

Economics 132.03
Principles of Macroeconomics
Spring 2008

Professor Peter Ireland

<http://www2.bc.edu/~irelandp/ec132.html>

Solutions to Final Exam

This exam has 12 questions on 5 pages; before you begin, please check to make sure that your copy has all 12 questions and all 5 pages. Each of the 12 questions will receive equal weight in determining your overall exam score. You can work on the questions in any order, but please be sure to keep your answers to all of the parts of a specific question together in your exam book.

1. Suppose that the Federal Reserve conducts monetary policy by setting a target for the federal funds rate.
 - a. If the Federal Reserve wants to lower its federal funds rate target, should it conduct an open market operation in which it purchases government bonds or an open market operation in which it sells government bonds?

The Fed should conduct an open market operation in which it purchases government bonds.

- b. Assuming that households and firms hold at least some of their money in the form of deposits instead of currency, will this open market operation work to increase or decrease the quantity of reserves held by banks?

It will increase the quantity of reserves held by banks.

- c. Will the money supply increase or decrease?

The money supply will increase.

- d. According to liquidity preference theory, which assumes that the economy-wide price level is held fixed, will this change in the money supply cause other interest rates in the economy to rise or fall?

It will cause other interest rates to fall.

- e. Continuing to assume that the economy-wide price level is held fixed, will this change in interest rates work to increase or decrease the aggregate demand for goods and services?

It will work to increase the aggregate demand for goods and services.

2. This question asks you to use supply and demand analysis applied to the market for money to consider the long-run effects of an increase in the money supply.
- a. To begin, draw a diagram with the quantity of money measured in dollars on the x-axis and the “goods price of money” measured as $1/P$, where P is the economy-wide price level, on the y-axis. Then draw in a demand curve for money.

In this graph, the money demand curve slopes downward.

- b. Assuming for simplicity that the Federal Reserve is able to fix the money supply at some initial level M^* , draw in the supply curve for money.

The money supply curve should be vertical at the point M^* along the x-axis.

- c. Show what happens in the graph when the Federal Reserve acts to increase the money supply to a new, higher level M^{**} .

The vertical money supply curve shifts to the right.

- d. What happens to the price level P as a result of this increase in the money supply?

The goods price of money $1/P$ falls, so the price level P rises.

3. Assume throughout this next question that the velocity of money is constant and that the Federal Reserve can control the money supply directly.
- a. If real GDP is constant and the Federal Reserve wants the price level to stay constant, what should it do with the money supply?

$M \times V = P \times Y$. V and Y are both constant. So to keep the price level constant, the Fed should hold the money supply constant.

- b. If real GDP is constant and the Federal Reserve wants the inflation rate to be 5 percent per year, what should it do with the money supply?

With V and Y still constant, if the Fed wants P to increase at a rate of 5 percent per year, it should increase the money supply at the same rate of 5 percent per year.

- c. If real GDP is growing at 5 percent per year and the Federal Reserve is holding the money supply constant, what is the inflation rate?

Now V and M are constant, but Y is rising at 5 percent per year. So the inflation rate is -5 percent per year.

- d. If real GDP is growing at 5 percent per year and the Federal Reserve wants the price level to stay constant, what should it do with the money supply?

If V is constant and Y is growing at 5 percent per year, the Fed should increase the money supply at the rate of 5 percent per year to keep the price level constant.

- e. If real GDP is growing at 5 percent per year and the Federal Reserve wants the inflation rate to be 5 percent per year, what should it do with the money supply?

If V is constant and Y is growing at 5 percent per year, the Fed should increase the money supply by 10 percent per year to make inflation equal to 5 percent per year.

4. For each part of this question, please indicate whether the fact explains why, in the aggregate demand/aggregate supply diagram: (i) the aggregate demand curve slopes down, (ii) the long-run aggregate supply curve is vertical, or (iii) the short-run aggregate supply curve slopes up.
- a. In the long run, “money is neutral.”

This fact explains why the long-run aggregate supply curve is vertical.

- b. Firms and workers often reach agreements under which nominal wages are “sticky” for periods as long as one or two years.

This fact explains why the short-run aggregate supply curve slopes up.

- c. When the price level rises, the real value of savers’ monetary wealth declines.

This fact explains why the aggregate demand curve slopes down.

- d. Some firms face “menu costs” that cause them to change their output prices infrequently.

This fact explains why the short-run aggregate supply curve slopes up.

- e. When the price level falls, the real value of savers’ monetary wealth rises.

This fact explains why the aggregate demand curve slopes down.

5. For each part of this question, please indicate whether the economic event works **initially (that is, in the short run)** to shift the (i) aggregate demand curve, (ii) the short-run aggregate supply curve, (iii) the long-run aggregate supply curve, or (iv) both the short-run and long-run aggregate supply curves.
- a. The Federal Reserve increases the money supply.

An increase in the money supply shifts the aggregate demand curve.

- b. The US experiences a wave of immigration.

A wave of immigration changes the natural rate of output, and shifts both the short-run and the long-run aggregate supply curves.

- c. Workers become more concerned about inflation (that is, the expected price level goes up) and are able to bargain for higher wages from their employers.

An increase in the expected price level shifts the short-run aggregate supply curve.

- d. Firms become more confident about future economic prospects.

When firm's become more confident about future economic prospects, they invest more at any given price level, shifting the aggregate demand curve.

- e. Congress and the President pass a fiscal stimulus bill that increases government spending.

When government spending increases, the aggregate demand curve shifts.

- 6. Suppose that the economy starts in a long-run equilibrium.
 - a. Draw the aggregate demand/aggregate supply diagram to illustrate this initial state of the economy, showing the aggregate demand curve together with both the short-run and the long-run aggregate supply curves.

(i) The aggregate demand curve should slope down, (ii) the short-run aggregate supply curve should slope up, (iii) the long-run aggregate supply curve should be vertical, and (iv) all three curves should intersect at the point at which output Y equals its natural rate Y^* .

- b. Now suppose that stock (equity) prices begin to rise much more rapidly than expected. Use the diagram to show what happens to output and the price level in the short run.

(i) The aggregate demand curve shifts to the right, (ii) output rises above the natural rate, and (iii) the price level rises above its initial level.

- c. What should the Federal Reserve do in response to the stock market boom if it wants to stabilize output and prices?

It should decrease the money supply (or increase its federal funds rate target) in order to shift the aggregate demand curve back to the left.

- d. Suppose, instead, that there are no changes in monetary or fiscal policy. If the stock market boom turns out to be temporary, so that equity prices soon return to their previous levels, what will happen in the diagram to bring output back to its natural rate? What happens to the price level as a result?

(i) The aggregate demand curve will shift back to its original position and (ii) the price level will fall back to its initial level.

- e. If there are no changes in monetary or fiscal policy, but the rise in stock prices turns out to be permanent, what will happen in the diagram to bring output back to its natural rate? What happens to the price level in this case?

(i) The expected price level will rise, shifting the short-run aggregate supply curve to the left, and (ii) the price level will increase still further and remain above its initial level.

7. This question asks you to use liquidity preference theory to show what might happen to the economy during the Christmas shopping season, when consumers demand more money.

- a. To begin draw a diagram with the quantity of money, measured in dollars, on the x-axis and the interest rate on the y-axis. Then draw in a demand curve for money.

The demand curve for money should slope downward.

- b. What is being assumed about the price level in this diagram? Which interest rate – the real or the nominal – is being measured along the y-axis?

(i) The price level is being held fixed, so (ii) the interest rate being measured along the y-axis is both the real interest rate and the nominal interest rate.

- c. Assuming for simplicity that the Federal Reserve is able to fix the money supply at some initial level M^* , draw in the supply curve for money.

The supply curve for money should be vertical at the point M^* along the x-axis.

- d. Now suppose that heading into the holiday shopping season, consumers demand more money at any given interest rate. What happens to the demand curve for money in the diagram? What happens to the interest rate?

(i) The money demand curve shifts to the right and (ii) the interest rate rises.

- e. If the Federal Reserve does not want the interest rate to change because of consumers' increased demand for money, what should it do to the money supply?

It should increase the money supply in order to shift the money supply curve to the right.

8. Suppose the economy starts in a long-run equilibrium in which the actual unemployment rate equals the natural unemployment rate U^* and the actual and expected inflation rate both equal π^* .

- a. Use a diagram showing both the short-run and long-run Phillips curves to illustrate this initial equilibrium. Label the point that corresponds to this initial equilibrium as point A in this diagram.

(i) The short-run Phillips curve slopes down, (ii) the long-run Phillips curve is vertical at the point U^* along the x-axis, and (iii) the short-run and long-run Phillips curves intersect at the point A, where unemployment equals U^* and inflation equals Π^* .

- b. Now suppose that the Federal Reserve acts deliberately to lower the rate of inflation, as it did under new Chairman Paul Volcker in 1979. What happens to inflation and unemployment in the short run? Label the point that depicts these short-run effects as point B in the diagram.

(i) Inflation falls below Π^* and (ii) unemployment rises above U^* as (ii) the economy moves to point B, down along the short-run Phillips curve and away from the long-run Phillips curve.

- c. Suppose that the Federal Reserve keeps inflation at a permanently lower level, even in the long run, after the unemployment rate returns to its natural rate U^* , so that the actual and expected inflation rate equals $\Pi^{**} < \Pi^*$. Label the point that depicts these long-run effects as point C in the diagram.

Point C should lie on the long-run Phillips curve at a point that is below the initial equilibrium point A, since unemployment is back at the natural rate but inflation is lower.

- d. What happens to the short-run Phillips curve as a result of this change in monetary policy?

The short-run Phillips curve will shift downward because expected inflation has declined.

- e. What happens to the long-run Phillips curve as a result of this change in monetary policy?

The long-run Phillips curve stays fixed because the natural rate of unemployment remains unchanged.

9. Assume throughout this next question that the economy's natural rate of unemployment stays constant at U^* . On a single graph, draw a diagram with one long-run Phillips curve and two short-run Phillips curves that describe the four situations listed below. In each case, label the point in the graph that corresponds to each situation.

The graph should show one vertical long-run Phillips curves and two short-run Phillips curves, both of which intersect the long-run Phillips curve at the natural rate of unemployment U^* . See figure 1 from the solutions to Problem Set 10 – this question is exactly the same as question 1 from that assignment.

- a. Point A: actual inflation is 5 percent and expected inflation is 3 percent.

Point A should lie along the lower short-run Phillips curve at a point to the left of the long-run Phillips curve.

- b. Point B: actual inflation is 3 percent and expected inflation is 5 percent.

Point B should lie along the higher short-run Phillips curve at a point that is to the right of the long-run Phillips curve.

- c. Point C: actual inflation is 5 percent and expected inflation is 5 percent.

Point C should lie along the higher short-run Phillips curve at the point that it intersects with the long-run Phillips curve.

- d. Point D: actual inflation is 3 percent and expected inflation is 3 percent.

Point D should lie along the lower short-run Phillips curve at the point that it intersects with the long-run Phillips curve.

10. During the first week of May 2008, the nominal interest rate on 30-year fixed-rate mortgage loans as reported by the *Wall Street Journal* was 6 percent per year.
- a. Suppose that the inflation rate in the United States turns out to be 3 percent per year, on average, over the next 30 years. What will the real interest rate on these mortgage loans be in this case?

With a 6 percent nominal interest rate and 3 percent inflation, the real interest rate equals 3 percent per year.

- b. Suppose that, instead, US inflation turns out to be 5 percent per year, on average, over the next 30 years. What will the real interest rate on mortgage loans be in this case?

With a 6 percent nominal interest rate and 5 percent inflation, the real interest rate equals 1 percent per year.

- c. Who “wins,” in the sense of being better off financially, if inflation turns out to be 5 percent instead of 3 percent: the households who take out new mortgage loans today at 6 percent, or the banks that make new mortgage loans today at 6 percent?

The real interest rate is the most relevant measure of the true cost of borrowing and the true benefit of lending. Since the higher inflation rate implies a lower real interest rate, households win and banks lose in that case.

11. A salesperson offers you two possible deals on a new big-screen TV: (i) pay \$1500 in cash today or (ii) buy on credit and pay \$1700 two years from now. Having taken “Principles of Macroeconomics” this term, you know that in order to decide which deal to take, you need to check on interest rates first. So suppose that having done this, you already know that by keeping your money in the bank, you can earn interest at the rate of 6 percent per year for the next two years.

- a. Write down a formula for the present value of the \$1700 that you would pay two years from now, assuming that you buy the TV on credit today (*note*: all you need to do is to write down the formula, since actually computing the numerical value of this present value isn't possible without the help of a calculator).

Present value of \$1700 paid two years from now = $\$1700/(1+0.06)^2$.

- b. Suppose that your present value from part (a) turns out to be *less* than the \$1500 that you'd pay if you decide to buy the TV with cash today. What should you do: pay \$1500 today or \$1700 two years from now?

Pay \$1500 today.

12. Macroeconomists sometimes think about the determinants of a nation's standard of living with the help of an "aggregate production function" such as

$$Y = AF(L,K,H,N),$$

where Y denotes real GDP, L the number of workers, K the stock of physical capital, H the stock of human capital, N the stock of natural resources, and A the stock of technological knowledge.

- a. What does it mean to say that holding the stock of knowledge fixed, the aggregate production function has the property of constant returns to scale?

Constant returns to scale means that holding A fixed, doubling L, K, H, and N leads to a doubling of output. Mathematically,

$$2Y = AF(2L,2K,2H,2N)$$

or, more generally, for any multiple or fraction x,

$$xY = AF(xL,xK,xH,xN).$$

- b. Assuming that this aggregate production function has this property of constant returns to scale, rewrite the equation from above as one that shows how productivity (output per worker) depends on four determinants: physical capital per worker, human capital per worker, natural resources per worker, and the stock of technological knowledge.

Choosing $x = 1/L$ in the last expression from above:

$$Y/L = AF(1,K/L,H/L,N/L).$$

- c. The British economist Thomas Robert Malthus (1766-1834) famously predicted that because natural resources are limited, population growth would inevitably lead to declining standards of living, perhaps to the point that societies are doomed to suffer from chronic poverty. Explain *briefly* (no more than a sentence or two), how Malthus' reasoning is reflected in your equation from part (b) above.

Malthus' idea was that with limited natural resources N , an increase in L would lead to a reduction in the stock of natural resources per worker, and hence to a lower level of productivity (output per worker).

- d. Thankfully, Malthus' prediction has proven to be far too pessimistic; instead of declining towards poverty, living standards in many countries around the world have grown enormously over the past 200 years. According to your equation from part (b) above, what economic factors allow for rising productivity and living standards, even as supplies of natural resources dwindle over time?

Malthus underestimated the possibility that increases in the stock of technological knowledge or in the stocks of physical and human capital per worker would more than offset dwindling supplies of natural resources.