14.02 Principles of macroeconomics
Spring 98
Problem Set #4 (Suggested Solution)

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1. There are two possible interpretations, and either one is a correct answer:

"Strong future demand growth" means that the future IS curve shifts to the right, thus causing higher future output and higher future interest rates.

Also, the statement by the Fed chairman can be taken as a sign that the Fed will try to counteract the future strong demand by shifting the future LM curve to the left. Such an action would mitigate the response from output, but would increase future interest rates even further.

2. So far, we have used the interest rate r to denote both the rate of return to lenders, and the cost of borrowing to borrowers. Suppose now that the government taxes capital gains by keeping x percentage points. If we denote the cost of borrowing by q and let r represent the rate of return to lenders, then it has to be the case that:

$$r = q - x$$

In other words, the rate of return that lenders get, r, is equal to the rate of return that borrowers pay (a.k.a. the cost of borrowing), q, minus the tax that the government keeps. Thus, the firms' investment decision depends on the cost of borrowing q, but money demand depends on the lenders' rate of return, r. This means that our IS-LM should be rewritten as:

```
IS:   Y   =  C(Y-T) + I(Y,q) +G      (1)
LM:  M/P =   Y·L(r)                   (2)
      r  =   q - x                    (3)
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You can now draw the IS and LM curves using q on the vertical axis, by substituting from equation (3) into equation (2) to get:

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LM:   M/P =   Y·L(q-x)                (2')
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It should be obvious that the IS is still downward sloping and the LM is still upward sloping when you have q on the vertical axis.

The question is what happens when the capital gains tax, x, is reduced. Since x only enters in the LM equation then only the LM curve shifts, and it shifts to the right. The reason is very simple: a change in capital gains tax does not affect the *relationship* between the cost of borrowing q and investment, and thus the IS curve stays the same. However, it does affect the relationship between q and money demand. What matters for money demand is

r, and thus when x goes down, at any level of q, the implied r is higher. So, at any level of q money demand is lower when x is lower, and a higher level of Y is needed to equilibrate the financial markets. That's why the LM curve will shift out when we draw our IS-LM with q on the vertical axis and Y on the horizontal.

q   LM

LM'

====>

IS

Y
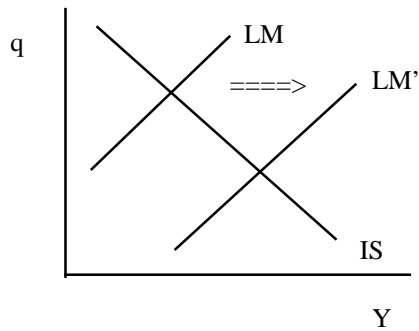
So, the overall effect of the capital gains tax is that output Y increases and the cost of borrowing q decreases. Thus, you can say, unambiguously that investment will also be higher.

What happens the rate of return to lenders, r? Recall that $r = q - x$. Since both q and x have decreased we cannot say for sure from this identity what happens to r. However, we can figure it out by looking at the LM curve:

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LM:   M/P  =   Y·L(r)                     (2)
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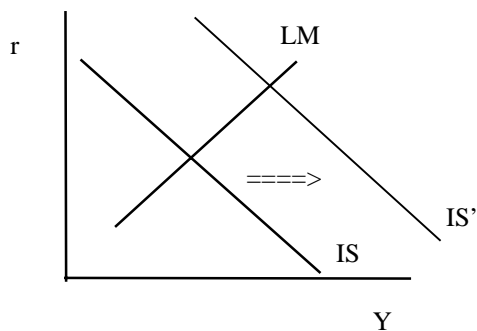
Since output has increased, the rate of return to lenders r must have also increased, to keep money demand equal to money supply.

We can also figure out what happens to r by drawing the IS-LM with r on the vertical axis, using:

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IS:    Y  =   C(Y-T) + I(Y,r+x) +G     (1')
LM:   M/P  =   Y·L(r)                     (2)
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In this case, its only the IS curve that shifts, and it shifts out. That's because at any level of r, a lower x implies a lower q and thus higher investment:

So, r is higher.

Overall, we can say that a decrease in the capital gains tax will increase output, increase the rate of return to lenders, decrease the cost of borrowing to firms and increase investment.

[Note: there can also be another mechanism at work, which we are not equipped to analyze: the capital gains tax cut will make financial assets more desirable, and it may be the case that demand for financial assets (such as bonds, stocks, etc) will increase, leading to a booming stock market, etc. This may lead to a consumption boom either because of optimism or because consumers feel wealthier now that their financial asset holdings are worth more.]

3.

The future IS shifts to the right [causing higher future interest rate (r') and higher future output (Y').]

a. The expected higher future interest rate and output have opposing effects on the current IS curve (in addition to the effect of lower future taxes on the current IS curve). The overall effect on r and Y is ambiguous.

b. To prevent changes in future output, the Fed shifts the future LM curve to the left, implying even higher r' but constant Y'. Higher future interest rates tend to shift the current IS to the left, but the lower future taxes tend to shift the current IS curve to the right. The overall effect on r and Y is still ambiguous. However, you can say that it is now more likely than in part (a) that the current IS curve will shift to the left. That's because the future interest rate effect is stronger and because the future output effect is no longer there.

c. To prevent changes in r', the Fed shifts the future LM curve to the right, implying an increase in Y' but constant r'. This tends to shift the current IS to the right, as does the expectation of lower future taxes. So the current IS curve does unambiguously shift to the right. The Fed responds by shifting the current LM to the right, in order to maintain the current interest rate r constant. Overall, the level of Y increases unambiguously.

4. There are a number of correct answers here. Here are two:

=> Perhaps the Fed would not have been convinced of President Clinton's intentions to reduce the deficit (this is the credibility issue), and would not have supported the effort with easy money in the future. This would have led to lower expected future output, and not as low expected future interest rates, thus making it more likely that the package would have shifted the current IS curve to the left and caused a recession.

=> If indeed there were a fiscal stimulus package included, then perhaps the Fed would not have been as supportive with easy money, since the fiscal stimulus package would have helped keep the current IS curve from shifting to the left.

5.
a. FALSE. The demand for money depends only on the current nominal interest rate. Future NOMINAL interest rate changes will only affect the demand for money in the future.

b. FALSE. There are undoubtedly a variety of ways in which one can attack the assumption that people have rational expectations. For example, phenomena such as stock market bubbles and subsequent crashes are very hard to reconcile with rational expectations. Or is may be reasonable to assume that not all people have the knowledge and mathematical skills needed to correctly formulate rational expectations. Nevertheless, the rational expectations framework is a very useful benchmark that can be used to assess the effectiveness of policy in the face of forward-looking rational consumers even if the consumers' expectations are not always correctly set. When conducting economic policy we have to take into account that the effectiveness of our policies will very much depend on how economic behavior today will change in the face of the anticipated future effects of our policies.

6. Higher interest rates will discourage borrowing even if firms use their own retained earnings to invest: the firms own investment projects will produce some rate of return. When the interest rate rises to above the rate of return on the firms own projects, it makes more sense for the firms to lend their retained earnings at the higher interest rate (e.g., by buying someone else's bonds), rather than to use it for their own projects.