QUIZ 2
14.02 Principles of Macroeconomics
April 14, 2005

I. True/False (30 points)

1. If the growth rate of productivity is zero, then in order to maintain unemployment at the natural rate, the growth rate of output must equal the growth rate of the labor force.

True. If the growth rate of productivity is zero, the normal growth rate of output must be equal to the growth rate of the labor force, and in the medium run, the growth rate of output is the normal growth rate. (ch. 9)

2. If the growth rate of output and the inflation rate are both zero in the medium run, a one-time monetary expansion (i.e., an increase in the level of the nominal money stock) decreases the nominal interest rate in the medium run.

False. In the medium run, the real interest rate is back to the natural rate of interest. When inflation rate is 0, the nominal interest rate equals the natural real rate of interest, which equals the nominal interest rate before the shock.

3. The nominal interest rate has always been higher than the real interest in the US since 1978.

True. Inflation (and expected inflation) has always been positive since 1978. (ch. 14-15)

4. The higher the level of wage indexation, the steeper the Phillips curve.

True. Higher the level of wage indexation, greater is the responsiveness of inflation to unemployment, and so steeper is the Phillips curve. (ch. 8)

5. The more forward looking consumers and firms are, the flatter the IS curve.

False. Since the more forward looking are consumers and firms, the weaker is the relationship between the current nominal/real interest rate and output, which translates into a steeper IS curve. (ch. 17)

6. According to the basic AS-AD model, an increase in the fiscal deficit will have no impact on investment in the medium run, if the central bank keeps nominal money supply constant.

False. In the short run, the equilibrium output increases in response to an increase in fiscal deficit (either as an increase in G or a decrease in T). The price level will increase eventually in order to restore output back to the natural level in the medium run. Since the nominal money supply is constant, a higher price level implies a lower real money supply, which requires a higher nominal interest rate to clear the money market. With output back to the natural level, a higher nominal interest rate in the medium run is associated with lower investment (compared to investment in the previous medium run).

II. AS-AD in levels (30 points)

Consider an economy of the following description
Consumption demand is given by : $C = 4 + 0.3Y$ (no taxes)
Investment demand is given by : $I = 0.2Y - i$
Government spending is : $G = 0$
Money demand is given by : $M/P = Y - i$
Money supply is constant : $M/P = 2$
Wage setting is described by : $W/P^e = 1 - u$
The production function is $Y = N$, and the markup is 25%
The labor force is 10, and in the above description i is stated in %

(i) Assume that $P^e = P$. Write down equations for the equilibrium in each of the three markets. (5 points)

Ans:

Goods market : $Y = 4 + 0.3Y + 0.2Y - i$

or $Y = 8 - 2i$

Money market : $Y = 2 + i$

Labor market : Set $P^e = P$, so that $1 - (1 - \frac{Y_n}{10}) = \frac{1}{1+0.25}$, which gives $Y_n = 8$ or $u_n = 20\%$

Now relax $P^e = P$

(ii) Write down the equation for the AS curve. (5 points)

Ans:

$W/P^e = Y/10$

$W/P = 0.8$

So the AS curve is obtained by eliminating W from these two equations : $P = Y/8$

(iii) Write down the equation for the AD curve if the stock of nominal money is 1 unit. (5 points)

Ans:

Given the information, the money market equilibrium condition (which you must now write without suppressing P), is

$1/P = Y - i$

Now eliminate i from this LM curve and the IS curve you obtained in (i), which gives

$Y = 8 - 2i = 8 - 2(Y - 1/P) \Rightarrow Y = \frac{8}{3} + \frac{2}{3P}$

(iv) Solve for the short-run equilibrium values for Y, P, and i if $P^e = 1$. (5 points)

Ans:

To compute equilibrium Y and i, use the IS ($Y = 8 - 2i$) and LM curves ($Y = 2 + i$), giving $Y = 4$, $i = 2\%$

Then use the equilibrium value of Y in the AS curve to get equilibrium P : $P = 0.5$

(v) Solve for the medium-run equilibrium values for Y, P, and i. (5 points)

Ans:

From (i), if we set $P^e = P$, $1 - (1 - \frac{Y_n}{10}) = \frac{1}{1+0.25}$, which gives $Y_n = 8$ or $u_n = 20\%$.

From AD you solved in (iv), $Y_n = \frac{8}{3} + \frac{2}{3P} \rightarrow 8 = \frac{8}{3} + \frac{2}{3P} \rightarrow P = \frac{1}{8}$.

From IS, $Y_n = 8 - 2i_n \rightarrow i_n = 0$.

(vi) Explain in words how the economy goes from the short-run equilibrium to the medium-run equilibrium. Can a monetary expansion help the adjustment? If so, how? (5 points)

Ans:

Since the short-run equilibrium involves an output level lower than the natural level, and a price higher than the medium run equilibrium price, the economy, if left to itself, will adjust to the medium run equilibrium through successive downward shifts in the AS curve, and falling prices. There will be no shifts in the AD curve. Monetary expansion can certainly help the adjustment. If the policy maker wishes to move the economy from the short-run equilibrium to the medium-run equilibrium all at once, then he/she needs to increase the money supply appropriately. The "all at once" part of the previous statement means that the AS curve will not shift. Instead, the monetary expansion will shift the AD curve just enough so that it intersects with the original AS curve you found in (ii) at the natural level of output, but at a higher price. If, on the other hand, the policy maker wants to move the economy to medium run equilibrium without price increasing from its short-run level, then he/she needs to wait for the AS curve to shift enough, and then expand the money supply so that the new AD intersects the new AS curve at the natural level of output and the same price as in the initial short-run equilibrium.

III. Long question - Stock prices rise? (15 points)

Excerpted from a popular financial news website from Friday, April 1, 2005 : "Stocks rose in the first half hour of trading after the release of a weaker-than-forecast March jobs report. While that would seem negative, stock investors worried about possible more aggressive rate hikes from the Federal Reserve took comfort in the numbers, which pointed to moderate economic growth and little upward pressure on wages."

Question : A weaker-than-forecast jobs report implies that employment (and therefore output) is lower than expected. This would ordinarily be bad news ("While that would seem negative...."), yet stocks rose. Explain (note that the answer is in the quote itself, but you must explain what is going on instead of merely reproducing the quote).

Ans:

First note that if output is lower than expected, and nothing else changes, then the present discounted value will be lower (since the numerator has decreased), and therefore stock prices lower, as markets revise their expectations

and re-price. But the statement also indicates that markets simultaneously revise down their expectations about future interest rates, since moderate economic growth means moderate inflation, and a lesser probability that the Fed will raise interest rates in the future (which presumably was the expectation factored into prices before the jobs report arrived). Thus both the numerator and the denominator decreased in the PDV calculations, and the fact that stock prices rose on net means that the latter decrease was proportionately larger.

IV. Long question - Investment Decision (25 points)

Imagine that you are a medical doctor and want to open your own clinic in year $t+1$. In order to do so, you need to rent a piece of medical equipment.

The nominal annual rental payment is $\$Z_t$. You *expect* it to increase at rate g (*not* in percentage) per year. For example, $\$Z_{t+2} = \$Z_{t+1}(1+g)$.

The nominal interest rate this period (from t to $t+1$) is i_t (again, *not* in percentage), You have no idea whether the nominal interest rate will be higher or not in year $t+1$. To play safe you form expectations such that $i^e_{t+1} = i^e_{t+2} = ... = i^e_{t+N} = i_t$.

Suppose that you decide to rent the equipment for m years. The rental contract stipulates that, if for any reason, the equipment does not work, another will be rented to you.

(i) Derive the expected present value of rentals on the equipment for the next m years. (10 points)

Ans:

$i^e_{t+1} = i^e_{t+2} = ... = i^e_{t+m} = i_t$.

$\$Z_{1t+k} = \$Z_{1t+1}(1+g)^{k-1} \quad \forall k \geq 2$

PDV of the expected rents for m years is:

$$\begin{aligned}
\$V(Z^e_t) &= \frac{\$Z_{1t+1}}{(1+i_t)} + \frac{\$Z_{1t+1}(1+g)}{(1+i_t)(1+i^e_{t+1})} + ... + \frac{Z_{1t+1}(1+g)^{m-1}}{(1+i_t)(1+i^e_{t+1})...(1+i^e_{t+m-1})} \\
&= \frac{\$Z_{1t+1}}{(1+i_t)} + \frac{\$Z_{1t+1}(1+g)}{(1+i_t)^2} + ... + \frac{\$Z_{1t+1}(1+g)^{m-1}}{(1+i_t)^m} \\
&= \frac{\$Z_{1t+1}}{(1+i_t)}\left[1 + \frac{(1+g)}{(1+i_t)} + ... \left[\frac{(1+g)}{(1+i_t)}\right]^{m-1}\right] \\
&= \frac{\$Z_{1t+1}}{(1+i_t)}\left[\frac{1-\left(\frac{1+g}{1+i_t}\right)^m}{1-\frac{1+g}{1+i_t}}\right] \\
&= \$Z_{1t+1}\left[\frac{1-\left(\frac{1+g}{1+i_t}\right)^m}{i_t - g}\right]
\end{aligned}$$

(ii) Suppose that you are instead offered the opportunity to buy the equipment today, at price P_t. You expect not to be able to resell it, so $P^e_{t+m} = 0$.

Should you buy or rent? Derive the condition under which you buy, and explain it in words. (10 points)

Ans:

Since $P^e_{t+m} = 0$, at the moment you buy the equipment, you know it will last for m periods.

Thus, you buy it if the price of the equipment P_t is lower than the expected present value of rentals for m years.

$$P_t \leq \$Z_{1t+1} \left[\frac{1 - \left(\frac{1+g}{1+i_t} \right)^m}{i_t - g} \right]$$

You are indifferent if the equality holds.

Otherwise, you are willing to pay rents for m periods instead.

(iii) Suppose the interest rate (current, and expected) increases. How does this affect your decision? (5 points)

Ans:

If both current and expected interest rates increase, renting the machine becomes cheaper because you discount the stream of expected future rentals more. If you look at the inequality above, higher i_t (recall that $i_t = i^e_{t+k}$ $\forall k \geqslant 1$.) makes the right hand side of the inequality smaller. Suppose that you were indifferent between buying and renting the equipment, when the interest rate increases, you prefer to rent it.