in government spending it means that one of the other components of aggregate demand has to fall given that output is unchanged in the medium run. Therefore the interest sensitive part of demand has to fall and this is due to the increase in the real interest rate.

What about the nominal interest rate? We now have the ingredients to answer this: given the real interest rate at the medium run equilibrium and the central bank's inflation target, we know what the medium-run nominal interest must be:  $r + \pi$  since inflation expectations must be fulfilled in the medium-run equilibrium. For the economy to remain in medium-run equilibrium, this is the nominal interest rate that the central bank must set.

QUESTION D: "Inflation is always and everywhere a monetary phenomenon." "Inflation reflects supply-side behaviour." "An expansionary fiscal policy leads to inflation." Take each statement separately and provide an evaluation of it. Would you conclude that policy to control inflation should be in the hands of a committee representing central bankers, representatives of wage- and price-setters and the government? Explain.

QUESTION D: ANSWER: We have seen how inflation is determined by the rate of growth of money supply or by the central bank's inflation target. The first quote reflects the fact that in medium-run equilibrium inflation is only determined by monetary policy. In equilibrium inflation is given by the intersection of the MR line and the vertical Phillips relation. So the supply side determines whether a particular level of output and unemployment is consistent with stable inflation. In the transition following a shock, the slope of the Phillips relation matters in determining the inflation path to the equilibrium. An inflation shock can also be caused by a supply-side change, e.g. a temporary interruption of supply due to the outbreak of a disease affecting agriculture. An expansionary fiscal policy leads to a burst of inflation if output temporarily increases above the equilibrium level, i.e. we have the standard inflation output path to the equilibrium. There would be too many conflicting interests in such a committee, depending on its mandate and independence, the central bank would want to keep inflation low; the government may be tempted especially before an election, to exploit the short run trade off between inflation and unemployment; and most probably also the wage setters and price setters would have an incentive to push up inflation indirectly especially if there is incertainty about the relationship between the central bank and the government. The conventional wisdom is that control of inflation has to be left to an independent central bank, while the other two sets of actors have to behave 'properly' if inflation is to be kept low and stable. For further discussion see Chapter 5 and for applications, see Chapter 17.