

# 14.02 Principles of Macroeconomics

## Quiz #3, Answers

**Name:** \_\_\_\_\_

**MIT ID:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date :** \_\_\_\_\_

Read all questions carefully and completely before beginning the exam. There are four sections and ten pages – make sure you do them all. The quiz has a total of 100 points. Show your work on all questions if you want to receive partial credit. If your answer involves a graph, please label all curves and axes clearly; if we can't read the graph you will lose points on your answer. No notes, calculators or books may be used during the quiz.

You have 2 hours to complete the quiz.

There are no blue books, you must respond in the space allotted to each question.

Please mark one of the following options.

Remember the Blue Number at the top of this page so that you can look up your grades when we publish them in the website.

- 10AM Samer Haj-Yehia
- 11AM Samer Haj-Yehia
- 12AM Samer Haj-Yehia
- 1PM Samer Haj-Yehia
- 2PM Samer Haj-Yehia

- 9AM Indradeep Ghosh
- 11AM Oscar Landerretche
- 1PM Indradeep Ghosh
- 1PM Veronica Rappoport
- 2PM Veronica Rappoport
- 3PM Veronica Rappoport

## Part I (Short Questions, 2 points each, 10 points total)

### 1. What is an automatic stabilizer?

It is something that diminishes automatically the volatility of the economy. It diminishes the multiplier so that shocks do not deviate the economy very far from normal growth levels and hence from the natural level of unemployment. This is the case of progressive tax schemes or unemployment benefit systems

### 2. What is the money multiplier?

The increase in the money supply resulting from a one-dollar increase in central bank money. This proportion is equal to  $(c+\theta(1-c))^{-1}$  where  $c$  is the proportion of money held in currency by individuals and  $\theta$  is the ratio of reserves to deposits held by banks.

### 3. What is Walras' Law? What role does it play in the way we construct the IS-LM?

The finding that if all but one of the conditions for general market clearing hold, then the final one must hold as well; this result follows because households' budget constraints must be satisfied. When we construct the IS-LM model we assume an economy with a bonds market, a money market and a goods market. The IS represents equilibrium in the goods market. The LM represents equilibrium in the money market. If household's budget constraints hold, then we know that the bonds market must clear and the IS-LM will represent macroeconomic equilibrium.

### 4. What is Okun's Law? How do we incorporate it into the general model of inflation and unemployment?

Okun's law is the observed relation between GDP growth and the change in the unemployment rate. We use Okun's law to close the macroeconomic model composed of the Phillips curve (relating unemployment and inflation) and the aggregate demand (relates gdp growth with inflation).

### 5. What is the Fischer hypothesis?

The proposition that in the medium run an increase in inflation is reflected in an identical increase in the nominal interest, leaving the real interest rate unchanged.

**Part II (True-False-Uncertain, 5 points each, 40 point total) Explain your answer, use graphs if possible and show calculations if necessary.**

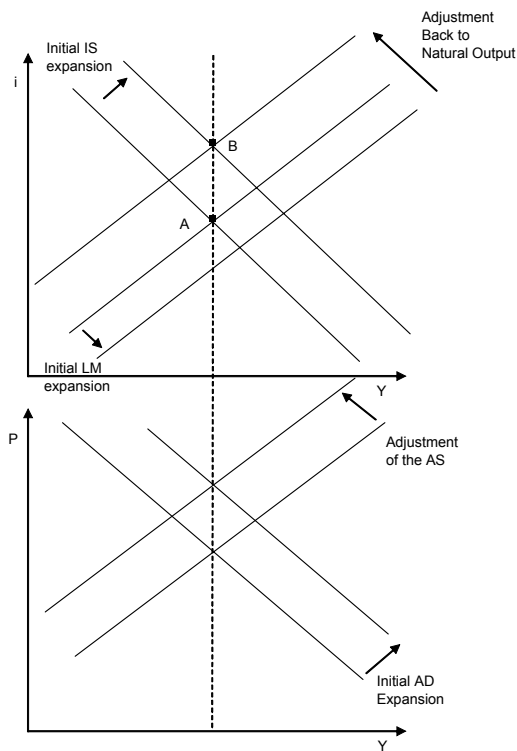
- Through a typical business cycle, we expect that each 1% increase in GDP will be associated with a 1% change in business investment and 1% change in private consumption.

False.

Both investment and consumption move together during the business cycle, but historically investment has been much more volatile than consumption. However, the level of investment is much smaller than the level of consumption, so that it turns out that both investment and consumption contribute roughly equally to fluctuations in output over time.

- In the medium run, a permanent monetary expansion coupled with a permanent fiscal expansion causes both output and the interest rate to increase for sure.

False.

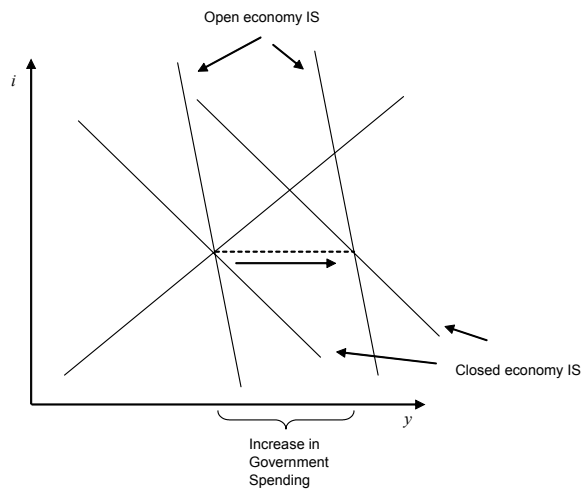


In the medium run a monetary expansion and a fiscal expansion will have no effect on output. Output will return to the natural level once the economy adjusts its price expectations. The interest rate, on the other hand, should increase in the medium run. Since the economy has to return to the same level of output with greater government demand, investment must fall. The only way that investment can fall is if the interest rate increases permanently. In the graph, once government spending has increased the economy (originally at A) can only get back to natural output at a point like B.

3. An increase in the budget deficit inevitably leads to a reduction in private investment, regardless of whether the economy is open or closed.

False

An economy that has a money demand that is very sensitive to the interest rate (so that the LM is flat) can have changes in the budget deficit with no effect on investment, since the interest rate will not change.



If the economy is open to trade flows it will have a marginal propensity to import. This will increase the absolute value of the slope of the IS. The result is that, for a given non-zero slope of the LM curve. An expansion in, lets say, government spending will increase the interest rate by more. The reason is that the economy needs to compensate for the increased multiplier effect generated by the marginal propensity to consume.

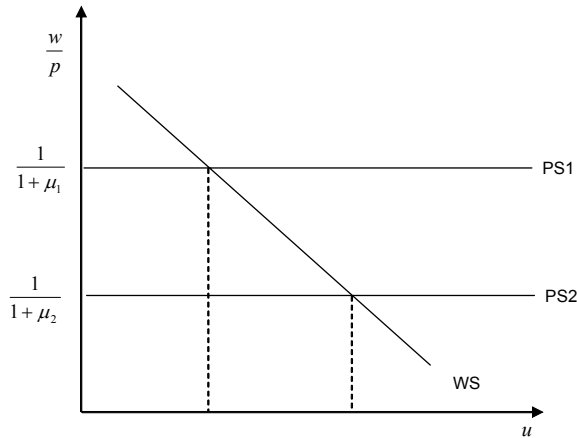
4. Higher monetary growth will never affect unemployment, rather, it will be reflected in higher inflation.

False

Higher monetary growth can affect unemployment in the short term as long as inflation expectations do not perfectly foresee the increase in the growth rate of money. In the medium term, however it is true that unemployment will not deviate from its natural rate and monetary growth will be fully reflected in inflation.

5. An increase in the markup will tend to reduce unemployment.

False



An increase in the markup will, by definition, make the real wage fall. The result is a increase in the natural unemployment rate. The only way we can make workers accepts their new lower wages is if they have a greater probability of staying for a long period unemployed if they fall out of their current job.

6. The natural interest rate is not affected by any policy instruments of the government.

False.

The natural interest rate is the interest rate that is consistent with equilibrium in the goods market when the economy is at the natural level of income. Hence it is the solution for  $r_n$  to:

$$Y_n = C(Y_n - T) + I(r_n) + G$$

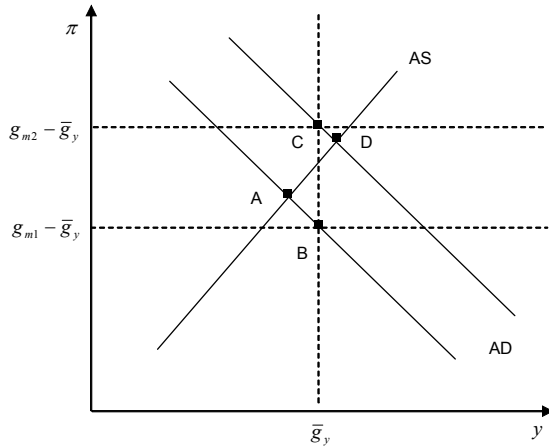
it is easy to show that

$$\frac{\partial r_n}{\partial T} = \frac{\frac{\partial C}{\partial Y_D}}{\frac{\partial I}{\partial r}} < 0 \quad \text{and} \quad \frac{\partial r_n}{\partial G} = \frac{-1}{\frac{\partial I}{\partial r}} > 0$$

so an increase in taxes will decrease the natural interest rate and an increase in government spending will increase the natural interest rate. Increased taxes lower the level of consumption at the natural income level and hence allow for higher investment (giving a lower natural interest rate). Increased government spending implies lower investment at the natural level of output (giving a higher natural interest rate).

7. In the current situation, when output is below potential output, stimulative monetary policy will only lead to higher prices in the short run and medium run.

False.



In the long term a stimulative monetary policy will be reflected in inflation. However, in the short run it will also allow the economy to approach potential output growth faster. The economy is at a point similar to A. If nothing is done, it will converge to a point like B. A stimulative monetary policy (increasing the rate of growth of money) will set a new medium term equilibrium for the economy (point C) with higher inflation, but it will also move the economy out of the recession (point D).

8. If the price of a one-year T-bill is \$90, while the price of a one-year T-bill to be issued a year from today is expected to be \$80, then the price of a two-year T-bill today is \$85. Note that the face values of all T-bills and T-notes are \$100 and that the two year T-bill has no coupon.

False.

The price of a two year T-bill can be shown to be

$$P_{2,t} = \frac{\$100}{(1+i_{1,t})(1+i_{1,t+1}^e)}$$

hence

$$P_{2,t} = \frac{P_{1,t} P_{1,t+1}^e}{\$100}$$

so the price of the two year note will be \$72

### Part III (The Stock Market, 25 points)

Consider our usual IS-LM economy. The only difference is that in each period companies will make profits that will be handed out as dividends. Dividends will increase when output increases and will be described by  $D(y_t)$ . Investment in period  $t$  will be described by a function  $I(q_t)$  where  $q_t$  is the value of stocks of the companies. Initially assume that the Fed is completely passive.

1. What is the value of  $q_t$  before dividends in period 0 (this year) are given out? (4 points)

The value of stocks is the present value of dividends.

$$q = D(y_0) + \frac{D(y_1)}{1+r_1} + \frac{D(y_2)}{(1+r_1)(1+r_2)} + \dots$$

2. Suppose that we suddenly find out that there is a probability of having a war in an oil producing country a few periods into the future. How would you expect this to impact  $q$ ? What will happen to the yield curve? What will happen to interest rates today? What will happen to unemployment today? (7 points)

An oil shock in the future will generate lower income and higher interest rates. The yield curve will become steeper as future interest rates increase. Stock prices will fall because there will be a recession in the future that we did not know about before the news and because we expect interest rates to increase. Since investment today depends on the value of stocks, we expect investment to fall today, pressing interest rates down today and unemployment up.

3. Suppose that the only way we can avoid the war in the future is by expanding government spending permanently in weapons so that people become very afraid of us. What happens to unemployment today if we find out that the government decides to do this (remember that the chances of war diminish)? What happens to stock prices today? And Investment? Does the slope of the money demand play any role? (7 points)

An increase in the amount of money coupled with government spending will decrease unemployment and expand output today generating a boost for dividends. But it will also increase the interest rate in the near future. The net effect is ambiguous and will depend on the slope of the LM. If money demand is very sensitive to the interest rate, the LM curve will be very flat since very small changes in the interest rate will be sufficient to clear the money market. If this is true, the effect on dividends will predominate and investment could increase. If money demand was not very sensitive to the interest rate, the LM would be very steep and most of the effect of increased government expenditure would go to increasing the interest rate.

4. Now assume that the Fed is no longer passive. Suppose that we suddenly expect the government to increase spending in the future. What is the resulting impact on  $q$  and investment today if the Fed does not react? What would we expect the Fed to do, accommodate or tighten? What is the resulting impact on  $q$  and investment today of either alternative? (7 points)

An expansion in government spending in the future will generate some increase in output and some substantial increase in inflation and the interest rate. Left on its own, the effect is ambiguous just as discussed in part 3. We would expect the Fed to react to the increase in inflation by contracting money growth just as the government increases spending. The effect on output of the government spending expansion will be minimized but the effect on interest rates will be exacerbated. Hence, stock prices will probably fall if we expect the Fed to tighten and investment today will fall.



**Part IV (Growth, 25 points)**

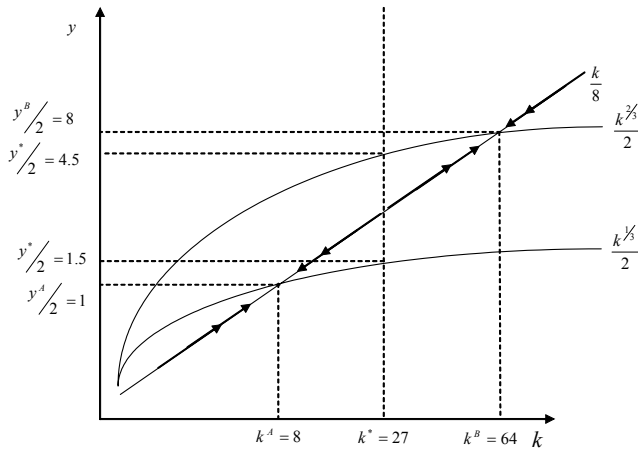
Suppose that the world has two types of economies: industrial and agricultural. Both have a production function of the following form:

$$Y = K^\alpha L^{1-\alpha}$$

agricultural economies have  $\alpha=1/3$ , industrial economies have  $\alpha=2/3$ . All countries have the same population and there is no population growth. Assume that all countries have the same savings rate  $s=1/2$  and depreciations rate of capital  $\delta=1/8$ . An economy can only become industrial if it can finance a lot of research and development. Assume that, in this world, this happens suddenly. Specifically, assume that an economy becomes industrial (its  $\alpha$  changes) once it has a level of 27 units of capital per capita.

1. What is convergence? Would we observe convergence in this world? Explain and show graphically. (5 points)

Convergence is the tendency for countries with lower output per capita to grow faster than wealthier countries. Its implication is that all countries will have the same output per capita in the long term. Convergence results from the existence of decreasing marginal returns to capital.



In this case there are two potential steady states for an economy. If the economy starts out at a level of capital per capita lower than 27, it will converge to  $k^A$ . Otherwise it will converge to  $k^B$ . Hence, we will not observe convergence across all economies, but rather across sub-samples.

Steady state levels are, of course, calculating by setting the capital accumulation equation to zero, giving

$$sk^\alpha = \delta k \quad \text{so that at any steady state} \quad k^{ss} = \left(\frac{s}{\delta}\right)^{\frac{1}{1-\alpha}} \quad \text{whith} \quad y^{ss} = \left(\frac{s}{\delta}\right)^{\frac{\alpha}{1-\alpha}}$$

also notice that economies become industrial in this coarse model when they reach an output per capita of 3.

2. Suppose that the World Bank wants to help poor economies develop. It decides to give a gift to any economy with an output per capita of less than 3. The gift consists of 2 units of capital per capita. Will this help convergence? What if the gift is 19 units of capital per capita? (10 points)

The subsidy will only be received by agricultural countries, since all countries with income per capita strictly greater than 3 are industrial. However, if the subsidy is 2, only countries with capital per capita greater or equal to 25 will be helped by the subsidy. All other agricultural countries will continue to converge to the poor steady state. If the subsidy is 19, all countries will converge to the wealthy steady state since any economy that arrives to the poor steady state will automatically be subsidized up to industrial levels.

3. Suppose that there are no World Bank subsidies and that Agricultural countries have a government that can set the savings rate of the economy. Is there a savings rate that will allow Agricultural economies to become industrialized? What if the world bank subsidizes the economy by donating a dollar for every dollar that the country saves? (10 points)

No, there is no savings rate that will deliver the country to industrialization in absence of any subsidies. To do this a savings rate would have to get the agricultural country to a steady state capital per capita of 27. Hence the savings rate would have to satisfy

$$s(27)^{1/3} = \frac{27}{8}$$

which gives  $s=9/8$  which is impossible since the savings rate will always be smaller than one.

With the subsidy to the savings rate, savings would have to satisfy

$$(2s)(27)^{1/3} = \frac{27}{8}$$

which gives  $s=9/16$ , a very high savings rate but that will allow the country to become industrialized.