14.02: Principles of Macroeconomics
Quiz #1 (Suggested Solution)
Spring 98

Part I: True, False, Uncertain (30 points)
Answer all six questions. Make sure to provide brief explanation for each of your answers. Your score will largely reflect the quality and relevance of your explanation.

1. When the Fed carries out a contractionary open market operation, it raises the price of bonds, and lowers the output level.

    False. When the Fed carries out a contractionary open market operation, it basically sells bond to the public and, in the process, reduce the money supply in the market. Thus, the interest rate increase as money supply is reduced. Higher interest rate means that the price of bonds will be lower, and through the investment channel, new equilibrium output will be lower.

2. A $100 million increase in defense spending will have the same impact on equilibrium output as does a $100 million tax cut.

    *False. An increase in government spending by $100 million will lead to an increase of ($100 million * multiplier term) in output level. On the other hand, a $100 million tax cut will lead to an increase in output by only ($100 million*c1*multiplier term), where c1 = marginal propensity to consume which is less than one. Thus, government spending in this case will increase output by more. The intuition is that with government spending, the first effect on GDP is one for one, but for tax cut, it increases GDP by a fraction of c1.*

3. In the IS-LM model, equilibrium output is determined in the goods market, while equilibrium interest rate is determined in the bond market.

    False. In the IS-LM model, both equilibrium output and interest rate are jointly determined by the equilibrium both in the goods and financial (bond) markets.

4. If consumers decide to increase their cash holdings, as a result of a higher fee for uses of checking account services, money supply will increase.

    *False. When consumers decide to increase a proportion of their wealth in form of cash, the money multiplier will be smaller since banks will have less deposit money to lend out to investors. This will effectively reduce the money supply. Mathematically, M = [(1+c)/(c+θ)]*H, where c is the ratio of currency to checkable deposits and θ is the ratio of reserves to deposits.*

5. If investment is very responsive to changes in the interest rate, the IS curve will be relatively flat. This will make monetary policy very effective in changing the output level.

True. If investment is very sensitive to changes in the interest rate, a small decrease in interest rate will cause a large increase in investment level. Thus, the IS curve will be relatively flat. This will make monetary policy, with it direct impact on interest rate, very effective tool the government can use to affect the output level.

6. An economy with a persistent high unemployment rate is usually associated with a low labor participation rate.

True. In an economy with a persistent high unemployment rate, there will be a lot of "discouraged workers", those who, after being out of work for a long period, have given up looking for jobs. Since they are no longer look for jobs, they are not considered to be in labor force. Thus, the participation rate, which measures the ratio of labor force over total working population, will be low. The empirical evidences across countries have been shown to support this relationship.

Part II: Short Question (20 points)

Nominal interest rates in Japan have been pushed close to zero, a historical low, yet output has barely increased. (In answering this question, please assume that this is a closed economy.)

a) Can you provide an explanation using the IS-LM model? (Hint: think about the relative slopes of the IS and LM curves, and its implication on the policy effectiveness.) (7 points)

A possible explanation is that investment is no longer responded to the interest rates. That means the link between goods market and financial market is broken. The IS curve, in this case, will be very steep or vertical. As a result, monetary policy, though can lower interest rate, will not have any effect on output.

b) Some economists suggest that a monetary expansion is needed. Do you agree? Explain. (6 points)

Given that interest rates are very close to zero, a monetary expansion will not have much further impact on output. After all, nominal interest rate cannot be negative. In addition, from (a), it seems that the Bank of Japan has already engaged in expansionary monetary policy without much success.

c) Suggest a policy (or policy mix) that would increase the level of output. (7 points)

A fiscal expansion would be the best policy in this case. A cut in taxes will have an immediate effect in consumption (disposable income goes up), coupled with an immediate increase in public spending in programs such as public construction, should lead to higher output. The IS curve should shift to the right.

Part III: Long Question (50 points)

Consider the following economy:
The goods market is described by the following behavioral equations for aggregate consumption and investment:

$$C = c_0 + c_1(Y - T),$$

$$I = d_0 + d_1Y - d_2i.$$

Assume that the levels of government spending, G, and government revenues (taxes net of transfers), T, are determined outside of this model. In addition, $c_1 + d_1 < 1$.

(1) Is the behavioral equation for investment consistent with the one developed in class? Explain the relationship between investment and the interest rate. (5 points)

Yes. (Investment is increasing in output; decreasing in the interest rate.) This is just a specific functional form. The higher is the interest rate, the lower is investment. This is because in order to finance their investment, oftentimes firms need to borrow money or issue bonds. The higher is the interest rate, the more expensive it becomes for firms to invest. You can also think of the interest rate as an opportunity cost of capital.

(2) Write down an expression for the aggregate demand, Z, in this economy. (5 points)

$$Z = C + I + G = c_0 + c_1(Y - T) + d_0 + d_1Y - d_2i + G$$

(3) Write down the IS relationship. Explain in words what this relationship describes. What is the slope of the IS curve (graphed in (Y, i) space)? Is it consistent with what we have learned in class about the shape of the IS curve? (6 points)

$$Y = Z = C + I + G = c_0 + c_1(Y - T) + d_0 + d_1Y - d_2i + G$$

IS relationship gives all combinations of output and the interest rate that are consistent with the goods market equilibrium.

$$i = \frac{c_0 - c_1T + d_0 + G}{d_2} + \frac{c_1 + d_1 - 1}{d_2}Y$$

So the slope of the IS curve is $\dfrac{c_1 + d_1 - 1}{d_2}$. *This quantity is negative because*

$c_1 + d_1 < 1$, *which is consistent with what we have learned in class.*

From now on, assume that $c_1 + d_1 = 1 - d_2$.

(4) Show that the slope of the IS curve equals –1. (2 points)

$$\frac{c_1 + d_1 - 1}{d_2} = \frac{1 - d_2 - 1}{d_2} = -1$$

Now let's consider financial markets. Assume, as we did in class, that the supply of money is perfectly controlled by the Central Bank, so that real money supply, $\frac{M_s}{P}$ equals some constant $\overline{M}$.

First, lets consider the following demand for money:

$$\frac{M_d}{P} = kY - i$$

(5) Show that this functional form is consistent with what we know about money demand. Graph money demand in ($\frac{M}{P}, i$) space, holding the level of income, Y, fixed. What relationship describes equilibrium in the financial markets? Show the equilibrium point on the graph. (6 points)

Money demand should be increasing in income and decreasing in the interest rate, which is true in our case. (Note that this formula only makes sense for $kY > i$.) Money demand is a straight line with a slope of –1. Equilibrium in the financial markets is described by $\frac{M_s}{P} = \frac{M_d}{P}$ or $\overline{M} = kY - i$. On the graph, the equilibrium point is at the intersection of the vertical money supply line with the downward-sloping money demand. (Money demand is linear!!!!)

(6) Derive the LM curve for this economy. Using IS-LM analysis, show the equilibrium output and interest rate on the graph. (6 points)

In order to derive the LM curve from the money demand/money supply graph above, you need to go from ($\frac{M}{P}, i$) space into (Y, i) space. You already know one equilibrium point for some fixed level of income. Now increase income to some new level. This will cause money demand to shift up. The new intersection of money demand with money supply gives you the second equilibrium combination of income and interest rate. Plot these points in (Y, i) space to get an upward-sloping line. Now combine the IS and LM curves on the same graph and label the overall equilibrium.

(7) Because of the upcoming elections, the President is concerned that the equilibrium output is too low. She suggests to use fiscal policy to boost output growth. However, her Council of Economic Advisors warns her that such measures could crowd out investment because of the high interest rates. The President decides to

cut a deal with the Central Bank to resolve this problem. Describe a policy mix that will increase output, while keeping the interest rate at its original level. (8 points)

We know that fiscal policy will increase output, but cause the interest rate to rise as well. Monetary policy will also increase output, but cause the interest rate to fall. In order to keep the interest constant we need to use both. When k=1 (the slope of LM equals 1), the amounts by which we need to shift the IS and LM curves are the same. When LM is steeper than 1, we need to shift it by more than IS. IS can be shifted to the right using fiscal policy, either by increasing government spending or by decreasing taxes. LM can be shifted down using monetary policy by increasing money supply (which can be attained through the purchase of bonds by the Central Bank). GDP components: investment increases because output increases; consumption will increase more or less depending on the type of fiscal policy used (if taxes are lowered, it will increase more); government spending will only increase if fiscal policy is implemented through increases in government spending.

(8) Now suppose that the LM curve is vertical. You are hired as an independent advisor to both government and the Central Bank. Your goal is to come up with an appropriate policy that will increase output in the short run. What will be your recommendation? (*Hint*: You should be thinking about responsiveness of output to fiscal and/or monetary policy. Describe how each policy can be implemented and what its effects would be on the equilibrium output.) (6 points)

Since LM curve is vertical, fiscal policy is useless (it will only raise the interest rate without any change in output). Monetary policy is very effective: shift LM out in order to increase output dramatically. Monetary policy is implemented through increases in money supply (CB buys bonds).

(9) Give your intuition as to why the LM curve could be vertical. What would be the shape of money demand in this case? (6 points)

LM is vertical when money demand is not responsive towards the interest rate. Money demand is vertical as well. This can happen, for example, at low levels of income, when people are using money solely to complete transactions essential to their survival.