1 Solutions to Problem Set 1: Open Economy

1. Mankiw, Chapter 5, Problem 1. Use the model of the small open economy to predict what would happen to the trade balance, the real exchange rate, and the nominal exchange rate in response to each of the following events.

(a) A fall in consumer confidence about the future induces consumers to spend less and save more.

An increase in saving shifts the \((S - I)\) schedule to the right, increasing the supply of national currency (pounds) available to be invested abroad. The increased supply of pounds causes the equilibrium real exchange rate to fall from \(\epsilon_1\) to \(\epsilon_2\). Because the pound becomes less valuable, domestic goods become less expensive relative to foreign goods, so exports rise and imports fall. This means that the trade balance increases. The nominal exchange rate falls following the movement of the real exchange rate, because prices do not change in response to this shock.

(b) The introduction of a stylish line of Toyotas makes some consumers prefer foreign cars over domestic cars.

The introduction of a stylish line of Toyotas that makes some consumers prefer foreign cars over domestic cars has no effect on saving or investment, but it shifts the \(N(\epsilon)\) schedule inward. The trade balance does not change, but the real exchange rate falls from \(\epsilon_1\) to \(\epsilon_2\). Because prices are not affected, the nominal exchange rate follows the real exchange rate.
(c) The introduction of automatic teller machines that reduces the demand for money. In the model under consideration, the introduction of ATMs has no effect on any real variables. The amounts of capital and labor determine output $Y$. The world interest rate $r^*$ determines investment $I(r^*)$. The difference between domestic saving and domestic investment $(S - I)$ determines net exports. Finally, the intersection of the $NX(e)$ schedule and the $(S - I)$ schedule determines the real exchange rate. The introduction of ATMs, by reducing money demand, does affect the nominal exchange rate through its effect on the domestic price level. The price level adjusts to equilibrate the demand and supply of real balances, so that $M/P = (M/P)^d$. If $M$ is fixed, then a fall in $(M/P)^d$ causes an increase in the price level: this reduces the supply of real balances $M/P$ and restores equilibrium in the money market. The formula for the nominal exchange rate is $e = e \times (P^*/P)$. We know that the real exchange rate remains constant, and we assume that the foreign price level $P^*$ is fixed. When the domestic price level $P$ increases, the nominal exchange rate $e$ depreciates.

2. Consider Syldavia, a small open economy. A change in world fashion makes its exports unpopular and imports from other countries more popular. Using the 2-period model seen in class, explain why it cannot lead to a permanent fall in exports and increase in imports.

We know that:

$$X_1 + \frac{X_2}{1+r} = M_1 + \frac{M_2}{1+r}$$

so if both $X_1$ and $X_2$ fall, $M_1$ and $M_2$ cannot both increase.

Intuitively, exports and imports have to add up, noone wants to ship goods to a foreign agent without getting anything back. So, following the change in fashion, the price (called exchange rate) adjusts and we start to export more of other things and import less.

3. Mankiw, Chapter 5, Problem 4. In 2005, US Federal Reserve Governor Ben Bernanke said in a speech: “Over the past decade a combination of diverse forces has created a significant increase in the global supply of saving – a global saving glut – which helps to explain both the increase in the US current account deficit [a broad measure of the trade deficit] and the relatively low level of long-term real interest rates in the world today”.

Is this statement consistent with the models you have learned? Explain

The global saving glut implies a lower interest rate:
This lower world interest rate increases investment in the US:
Thus net exports decrease, which implies an increase in the US current account deficit.
So the statement is consistent with the models you’ve learned.

4. Mankiw, Chapter 5, Problem 5. What will happen to the trade balance and the real exchange rate of a small open economy when the government purchases increase, such as during a war? Does your answer depend on whether this is a local war or a global war?
The increase in government spending decreases government saving and, thus, decreases national saving; this shifts the saving schedule to the left. Given the world interest rate \( r^* \), the decrease in domestic saving causes the trade balance to fall.

The figure below shows the impact of this increase in government purchases on the real exchange rate.
The decrease in national saving causes the \((S-I)\) schedule to shift to the left, lowering the supply of dollars to be invested abroad. The lower supply of dollars causes the equilibrium real exchange rate to rise. As a result, domestic goods become more expensive relative to foreign goods, which causes exports to fall and imports to rise. In other words, the trade balance falls.

The answer to this question does depend on whether this is a local war or a world war. A world war causes many governments to increase expenditures; this increases the world interest rate \(r^*\). The effect on a country's external accounts depends on the size of the change in the world interest rate relative to the size of the decrease in saving. For example, an increase in the world interest rate could cause a country to have a smaller trade deficit, as in this figure:

or even perhaps a trade surplus:
5. Mankiw, Chapter 5, Problem 10. “Travelling in Mexico is much cheaper now than it was ten years ago,” says a friend. “Ten years ago, a dollar bought 10 pesos; this year, a dollar buys 15 pesos.” Is your friend right or wrong? Given that total inflation over this period was 25 percent in the United States and 100 percent in Mexico, has it become more or less expensive to travel in Mexico? Write your answer using a concrete example—such as an American hot dog versus a Mexican taco—that will convince your friend.

The easiest way to tell if your friend is right or wrong is to consider an example. Suppose that ten years ago, an American hot dog cost $1, while a Mexican taco cost 10 pesos. Since $1 bought 10 pesos ten years ago, it cost the same amount of money to buy a hot dog as to buy a taco. Since total U.S. inflation has been 25 percent, the American hot dog now costs $1.25. Total Mexican inflation has been 100 percent, so the Mexican taco now costs 20 pesos. This year, $1 buys 15 pesos, so that the taco costs 20 pesos/15 pesos/dollar = $1.33. This means that it is now more expensive to purchase a Mexican taco than a U.S. hot dog. Thus, your friend is simply wrong to conclude that it is cheaper to travel in Mexico. Even though the dollar buys more pesos than it used to, the relatively rapid inflation in Mexico means that pesos buy fewer goods than they used to—it is more expensive now for an American to travel there.
2 Solutions to Problem Set 2: Okun’s Law and Keynesian cross

1. Consider the following data on the growth rate and the unemployment rate for Germany, Spain, and the U.S.

<table>
<thead>
<tr>
<th>Year</th>
<th>Germany</th>
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<th>Spain</th>
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<th>U.S.</th>
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<td>7.5</td>
<td>5</td>
<td>11.1</td>
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<td>4</td>
</tr>
<tr>
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<td>3.6</td>
<td>10.4</td>
<td>1.1</td>
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<td>2.7</td>
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<td>1.8</td>
<td>5.8</td>
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<tr>
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<td>−3.6</td>
<td>18</td>
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<td>7</td>
<td>−0.4*</td>
<td>19.9</td>
<td>2.7*</td>
<td>9.7</td>
</tr>
</tbody>
</table>

*: estimated/predicted. Sources: OECD and Eurostat.

1. (a) Does Okun’s law hold for each of these countries taken individually?

If we represent \( g_{yt} \) (X-axis) against \( u_t - u_{t-1} \) (Y-axis), a negative relation seems to hold in all three cases (but the relation is perhaps less evident for Germany).
b. Let $u_t$ and $g_{yt}$ respectively denote the unemployment rate and the growth rate in year $t$, and $\overline{g}_y$ the “normal growth rate”. Assume an Okun’s Law of the form $u_t - u_{t-1} = \beta \overline{g}_y - \beta g_{yt}$. Which would be the value(s) of $\overline{g}_y$ and $\beta$ that you would consider for each of these three countries? (Hint: graphically represent the observations and choose a line that fits them well)

The idea is to choose a linear relation that fits well the observations. The absolute value of the slope gives the value of $\beta$ and the value of the intercept $a = \beta \overline{g}_y$ enables us to determine $\overline{g}_y$ once we know $\beta$. It is not easy to determine graphically which is a line which fits well the data, but at least we can say that the line is the steepest for Spain and the less steep for Germany, so $\beta_{\text{SPAIN}} > \beta_{\text{US}} > \beta_{\text{GERMANY}}$. A more precise way of getting the best values of $\overline{g}_y$ and $\beta$ is to do a regression (but you are not expected to know how to do it!). In this case, we get for Germany $\overline{g}_y = 0.35$ and $\beta = 0.17$ and we cannot actually reject that $\beta = 0$. For the U.S., instead $\overline{g}_y = 2.62$, $\beta = 0.66$ and we can say that $\beta$ is actually different from 0. For Spain, $\overline{g}_y = 3.01$, $\beta = 0.95$, and we can say that $\beta$ is actually different from 0.

c. If your chosen values for $\beta$ are different for the three countries under consideration, which characteristics of these economies could be behind such differences?

In Germany, unemployment seems to remain almost constant independently of growth. This may be due partly to the fact that most workers have permanent contracts with relatively high firing costs (implying low levels of hiring and firing) and that firms change the number of
hours depending on the strength of demand (during the financial crisis, firms have reduced the number of hours of workers - and thus their total wages - and this seems to be one of the reasons why unemployment has not risen in Germany).

Spain: dual labour market, with temporary contracts representing a large share of contracts. This means that firms hire a lot in good times and fire a lot in bad times.

U.S.: firing costs lower than in Germany (but more expensive that in Spain for temporary contracts): unemployment depends more on growth than in Germany, and less than in Spain).

2. Government are often reluctant to run budget deficits. Here we examine whether policy changes in $G$ and $T$ that maintain a balanced budget are macroeconomically neutral. Put another way, we examine whether it is possible to affect output through changes in $G$ and $T$ so that the government budget remains balanced.

a. Consider $Y = \frac{1}{1-c_1}(c_0 + T + G - c_1 T)$. By how much does $Y$ increase when $G$ increases by one unit?

$Y$ increases by $1/(1-c_1)$.

b. By how much does $Y$ decrease when $T$ increases by one unit?

$Y$ decreases by $c_1/(1-c_1)$.

c. Why are your answers to (a) and (b) different?

The answers differ because spending affects demand directly, but taxes affect demand through consumption, and the propensity to consume is less than one.

d. Now suppose that the economy starts with a balanced budget, $T = G$, and that $G$ and $T$ increase by exactly one unit. Using your answers to part (a) and (b), what is the change in equilibrium GDP? Are balanced-budget changes in $G$ and $T$ macroeconomically neutral?

The change in $Y$ equals $1/(1-c_1) - c_1/(1-c_1) = 1$. Balanced budget changes in $G$ and $T$ are not macroeconomically neutral.

e. How does the propensity to consume affect your answer? Why?

The propensity to consume has no effect because the balanced budget tax increase aborts the multiplier process. $Y$ and $T$ both increase by one unit, so disposable income, and hence consumption, do not change.

3. Mankiw, Chapter 10, Problem 2. In the Keynesian cross, assume that the consumption function is given by

$$C = 200 + 0.75(Y - T)$$

Planned investment is 100; government purchases and taxes are both 100.

a. Graph planned expenditure as a function of income.

Total planned expenditure is

$$PE = C(Y - T) + I + G$$

Plugging in the consumption function and the values for investment $I$, government purchases $G$, and taxes $T$ given in this question, total planned expenditure $PE$ is:

$$PE = 200 + 0.75(Y - 100) + 100 + 100 = 0.75Y + 325$$

Graphically,
b. What is the equilibrium level of income?

To find the equilibrium level of income, combine the planned-expenditure equation derived in part (a) with the equilibrium condition \( Y = PE \):

\[
Y = 0.75Y + 325 \Leftrightarrow Y = 1300.
\]

c. If government purchases increase to 125, what is the new equilibrium income?

If government purchases increase to 125, then the planned expenditure changes to \( PE = 0.75Y + 350 \). Equilibrium income increases to \( Y = 1400 \). Therefore, an increase in government purchases of 25 (i.e. \( 125 - 100 = 25 \)) increases income by 100. This is what we expect to find, because the formula for the government-purchases multiplier is \( 1/1 - MPC \), the MPC (marginal propensity to consume) is 0.75, and the government-purchases multiplier therefore has a numerical value of 4.

d. What level of government purchases is needed to achieve an income of 1,600?

An income level of 1,600 represents an increase in 300 over the original level of income. The government-purchases multiplier is \( 1/1 - MPC \): the MPC in this example equals 0.75, so the government-purchases multiplier is 4. This means that government purchases must increase by \( 300/4 = 75 \) (to a level of 175) for income to increase by 300.
3 Solutions to Problem Set 3: IS-LM

1. Mankiw, Chapter 10, Problem . Suppose that the money demand function is

\[
\left( \frac{M}{P} \right)^d = 1,000 - 100r,
\]

where \( r \) is the interest rate in percent. The money supply \( M \) is 1,000 and the price level \( P \) is 2.

a. Graph the supply and demand for real money balances.

The downward sloping line in the Figure below represents the money demand function \( \left( \frac{M}{P} \right)^d = 1,000 - 100r \). With \( M = 1,000 \) and \( P = 2 \), the real money supply is \( (M/P)^s = 500 \). The real money supply is independent of the interest rate and is, therefore, represented by a vertical line.

b. What is the equilibrium interest rate?

We can solve for the equilibrium interest rate by setting the supply and demand for real balances equal to each other:

\[
500 = 1000 - 100r \iff r = 5
\]

c. Assume that the price level is fixed. What happens to the equilibrium interest rate if the supply of money is raised from 1,000 to 1,200?

If the price level remains fixed at 2 and the supply of money is raised from 1,000 to 1,200, then the new supply of real balances \( (M/P)^s \) equals 600. We can solve for the new equilibrium interest rate by setting the new \( (M/P)^s \) equal to \( (M/P)^d \):

\[
600 = 1000 - 100r \iff r = 4
\]

Thus, increasing the money supply from 1,000 to 1,200 causes the equilibrium interest rate to fall from 5 percent to 4 percent.
d. If the Fed wishes to raise the interest rate to 7 percent, what money supply should it set? 

To determine at what level the Fed should set the money supply to raise the interest rate to 7 percent, set \((M/P)^e\) equal to \((M/P)^d\): 

\[
M/P = 1000 - 100r
\]

Setting the price level at 2 and substituting \(r = 7\), we find:

\[
M/2 = 1000 - 100 \times 7 \Leftrightarrow M = 600.
\]

For the Fed to raise the interest rate from 5 percent to 7 percent, it must reduce the nominal money supply from 1,000 to 600.

2. Consider the short run impact of an exogenous increase in public expenditures in a closed economy.

a. Assume first that the interest rate and the price are given (exogenous). Graphically represent the impact of an exogenous increase in public expenditures in (i) a Keynesian cross diagram (ii) an IS-LM diagram.

(i) Keynesian cross diagram: Assume that \(G_1 > G_0\).

![Keynesian cross diagram](image)

(ii) IS-LM diagram

![IS-LM diagram](image)
b. Assume next that the interest rate is endogenous (while the price remains exogenous). Graphically represent the impact of an exogenous increase in public expenditures in (i) an IS-LM diagram (ii) a Keynesian cross diagram.

(i) IS-LM diagram:

(ii) Keynesian cross diagram

2. Mankiw, Chapter 11, problem 4. Explain why each of the following statements is true. Discuss the impact of monetary and fiscal policy in each of these special cases.

a. If investment does not depend on the interest rate, the IS curve is vertical.

The IS curve represents the relationship between the interest rate and the level of income that arises from equilibrium in the market for goods and services. That is, it describes the combinations of income and the interest rate that satisfy the equation:

\[ Y = C(Y - T) + I(r) + G \]

If investment does not depend on the interest rate, i.e. if

\[ Y = C(Y - T) + I + G \]
then nothing in the IS equation depends on the interest rate and we get the same level of equilibrium income no matter the level of the interest rate. For this reason, the IS is vertical. When the IS is vertical, monetary policy has no effect on output, because the IS curve determines \( Y \). Monetary policy can only affect the interest rate. Instead fiscal policy is effective.

b. If money demand does not depend on the interest rate, the LM curve is vertical. The LM curve represents the combinations of income and the interest rate at which the money market is in equilibrium. If money demand does not depend on the interest rate, then we can write the LM equation as

\[
\frac{M}{P} = L(Y).
\]

For any given level of real balances \( \frac{M}{P} \), there is only one level of income at which the money market is in equilibrium. Thus, the LM is vertical. Fiscal policy has no effect on output: it can affect only the interest rate. Monetary policy is effective: a shift in the LM curve increases output.

c. If money demand does not depend on income, the LM curve is horizontal. If money demand does not depend on income, then we can write the LM equation as \( \frac{M}{P} = L(r) \). For any given level of real balances \( \frac{M}{P} \), there is only one level of the interest rate at which the money market is in equilibrium. Hence the LM curve is horizontal. Fiscal policy is very effective: output increases by the full amount that the IS curve shifts. Monetary policy is also effective: an increase in the money supply causes the interest rate to fall, so the LM curve shifts down.

d. If money demand is extremely sensitive to the interest rate, the LM curve is horizontal. The LM curve gives the combinations of income and the interest rate at which the supply and the demand for real balances are equal, so that the money market is in equilibrium. The general form of the LM equation is:

\[
\frac{M}{P} = L(r,Y).
\]

Suppose income \( Y \) increases by \( \Delta Y \). How much must the interest rate change to keep the money market in equilibrium? The increase in \( Y \) increases money demand. If money demand is extremely sensitive to the interest rate, then it takes a very small increase in the interest rate to reduce money demand and restore the equilibrium in the money market. Hence, the LM curve is nearly horizontal.

If money demand is very sensitive to the interest rate, then fiscal policy is very effective: with a horizontal LM curve, output increases by the full amount as the IS curve shifts. Monetary policy is now completely ineffective: an increase in the money supply does not shift the LM curve at all.
4 Solutions to Problem Set 4: AD-AS

1. Suppose that investment is not responsive to the interest rate.
   a. Can you think of a situation where this may happen?
      Open question. Firms may be so pessimistic about sales that they do not want to borrow at any interest rate.
   b. What does it imply for the IS curve?
      The IS curve is vertical; the interest rate does not affect equilibrium output.
   c. What does it imply for the LM curve?
      No change.
   d. What does it imply for the AD curve? Explain.
      The AD curve is vertical. The price level does not affect equilibrium output, as the link from prices to aggregate demand would go through the effects of interest rates on investment.

2. Consider the short run impact of an exogenous increase in public expenditures in a closed economy in which both the interest rate and the price are assumed to be endogenous. Graphically represent the impact of such an increase in (i) a AD-AS diagram (ii) an IS-LM diagram (iii) a Keynesian cross diagram.

   (i) AD-AS diagram

   (ii) IS-LM diagram
3. Mankiw, Chapter 9, Problem 2. Suppose the Fed reduces the money supply by 5 per cent.

a. What happens to the aggregate demand curve? If the Fed reduces the money supply, the equilibrium interest rate in the money market goes up. For a given level of $Y$, this corresponds to an inward shift of the LM curve which lowers output. As a result, in the AD-AS, for a given level of $P$ the output level is now lower, which corresponds to an inward shift in the AD curve.

b. What happens to the level of output and the price level in the short run and in the long run? In the short run, if we are assuming that the AS curve is horizontal, prices do not change and all the inward shift in the AD curve translates into a reduction in output. Instead, if we assume that the AS curve is upward sloping (as implied for example by the sticky price model), the price actually falls in the short run, and output still falls, but to a lower extent. In the long run, the output level depends only on the aggregate supply conditions (the AS curve is vertical) and therefore output does not change and the decrease in the money supply ends up translating only into a fall of prices.

c. According to Okun’s law, what happens to unemployment in the short run and in the long run? In the short run, as the level of output is below its natural level, the unemployment rate is increasing. In the long run, given that output goes back to its natural level, the unemployment rate goes back to its natural level also.
4. Consider an unexpected increase in the demand for money in the economy. The increase in the demand for money implies an increase in interest rates.

(a) What are the short run effects on price level and output? The increase in interest rates leads to a contraction on investment. Hence, the aggregate demand curve shifts right and both $P$ and $Y$ fall.

(b) Suppose the Central Bank cares only about keeping the price level stable. What should the Central Bank do? If the Central Bank cares only about keeping the price level stable, it should increase the money supply, so that the AD curve will get back to the initial position and prices will be as before.

(c) Suppose the Central Bank cares only about keeping output stable. What should the Central Bank do? If the Central Bank cares only about keeping output stable, it should increase the money supply, so that the AD curve will get back to the initial position and output will be as before.

In sum, this is simple: if the demand for money increases, the Central Bank should increase the money supply and the economy will be stable.
5 Solutions to Problem Set 5: the Phillips curve

1. Mankiw, Chapter 13, Problem 2. Suppose that an economy has the Phillips curve

\[ \pi = \pi_{-1} - 0.5(u - 0.06) \]

(a) What is the natural rate of unemployment?

The natural rate of unemployment is the rate at which inflation does not deviate from the expected inflation rate. Here, the expected inflation rate is just last period's actual inflation. Setting the inflation rate equal to last period's inflation rate, i.e. \( \pi = \pi_{-1} \), we find that \( u = 0.06 \). Thus, the natural rate of unemployment is 6%.

(b) Graph the short-run and long-run relationships between inflation and unemployment.

In the short run (that is, in a single period) the expected inflation rate is fixed at the level of inflation in the previous period, \( \pi_{-1} \). Hence, the short-run relationship between inflation and unemployment is just the graph of the Phillips curve: it has a slope of \(-0.5\), and it passes through the point where \( \pi = \pi_{-1} \) and \( u = 0.06 \). In the long run, expected inflation equals actual inflation, so that \( \pi = \pi_{-1} \), and output and unemployment equal their natural rates. The long-run Phillips curve thus is vertical at an unemployment rate of 6 percent.

(c) How much cyclical unemployment is necessary to reduce inflation by 5 percentage points?

To reduce inflation, the Phillips curve tells us that unemployment must be above its natural rate of 6 percent for some period of time. We can write the Phillips curve in the form

\[ \pi - \pi_{-1} = -0.5(u - 0.06) \]

Since we want inflation to fall down by 5 percentage points, we want \( \pi - \pi_{-1} = -0.05 \). Plugging this into the left-hand side of the last equation, we find:

\[ -0.05 = -0.5(u - 0.06) \]

i.e. \( u = 0.16 \). Hence, we need 10 percentage points of cyclical unemployment above the natural rate of 6 percent.
(d) Inflation is running at 10 per cent. The central bank wants to reduce it to 5 per cent. Give two scenarios that will achieve that goal.

One scenario is to have very high unemployment for a short period of time. For example, we could have 16 percent unemployment for a single year. Alternatively, we could have a small amount of cyclical unemployment spread out over a long period of time. For example, we could have 8 percent unemployment for 5 years. Both of those plans would bring the inflation rate down from 10 percent to 5 percent, although at different speeds.

2. Suppose the Phillips curve is given by

\[ \pi_t = \pi^e_t + 0.1 - 2u_t \]

where \( \pi^e_t = \theta \pi_{t-1} \). Also, suppose that initially \( \theta = 0 \).

a. What is the natural rate of unemployment \( u_n \)?

\( u_n = 0.1/2 = 0.05 \) (i.e. 5 percent)

b. Suppose that initially unemployment is equal to the natural rate. In year \( t \) the authorities decide to bring the unemployment rate down to 3% and hold it there forever. Determine the rate of inflation in years \( t, t+1, t+2, t+10, t+15 \).

\( \pi_{t+1} = 0.1 - 2 \times 0.03 = 0.04 \), i.e. 4 percent for all \( i \geq 0 \).

c. Do you believe your answer in (b)? (Hint: think about how inflation and expectations are formed.)

Answers to (b) imply \( \pi^e_{t+i} = 0 \) and \( \pi_{t+i} = 4\% \) forever. Inflation expectations will be forever wrong, and this is unlikely.

d. Now suppose that in year \( t+5 \), \( \theta \) increases from 0 to 1. What is the effect on \( u_u \)?

\( \theta \) might increase because people’s inflation expectations adapt to persistently positive inflation. The increase in \( \theta \) has no effect on \( u_u \).

e. Suppose that the government is still determined to keep unemployment at 3% forever. What will the inflation rate be in years \( t+5, t+10, t+15 \)?

\( \pi_{t+5} = \pi_{t+4} + 0.1 - 0.06 = 4\% + 4\% = 8\% \). For \( i > 5 \), repeated substitution implies, \( \pi_{t+i} = \pi_{t+5} + (i - 5) \times 4\% \). So \( \pi_{t+10} = 28\%; \pi_{t+15} = 48\% \).

f. Do you believe the answer in (e)?

Inflation expectations will again be forever wrong. This is unlikely in the long run.

3. Mankiw, Chapter 13, Problem 3. According to the rational-expectations approach, if everyone believes that policy makers are committed to reducing inflation, the cost of reducing inflation – the sacrifice ratio – will be lower than if the public is sceptical about the policy makers’ intentions. Why might this be true? How might credibility be achieved?

The cost of reducing inflation comes from the cost of changing people’s expectations about inflation. If expectations can be changed costlessly, then reducing inflation is also costless. Algebraically, the Phillips curve tells us that

\[ \pi = \pi^e - \beta(u - u_n) + \nu \]

If the government can lower expected inflation \( \pi^e \) to the desired level of inflation, then there is no need for unemployment to rise above its natural rate.

According to the rational-expectations approach, people form expectations about inflation using all of the information that is available to them. This includes information about current policies in effect. If everyone believes that the government is committed to reducing inflation, then expected inflation will immediately fall. In terms of the Phillips curve, \( \pi^e \) falls immediately with little or no cost to the economy. That is, the sacrifice ratio will be very small.
On the other hand, if people do not believe that the government will carry out its intentions, then $\pi^e$ remains high. Expectations will not adjust because people are skeptical that the government will follow through on its plans.

Thus, according to the rational-expectations approach, the cost of reducing inflation depends on how resolute and credible the government is. An important issue is how the government can make its commitment to reducing inflation more credible. One possibility, for example, is to appoint people who have a reputation as inflation fighters. A second possibility is to have laws requiring the Central Bank to lower inflation. Of course, people might expect the Central Bank to ignore this law, or expect the legislator to change the law later. A third possibility is to pass a constitutional amendment limiting monetary growth. People might rationally believe that a constitutional amendment is relatively difficult to change.
6 Solutions to Problem Set 6: Macro Policy Debates


Assume that the preferences of the benevolent policy maker can be represented through the following loss function (i.e., the utility of the policy maker is higher the lower the loss)

\[ L = \frac{a}{2} \pi^2 - b(\pi - \pi^e) \]

where \( a \) and \( b \) are two positive constants, \( \pi \) is inflation, and \( \pi^e \) expected inflation.

(a) Provide an interpretation for the first term of the loss function

The first term indicates that the policy maker dislikes inflation, as the size of the loss increases when inflation goes up \( \frac{\partial L}{\partial \pi} = a \pi \). Note that the marginal cost of inflation to the policy maker is increasing, since the specification of the first term is quadratic \( \frac{\partial^2 L}{\partial \pi^2} = a \).

(b) Does the policy maker care about unemployment?

The second term of the loss function represents the benefits from inflation shocks: the loss is lower when inflation is above its expected value. This can be interpreted as representing indirectly a preference for low unemployment. From the expectations-augmented Phillips curve, \( \pi - \pi^e = -\alpha(u - u_n) \) so if the current unemployment rate is below its natural rate, current inflation is above expected inflation, and the value of the loss function is ceteris paribus smaller.

(c) Assume that the policy maker announces an intention to achieve zero inflation, and that this is believed by the agents. Show that it is optimal for the policy maker to deviate from its initial announcement. Explain.

In that case, \( \pi^e = 0 \). The policy maker will not deviate from its initial announcement if and only if \( \pi = 0 \) is the inflation rate that minimises the loss. However, minimising \( L \) subject to \( \pi^e = 0 \) generates an optimal inflation rate of \( b/a \) and a loss of \( -b^2/2a \), which is smaller than the loss achieved by following the announced rule. The gain comes from the benefit of surprise inflation in lowering unemployment below the natural rate. Note that the form of the loss function implies that the cost of inflation is zero (at the margin) when inflation is zero, so there is always some gain to surprise inflation.

(d) Assume now that the private sector does not believe the announcement. What is the corresponding inflation rate in that case? Would society gain by imposing rules on the policy maker’s decisions?

In the absence of some credible mechanism that forces policymakers to adhere to their announced policy, the private sector will never believe the announcement. Expecting that policymakers will act in a discretionary fashion, the private sector will set \( \pi^e = b/a \). Because this constant value of \( \pi^e \) does not alter the solution of the policymaker’s optimisation problem, the actual rate of inflation will indeed turn out to be \( \pi = b/a \). However, since this inflation rate is no longer a surprise, there are no unemployment gains and the loss becomes \( L = b^2/2a \), a worse outcome than would have been achieved by following the rule. Since policymakers are assumed to be benevolent- i.e., their loss function accurately reflects social preferences—society would be better-off by removing their discretion if possible.

2. Extract from the Minutes of the Monetary Policy Committee Meeting, Bank of England, 9 and 10 June 2010.

26 Recent backward-looking indicators suggested that economic activity had continued to recover broadly as the Committee had expected at the time of the May Inflation Report. Abstracting from the temporary effects of a number of factors, the evidence pointed towards underlying GDP growth at only a little below its historical average rate during the first half of 2010 (…).
27 Two risks to the medium-term outlook for inflation had intensified, however. First, heightened concerns among financial market participants about the sustainability of government deficits and debt levels, particularly in certain euro-area countries, had prompted the announcement of accelerated fiscal consolidation by several governments. (...) It was likely that these events would dampen the prospects for growth in key UK export markets. In the United Kingdom, the Government had announced measures to reduce public spending by £6.2 billion within the current financial year, and was set to reveal more details about its intended fiscal consolidation on 22 June. (...)

28 Second, this month’s data had brought into sharper relief the recent resilience of inflation in the United Kingdom. Although CPI inflation had fallen in May, near-term inflation prospects remained elevated. This followed a period over recent years in which inflation had been above target for a majority of the time. It was likely that inflation would take some time to return to around the target. (...) Against that background, there was a risk that inflation would have a further tendency to remain above the target if the private sector’s expectations of inflation over the medium term also rose. That might necessitate tighter policy than would otherwise be the case. Survey-based measures of households’ short-term inflation expectations had risen sharply on the month, but the evidence regarding longer-term measures was more mixed (...)

29 The Committee’s central view remained that the substantial margin of spare capacity was likely to persist for some time and would bear down on inflation into the medium term (...)

30 For one member, developments over the past month were consistent with a pattern which had been developing over the past year. Inflation had proved resilient in the aftermath of the recession, casting doubt on the future dampening impact of spare capacity on inflation. (...)

32 Other members thought that changes to the balance of risks were insufficient to warrant a change in the stance of monetary policy. For them, the broad weight of evidence provided by a range of indicators of the outlook – including asset prices, the growth rates of money and credit, money spending, wage growth and estimates of spare capacity – continued to support the view that the current level of Bank Rate and stock of asset purchases financed by the creation of central bank reserves remained appropriate to meet the inflation target in the medium term. Furthermore, uncertainty over the nature and scope of the fiscal measures to be announced in the forthcoming Budget would be resolved by the time of the Committee’s next meeting.

33 The Governor invited the Committee to vote on the proposition that: Bank Rate should be maintained at 0.5%; The Bank of England should maintain the stock of asset purchases financed by the issuance of central bank reserves at £200 billion.

Seven members of the Committee (the Governor, Charles Bean, Paul Tucker, Spencer Dale, Paul Fisher, David Miles and Adam Posen) voted in favour of the proposition. Andrew Sentance voted against, preferring an increase in Bank Rate of 25 basis points.

34 The following members of the Committee were present: Mervyn King, Governor Charles Bean, Deputy Governor responsible for monetary policy Paul Tucker, Deputy Governor responsible for financial stability Spencer Dale Paul Fisher David Miles Adam Posen Andrew Sentance

Dave Ramsden was present as the Treasury representative.

• a. Explain the following terms: “Bank rate”, “inflation above target” and “fiscal consolidation”.

“Bank rate” (or “repo rate”) The Bank of England derives its influence over interest rates in the wholesale money markets from its monopoly of the supply of central bank money It sets the price (interest rate) at which it provides refinancing by lending to its counterparties in the wholesale money markets. The interest (or repo) rate charged on this lending is often referred to as the Bank of England’s ‘official rate’1 and is set by the Monetary Policy Committee (MPC). The official repo rate changes only when the MPC decides that it should. In its money market operations, the Bank of England satisfies the marginal liquidity demand of the banking system as a whole, through open market operations.

“inflation above target”: the objective of the Bank of England is to keep inflation close to the target of 2%, set by the government.

“fiscal consolidation”: reduction in expenditures and/or increase in taxes to reduce the budget debt

b. How would you represent point 27 in an AD-AS diagram?
This could be represented by a downward shift of the AD curve in an AD-AS diagram in which the AS curve is upward sloping. This point is arguing that since the last meeting of the Monetary Policy Committee (MPC), there have been changes in the environment leading to a reduction in aggregate demand and thus a reduction in the risk of inflation picking up.

c. “There was a risk that inflation would have a further tendency to remain above the target if the private sector’s expectations of inflation over the medium term also rose.” (point 28).

Interpret this statement using a piece of theory presented in the lectures.

*This can be interpreted with an expectations-augmented Phillips curve $\pi = \pi^e - \beta(u - u_n) + \nu.*

d. What are the profiles of the members of the Monetary Policy Committee? (“hint”: see Bank of England web page).

Mervyn King (former LSE Professor), Charles Bean (former LSE Professor), Paul Tucker (carrier mainly in the Bank of England), Spencer Dale (BoE Chief Economist, carrier mainly in the BoE), Paul Fisher (PhD Economics Warwick, recent carrier in the BoE, David Miles (Professor of Economics, Imperial College), Adam Posen (PhD Harvard, U.S. citizen), Andrew Sentance (PhD in Economics from the LSE, previously Chief Economist at British Airways). So MPC members likely to be familiar with macro theories...probably a channel for these theories to influence the actual economy...

e. The minutes indicate whether there has been a consensus in taking the decision or not. Do you think that this should be the case

Yes: transparency: even if the MPC takes a 0 or 1 decision, the information concerning the absence of unanimity can provide a more precise information to the agents concerning the way the MPC interprets the situation of the economy. No: the agents may interpret negatively a systematic absence of unanimity (or the fact that the results of the votes are very tight). They may think that the committee has not a clear policy.

f. Why do the minutes indicate what the different members of the Committee have voted?

(other arguments possible) As the members of the MPC vote more than once, the agents may at some point try to rank them in terms ‘more conservative’-‘less conservative’ (different members may have different reputations). If the preferences of the public are heterogeneous, some agents will tend to trust different members of the MPC and interpret the decisions taken by the MPC in the light of what their ‘preferred member’ has voted. So again transparency may increase the reputation of the MPC. At the same time, the members themselves know that their position will be published. It may also be a way of giving them an opportunity to convey their personal opinion without a direct contact with the media.