Carlin & Soskice: Macroeconomics

5 Monetary Policy

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 5. Monetary Policy

1.1 Checklist questions

1. 'If the economy has high but stable inflation, the government has much to lose and little to gain by reducing inflation to a low rate.' Explain and assess this statement.

ANSWER: This statement is true in some senses but wrong in others. Generally inflation is highly volatile when high. This therefore generates higher uncertainty and misallocation of resources coupled with the classic shoe-leather cost, the cost of frequently going to the bank to withdraw cash. There are also menu costs to take into account plus the fact that not everything is perfectly indexed in the economy. However in order to cut inflation to a low level the government has to accept a period of high unemployment (unless no nominal rigidities and rational forward looking expectations are assumed).

2. What are the advantages and disadvantages of an inflation rate of 3% as compared with one of zero per cent per annum? Would you advocate the replacement of the inflation target by a price level target?

ANSWER: Advantages of 3% cf. zero: this allows for real wage cuts without nominal wage cuts and may be necessary in the face of sectoral shocks in the labour market. Nominal wage cuts are hard to achieve. If a negative real interest rate is required, this requires some positive inflation since the nominal interest rate cannot be less than zero. Advantages of zero cf. 3%: the usual discussion of shoe leather costs and distortions if tax thresholds are not indexed. Potential for confusion between relative price changes and inflation (and hence misallocation): this is usually related to the fact that inflation is more variable when it is higher.

3. Explain what is meant by the central bank's loss function. How are the central bank's preferences reflected in the loss function? Use a numerical example and diagrams to explain how the central bank's preferences affect its reaction to a negative demand shock

ANSWER: We assume here that the central bank has an inflation target and that its output target is equilibrium output. The central bank cares about deviations of both inflation and output from its targets but it attaches different weights to them. A dry (inflation averse) central banker would weigh a departure of inflation from its target highly, while a 'wet' (unemployment averse) central banker would care more about the fluctuation of output from the target level (the *ERU*). Numerical example left to the reader.

4. How can the central bank diagnose what kind of shock has disturbed the economy?

ANSWER: The CB can look at the path of inflation/unemployment. A positive aggregate demand shock will trigger an increase in employment and in inflation, while a positive aggregate supply shock will trigger a fall in inflation. Using the 3-equation model, only aggregate demand shocks lead to immediate changes in output. Inflation or supply shocks lead to changes in inflation but not in output until the CB responds. This helps to distinguish between, for example, a negative aggregate demand shock and a positive supply shock: in both cases inflation falls but only in the first does output change, in this case, it falls. From the data on inflation and output it will be difficult for the CB to distinguish between a temporary and a permanent aggregate demand shock. It will need to make use of other indicators. Similarly it will be difficult to distinguish between an inflation shock and a supply shock initially. However, more information will be revealed as the CB implements its policy. These issues can be discussed by going through the above examples.

5. Compare the response of an inflation-targeting central bank to a permanent negative aggregate supply shock with that to a permanent negative aggregate demand shock.

ANSWER: The main difference is that while a negative supply shock will rise the ERU the aggregate demand shock does not. Therefore in the case of the supply shock the CB has to change its MR to be consistent with the new lower equilibrium value of output; diagrammatically, the MR line shifts to the left. After the shock inflation raises and therefore the CB has to increase the interest rate in order to achieve its inflation target. In the case of an aggregate demand shock activity will be depressed and inflation will fall, therefore the CB has to lower interest rates in order the expand demand and return to the inflation target.

6. Suppose there are two regions of the economy, in one of which the WS curve is quite steep and in the other, the WS is quite flat. Why might this be so? Compare the implications for inflation and unemployment of a common positive temporary aggregate demand shock. How should the central bank respond?

ANSWER: One explanation could be that the WS curve is convex, i.e. it is rather flat at high unemployment rates and rather steep at low unemployment rates. This would be consistent with the observation that unemployment is very different in the two regions. A convex WS curve is plausible, reflecting the weak disinflation effect of a rise in unemployment when it is already high. (For simplicity, assume that the PS curve is common to both regions.) Since the central bank sets the interest rate for the country as a whole, its response will be to raise the interest rate by less than is optimal in the region with the steep WS curve and by more than is optimal in the other region. 7. If a central bank adopts an interest-rate based monetary policy rule like a Taylor Rule rather than a monetary growth rate rule, what would you expect to happen to the money supply?

ANSWER. Assume to begin with that the demand for money is stable. Then the use of a Taylor Rule entails adjusting the interest rate to stabilize fluctuations in the economy: the money supply will therefore adjust in a countercyclical way so that money supply equals money demand at the level of output determined by the Taylor Rule. Implicitly, the LM curve will go through the intersection of the IS and the interest rate determined by the Taylor Rule. If there is instability in the demand for money, then the money supply will be allowed to adjust so that the desired interest rate is maintained.

- 8. In implementing a Taylor-type interest rate rule, does the central bank need to know anything more than the coefficients in the rule, its inflation target, and current output and inflation? ANSWER: The stabilizing real interest rate is needed, as well as the equilibrium level of output.
- 9. Write down the Taylor Rule in terms of the real interest rate. Holding the output gap constant, does a rise in inflation by x percentage points call for a rise in the *nominal* interest rate of more than, less than or by just x percentage points? Explain.

ANSWER: $r_0 - r_S = .5(\pi_0 - \pi^T) + .5(y_0 - y_e)$. Since a rise in inflation by x percentage points will raise the nominal interest rate by x, then in order for the real interest rate to rise by .5x, the nominal interest rate will have to rise by x + .5x = 1.5x, i.e. by 1.5 times x percentage points.

10. Under what circumstances, will a central bank utilizing an interest rate based monetary rule to stabilize the economy fail in its objective of raising output?

ANSWER: If the interest rate sensitive component of aggregate demand does not really react to a change in interest rates; if the change in the short run interest rate is not coupled by a sizeable fall in the long-run interest rate on which investment is based; in the deflation trap.

11. The central bank faces a short-run trade-off between inflation and unemployment (a) if inflation expectations are backward-looking or (b) if inflation expectations are rational but are formed before the central bank chooses its optimal inflation-output pair. Explain each of these cases. What difference does it make whether (a) or (b) holds?

ANSWER: If expectations are backward looking what matters for the Phillips curve is past inflation and therefore even if a different level of inflation is announced and even if it is credible it does not make any difference for the inflation path (see discussion in the chapter). On the other hand if expectations are rational (based on the information set available at the time of the decision and not allowing for systematic mistakes) there is a fundamental role for announcements and credibility.

However in both cases there is always a trade-off in the short-run between inflation and unemployment since once the public has fixed its expectations the CB can always reach a lower loss if it trades some extra inflation for a higher output (assuming that the target output is higher than the equilibrium one); graphically it can be seen in Fig. 5.13.

12. Explain what is meant by the statement that a government that is determined to reduce inflation may have a problem in achieving this outcome because of a lack of credibility.

ANSWER: There are a number of ways of approaching this question. One is to discuss it in terms of time inconsistency. Although the government may 'be determined' to reduce inflation, the question is whether lower inflation — say, its new target — is consistent with its preferences. If not, then it will be not able to achieve the target because wage and price setters will figure out that it is aiming for unemployment below equilibrium with the implication that were they to reduce inflation expectations to the target, the government would choose to exploit the short-run trade off. In the knowledge of this, the private sector will not adjust their expectations and a fall in inflation to the target will not occur. Another approach is to take the case where the government has not only adopted a low inflation target but has also realized that it can only achieve this if it reduces its output target to the equilibrium level. It announces this to the public. However, perhaps because of long experience, the public is sceptical of the government's claims and they do not alter their expectations. The government will now be choose to impose a deflationary policy, i.e. they will raise the interest rate. The reason is that given their new preferences, the MR line has shifted to the left and given the Phillips curve, their preferred output level is lower. They will therefore be prepared to reduce output and thereby prove to the public that their utility is higher at lower output. This is a method of establishing credibility.

1.2 Problems and questions for discussion

QUESTION A: What are the incentives for a policy-maker to exploit the short-run trade-off between unemployment and inflation? What are the consequences? Is this a good description of contemporary central bankers? Use official reports of a central bank of your choice to provides support for your argument.

QUESTION A: ANSWER: Many of the issues are covered in the answers to Questions 11 and 12. The question is asking the students to think about how realistic the time inconsistency model

is when applied to contemporary central bankers. Many recent discussions suggest that central bankers 'understand the model' and are not 'over-ambitious'. Their reputations depend on achieving the inflation target so they are not tempted to exploit the short-run trade-off.

Last part left to the reader.

QUESTION B: Consider a Central Bank that maximizes the following utility function:

$$Z = k(y - y_e) - (\pi - \pi^T)^2$$

where k is a positive constant. Its policy instrument is the growth rate of the money supply, γ_M . Assume that the inflation target is $\pi^T = 0$. Explain this utility function and compare it with the loss function used in the chapter (Hint: focus on how the central bank's utility rises with output. Is this central bank 'over-ambitious'?) Now assume that the central bank sets the money supply growth rate after economic agents have incorporated their expectations about inflation into their decision-making, and thus faces a Phillips Curve:

$$\pi = \pi^E + \alpha (y - y_e)$$

a) Assuming that agents have rational expectations, solve algebraically for the optimal inflation rate under discretion, i.e. find the inflation rate that the central bank will choose using its monetary policy instrument, γ_M . (Hint: maximize utility with respect to γ_M , having used the Phillips curve to substitute for y in the utility function; and used $\gamma_M = \pi$ to substitute for π .)

b) Suppose that, before private-sector inflation expectations were formed, the central bank could commit to a particular rate of inflation. What would that rate be? Discuss.

c) Now return to the case of discretion, and suppose that we extend the model to cover two periods. In other words, the central bank now cares about the sum of its loss functions in each period, i.e.

Total utility =
$$\left[k(y_1 - y_e) - (\pi_1 - \pi^T)^2\right] + \left[k(y_2 - y_e) - (\pi_2 - \pi^T)^2\right]$$

where the subscripts indicate the period.

Suppose also that in the first period, agents expect no inflation ($\pi^E = 0$), while when the second period arrives agents expect that inflation will be equal to the rate that actually occurs in the first round (i.e. expectations are adaptive, so $\pi_2^E = \pi_1$). What will be the equilibrium rates of output and inflation in each period?

QUESTION B: ANSWER: The unusual feature of the utility function is that the output component

is introduced linearly and therefore the CB derives utility from actual output higher then equilibrium output and in this sense it can be considered overambitious since we know that the only long-run equilibrium is given by $y = y_e$.

a) Following the hints in the question, the result is $\gamma_M = \frac{k}{2\alpha}$, the CB delivers a higher inflation the higher is the weight attached to output (k) and the lower is the reaction of inflation (α) to output deviation from equilibrium in the Phillips relation.

b) The CB would commit to 0, since it is the rate that maximizes utility.

c) $\pi_1 = 0$; $\pi_2 = \frac{k}{2\alpha}$; $y_1 = y_e$; $y_2 = y_e + \frac{k}{2\alpha}$. The CB would deliver the expected inflation in the first period and then surprise the public by a higher inflation in the second one, this would allow output in the second period to be above the equilibrium rate.

QUESTION C: Is there a trade-off between stabilizing inflation and stabilizing the real side of the economy? Explain.

QUESTION C: ANSWER: Let us assume that the economy is subject to random inflation shocks. We can then compare two central banks, both of which have the same inflation target and the same form of loss function (as studied in Chapter 5). However, one places a high weight on minimizing inflation fluctuations ($\beta > 1$) and the other places a high weight on minimizing output fluctuations ($\beta < 1$). The average amplitude of output fluctuations around the equilibrium will be greater in the $\beta > 1$ case (flatter *MR* line) but inflation will be stabilized more effectively. In the $\beta < 1$ case, the economy is kept quite close to equilibrium output but inflation is more unstable.

QUESTION D: Using Fig. 5.8 as a guide, draw the corresponding diagram to illustrate the lag structure in the standard version of the 3-equation model. Now assume that there is no lag between a change in the interest rate and its effect on output. Draw a diagram to illustrate this lag structure. Use all three figures to provide a concise summary of the role of lags in the operation of monetary policy. Go to the website of one of the central banks listed in the next question (or another one of your choice) and find out their view about the lags between a change in the interest and its effects on output and inflation. Do they identify the same factors as responsible for the lags?

QUESTION D: ANSWER: Left to the reader to solve using the hints given both here and in the book. This is discussed in detail in Wendy Carlin and David Soskice (2005) 'The 3-Equation New Keynesian Model: A Graphical Exposition' Contributions to Macroeconomics.

http://www.bepress.com/bejm/contributions/vol5/iss1/art13

QUESTION E: Select two out of the following central banks: Bank of England, Reserve Bank of New Zealand, Bank of Canada and the Swedish Riksbank. Each of these central banks has adopted

explicit "inflation-targeting". For each of your chosen banks, find out how it explains what this means to the public. How does it communicate and explain its interest rate decisions to the public? Compare what each central bank did and how it explained its actions following the events of September 11th 2001.

QUESTION E: ANSWER: Left to the reader.