

14.02 PRINCIPLES OF MACROECONOMICS

Fall 2003- Quiz Three

READ INSTRUCTIONS FIRST:

Read all questions carefully and completely before beginning the quiz. Label all of your graphs, including axes, clearly; if we can't read the graph, you will lose points on your answer. Show your work on all questions in order to receive partial credit. The quiz is worth a total of 100 points. You will have 90 minutes to complete the quiz.

No blue books; use the blank space in this sheet. Please answer each question in the assigned space, and keep your answers brief and to the point. If you require additional space for a particular question, you may use the extra page provided at the end of the quiz. Write your name, TA name, and section or recitation time below. Also, return your copy of the quiz to the TA's when you complete the test.

No notes, calculators, or books may be used during the quiz.

Please, check your recitation:

- | | |
|---|--|
| <input type="checkbox"/> 10am Samer Haj-Yehia | <input type="checkbox"/> 9am Melissa Boyle |
| <input type="checkbox"/> 12pm Samer Haj-Yehia | <input type="checkbox"/> 11am Francesco Franco |
| <input type="checkbox"/> 1pm Samer Haj-Yehia | <input type="checkbox"/> 12pm HaYan Lee |
| <input type="checkbox"/> 10am Thomas Chaney | <input type="checkbox"/> 1pm HaYan Lee |
| <input type="checkbox"/> 11am Thomas Chaney | <input type="checkbox"/> 1pm Thomas Chaney |
| <input type="checkbox"/> 12pm Thomas Chaney | <input type="checkbox"/> 2pm James Vickery |
| | <input type="checkbox"/> 3pm James Vickery |

First Name

Last Name

MIT ID#

Signature

Good luck!

PART I: TRUE OR FALSE? (6 points per question, 36 points total)
Answer True/False and explain briefly why true or false.

1. In the US over the past few years, inflation has fallen, while the unemployment rate has increased from 4% to 6%. If inflation expectations are given by $\pi_t^e = \pi_{t-1}$ [where t is measured in years], these two facts imply that the natural rate of unemployment has increased.

False: This is just a movement along the augmented Philips curve. The natural rate of unemployment is determined in the medium-run and not by short-run movements.

2. Assume that inflation expectations are given by $\pi_t^e = 5\% + 0.75\pi_{t-1}$. This implies that, in the medium/long run, people expect the inflation rate to converge to 25%.

False: In the medium-run $\pi_t^e = \pi_t = \pi_{t-1}$. Substitute in the equation above to get: $\pi_t = 5\% + 0.75 \pi_t$, which means $\pi_t = 20\%$.

3. Since the IS curve depends on the real interest rate rather than the nominal interest rate, an increase in expected inflation causes the IS curve to shift inwards in the short-run.

False: For a given Y on the IS curve, nominal interest rate has to be higher in order to accommodate the increase in expected inflation rate. Therefore, IS curve shifts right-up.

4. A decrease in the money growth rate (e.g., from 10% per year to 5% per year) causes real and nominal interest rates to increase in the short run, but has no effect on real interest rates in the medium/long run.

True: By the Fisher effect, the real and nominal interest rates will increase in the short run. In medium-run, however, real interest rate will return to its initial level while nominal interest rate will decrease to lower level than the initial (See Blanchard, p303-304).

5. In Country A, the growth rate of nominal GDP per capita is 5 per cent. In Country B, the growth rate of real GDP (NB: real GDP, not real GDP per capita) is 3 per cent. In Country C the growth rate of real GDP per capita is 4 per cent. If population growth and inflation is positive in all three countries, then we know that (comparing the growth rates of real GDP per capita) Country C is growing faster than Country B, while Country A may be growing faster or slower than Country B.

True: the growth rates of real GDP per capita in country A is $5\% - \pi_A$,

the growth rates of real GDP per capita in country B is 3%,

the growth rates of real GDP per capita in country C is $4\% + g_L$.

Compare the above number and you come to the conclusion in the questions.

6. When an economy exhibits constant returns to scale, a doubling of the capital stock per capita leads to a doubling of the level of output per capita.

False: When an economy exhibits constant returns to scale means that doubling both capital and stock leads to doubling output.

PART II: (points as marked, 64 points total)

Please read the following instructions and questions carefully. Answer each of the questions as precisely as you can. Clearly label your graphs.

Consider an open economy with the following equations for price setting (PS), wage setting (WS), and aggregate demand (AD), respectively:

$$\mathbf{PS: } P = (1 + \mu) \left(\frac{W}{A} \right)$$

$$\mathbf{WS: } W = P^e F(u, z)$$

$$\mathbf{AD: } Y = C(Y^d) + I(Y, i) + G + NX(Y, Y^*, \varepsilon)$$

where P , W , A , μ , u , and z are the price level, nominal wage, productivity, markup, unemployment rate, and catchall variable, respectively. Also, Y , Y^d , Y^* , C , I , i , G , NX , and ε are GDP, disposable income, GDP of the world, consumption, investment, nominal interest rate, government spending, net export, and real exchange rate, respectively. The superscript “e” indicates expectations.

Please note that the wage setting curve does not depend on the level of productivity.

Please also note that for simplicity, it is assumed that investment depends on the nominal interest rate (i) rather than the real interest rate.

The relationship between output and the unemployment rate is given by:

$$Y = A(1-u)$$

The nominal exchange rate E is fixed.

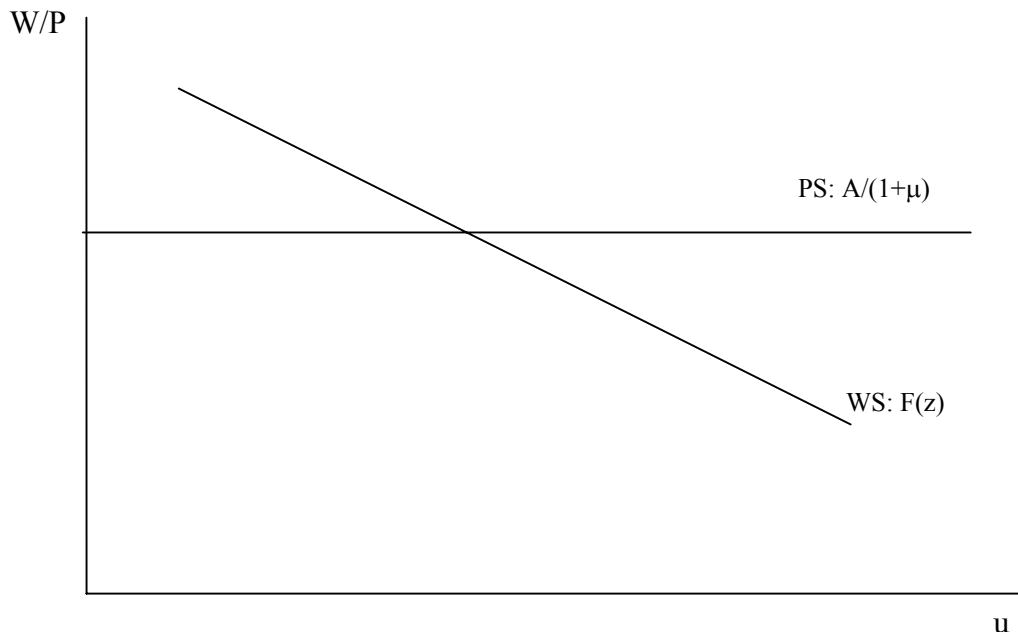
In the short run, assume P^e (expectations of the price level) is constant (fixed). As usual, in the medium run P^e adjusts so that $P = P^e$. Finally, assume the Marshall-Lerner condition holds.

1. In the space provided below, graph the price setting and wage setting curves in the medium/long run equilibrium. On your graph, indicate the equilibrium real wage and the natural rate of unemployment. Explain briefly in the space provided why the natural unemployment rate does not depend on P^e . (6 points)

In the short-run $P^e = P$. therefore:

From PS: $W / p = A / (1 + \mu)$

From WS: $W/P = F(u, z)$ where $dF/du < 0$.



2. Algebraically derive the AS equation. Using the equation you have derived, show/explain that the AS curve is indeed upward sloping. **(6 points)**

Substitute the WS equation in the PS equation:

$$P = \frac{(1 + \mu)}{A} P^e F(u, z)$$

Note that:

$$Y = A(1 - u) \Rightarrow u = 1 - Y / A$$

Substitute u in the above equation:

$$P = \frac{(1 + \mu)}{A} P^e F\left(1 - \frac{Y}{A}, z\right)$$

Note, when $Y \uparrow$, $(1 - Y/A) \downarrow$, $F \uparrow$, $P \uparrow$, which means the AS curve is upward sloping.

3. What is the slope of the AD curve (positive, negative or flat)? Explain as precisely as you can why, in this economy, the slope of the AD curve has the sign you say it does. **(6 points)**

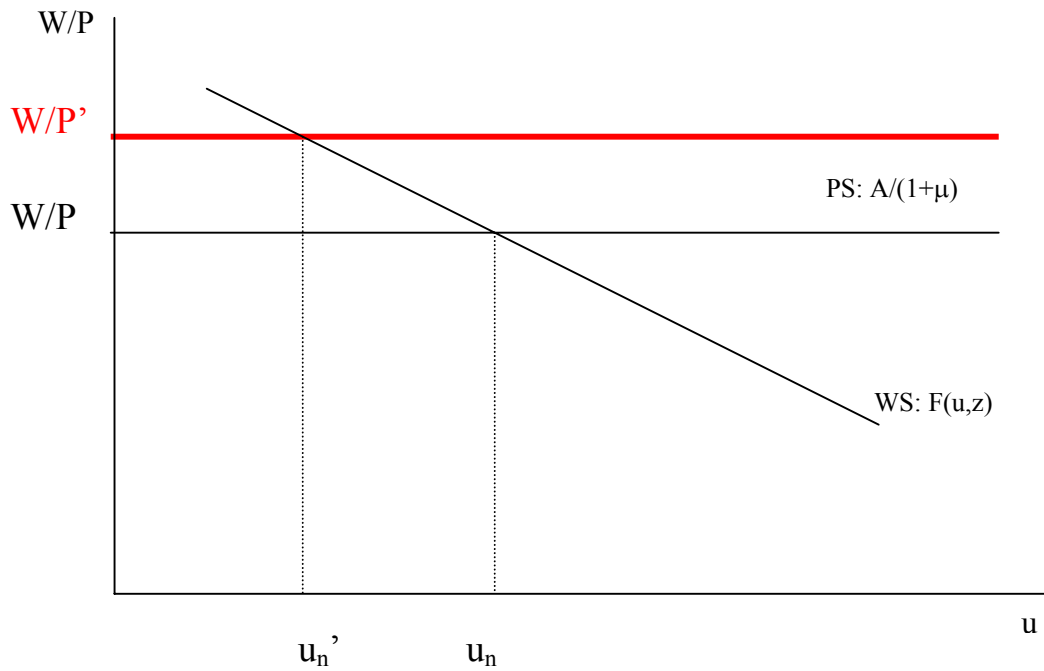
P impacts AD only through the negative effect of P on real exchange rate, which in turn has a positive effect on NX. Therefore, the final effect of P on AD is negative, meaning downward sloping AD curve. It is wrong to say that P impacts AD through the LM curve in a fixed exchange rate regime.

4. Using the graph provided below, illustrate the impact of a sudden increase in productivity on the real wage and the unemployment rate in the medium/long run. Based on your answer, in the space provided state whether the relationship between productivity growth and unemployment is positive or negative, and explain the reason why as precisely as you can. (7 points)

From PS: $W/P = A/(1 + \mu)$, therefore when A increases, PS curve shifts up.

From WS: $W/P = F(u, z)$, therefore changes in A have no effect on the WS curve.

So, from the graph below, we can see that the real wage in the medium-run increases, while the natural rate of unemployment decreases. Therefore, there is a negative correlation between productivity growth and unemployment. In this setting, improvement in productivity will allow lower prices, which means higher real wages that will bring more workers to work.



5. Using the graph provided below, illustrate what happens in AS-AD in the short run following the increase in A. On your diagram, mark the original AS curve by AS_0 and the original AD curve by AD_0 . Mark the new AS curve by AS_1 and the new AD curve by AD_1 . Also mark the initial equilibrium by (P_0, Y_0) and the new short-run equilibrium by (P_1, Y_1) . (7 points)

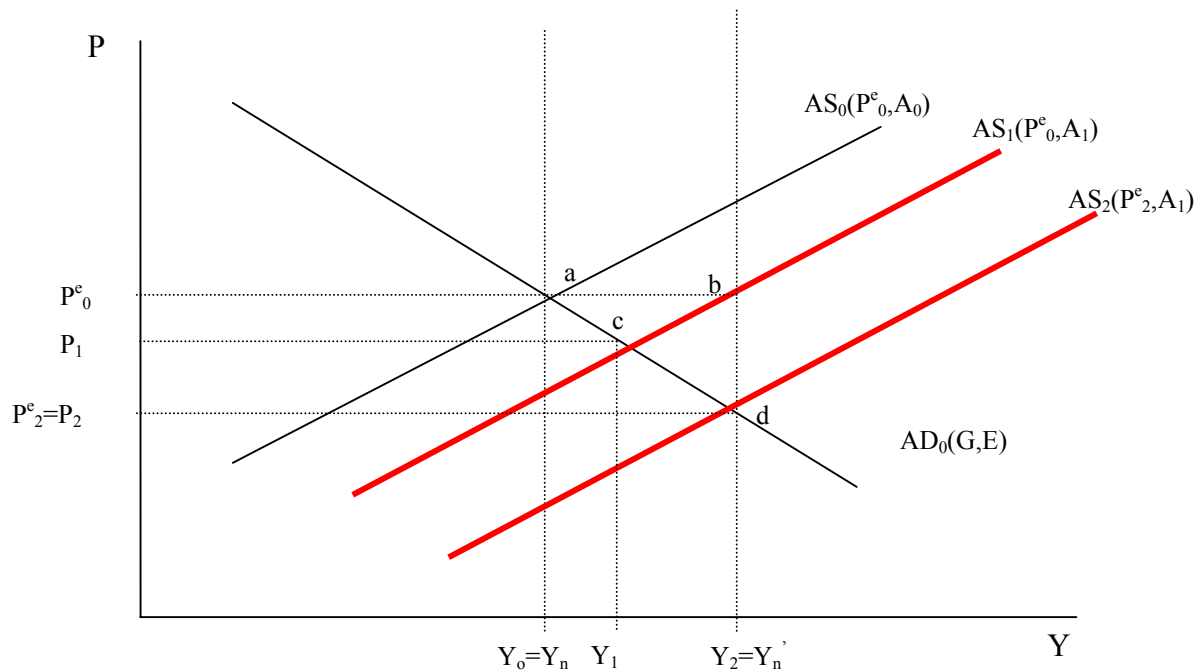
The AS equation is:

$$P = \frac{(1 + \mu)}{A} P^e F\left(1 - \frac{Y}{A}, z\right)$$

Which means, if $A \uparrow$, both $1/A \downarrow$ and $F \downarrow$ (because $(1 - Y/AL) \uparrow$ and F is negatively affected by $(1 - Y/A)$), therefore, $P \downarrow$, which means the AS curve shifts outward.

Also, Y_n increases as we saw in part 4 above. P^e remains the same equals to the price level of the previous level. New AS has to go through the point P^e and new Y_n .

The new equilibrium in the short-run is at point c.



6. On your graph from part 5, show what happens to the AS and AD curves in the medium/long run. Mark the new medium run AS curve AS_2 and the new medium run AD curve AD_2 . Also on your graph, mark the old and new levels of natural output.

Based on your answers from above, state below what happens to the natural level of output (Y) in the medium/long run following the increase in A ? Is the percentage change in Y larger, smaller or the same as the percentage change in the employment rate ($1-u$)? Explain your answer. **(7 points)**

Since in the short-run the expected inflation is higher than the actual, the expected prices will gradually adjust down causing AS to shift down. This will continue until AS curve goes through point d , where $P^e_2=P_2$. Y increases in the medium run more than the percentage change in $(1-u)$ because the former increases due to two factors: decrease in u and increase in A .

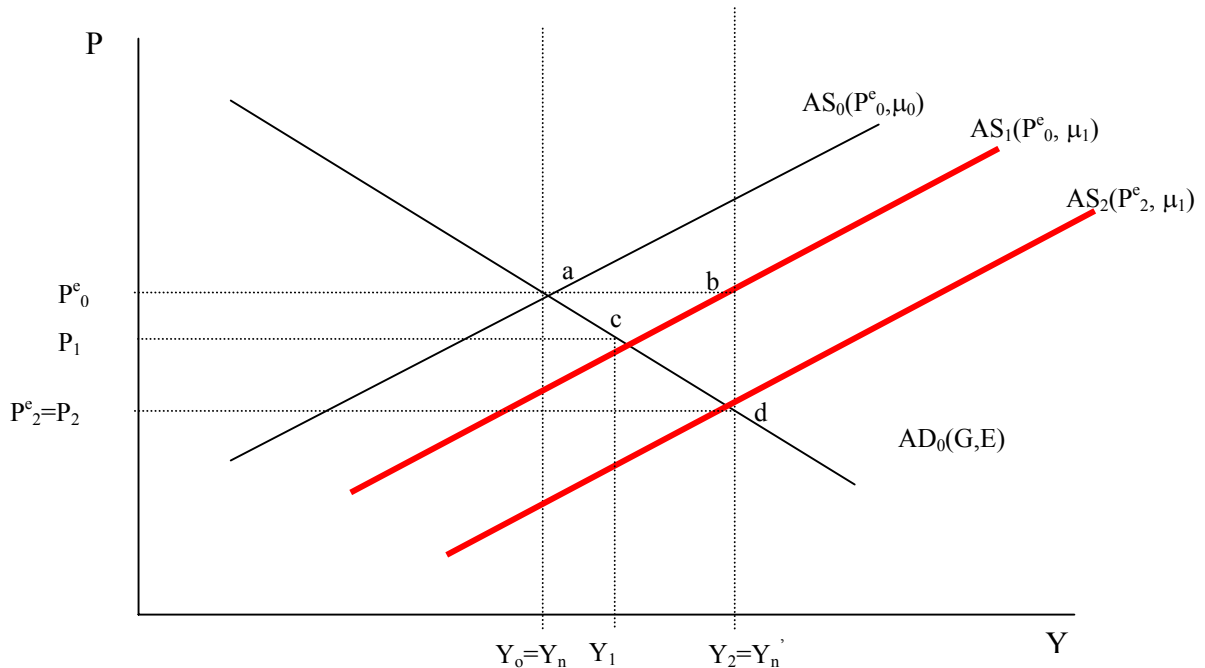
Now assume that the economy is back in medium/long-run equilibrium. Suddenly there is a fall in oil prices (in terms of our model represented by a fall in μ), causing an increase in the natural level of output (i.e., the new natural level of output is higher than the current level of output).

7. Show, in the diagram below, how the economy adjusts towards the new higher level of output.

What happens to the price level as the economy adjusts to the medium-run equilibrium? What happens to the real exchange rate? Assume that price expectations (P^e) adjust only very slowly to changes in the price level; explain concisely why this means the adjustment to the new medium run equilibrium might take a long time. **(7 points)**

Qualitatively, the fall in μ has the same effect as the increase in A . Therefore, the same analysis carries over from the previous sections.

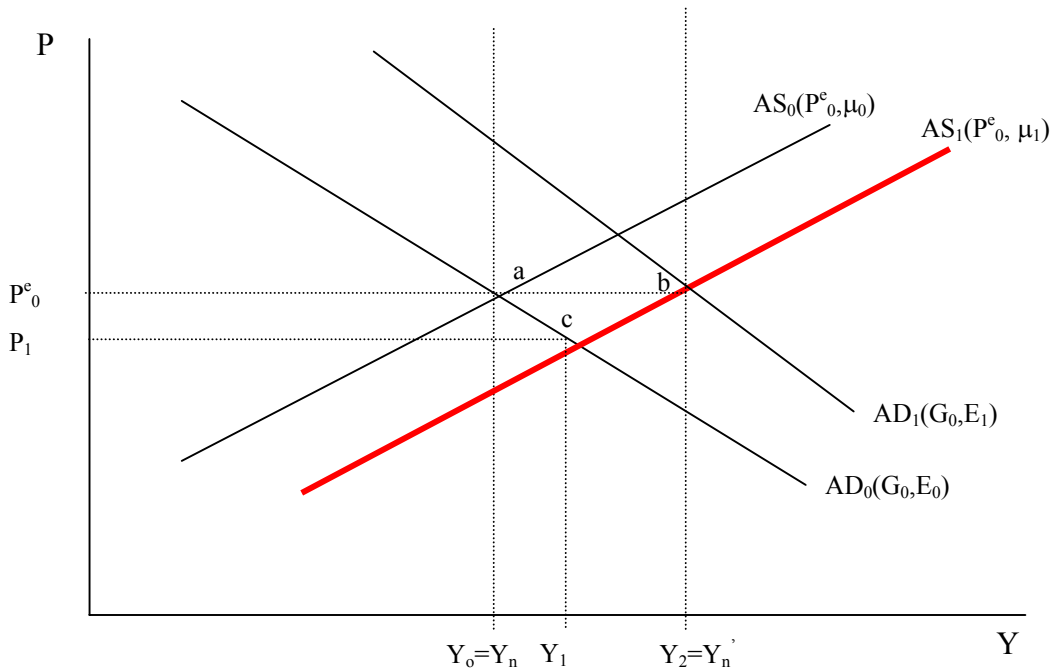
The real exchange rate increases since the nominal exchange rate is fixed while the price level decreases.



In response to the situation described above in part 7, assume the central bank announces that it intends to devalue the currency. As a result, E^e increases by an amount Δ .

8. Assuming the central bank leaves interest rates unchanged, what will happen to the exchange rate (E)? On the below AS-AD diagram, show what effect this will have on output and the price level. Does the announced devaluation help the economy converge towards the new medium/long run equilibrium? Explain. **(6 points)**

By the uncovered interest parity ($i = i^* + \frac{E^e - E}{E}$), if the central bank leaves interest rates unchanged, then to maintain the parity, E has to increase immediately exactly by Δ . This change will cause AD curve to shift outward and cross the AS at point b. Price level will increase, while output level increases. Since AS crosses AD at $Y=Y_n$, this will also be the medium-run equilibrium.



9. How does the decision to announce a devaluation (as described in part 8 above) affect the **real** exchange rate in the short run **and** in the medium/long run? Explain your answer. **(6 points)**

Note that the short-run and medium-run coincide. In the short-run, both nominal exchange rate ($\uparrow E$) and prices increase ($P \uparrow$). Yet, the real exchange rate P^*E/P still increases because otherwise Y cannot increase from Y_1 to Y_2 . Since $P^e = P$ at point b, this is also the medium-run, therefore, no further changes will take place.

10. Assume you are an adviser to the government faced with the situation described in Part 7 above. Suggest an alternative macroeconomic policy (other than trying to change the exchange rate) that could be used to increase the speed with which the economy converges to the new higher medium/long run equilibrium, and explain why and how it would work. **(6 points)**

A fiscal expansionary policy (higher G or lower T) would cause AD curve to shift outward similar to the above graph.