Econ 340: Money, Banking and Financial Markets Midterm Exam, Fall 2011

Essay Questions:

At their September 2011 Open Markets Committee Meeting, the Federal Reserve Board decided to “extend the average maturity of its holdings of securities. The Committee intends to purchase, by the end of June 2012, $400 billion of Treasury securities with remaining maturities of 6 years to 30 years and to sell an equal amount of Treasury securities with remaining maturities of 3 years or less.”

Bond yields, term structure and exchange rates. (60 points–20 points each)
For the purpose of answering these questions, assume that the Federal reserve will purchase 10 year bonds and sell 1 year t-bills. (That is, don’t worry about the remaining maturities.)

1. As of the announcement in mid September, what would happen to both short term (1-year) yields and long-term (10 year bond) yields? Use a supply and demand for bonds model to illustrate graphically (along with a detailed explanation) the impact of the FED’s announcement on both short-term and long-term markets.

The Fed has announced that it will be selling off $400 billion of short term (1-year t-bills) beginning October 4, 2011. The easiest way to evaluate the effect of these changes is to treat the supply of t-bills as fixed and treat the Fed’s announcement as a reduction in the demand for treasury bills. (In fact it makes sense to use a vertical supply curve, except that on occasion the treasury department may respond to price movements when deciding how many t-bills to sell.) The demand curve is downward sloping because as the current price of a bill, \( P_t \), rises, the yield to maturity on the bill, \( i \), declines,

\[
\downarrow i = \frac{FV}{P_t} - 1, \tag{1}
\]

where \( FV \) is the discount bill’s face value. As the yield to maturity declines, t-bills are less attractive, and the quantity of t-bills demanded declines (moving along D curve).

In figure (1), the Feds’ actions mean a lower quantity of t-bills being purchased by the FED at any price. In other words, as the Fed’s current holdings of t-bills mature, they do not purchase new ones. Instead, they take the proceeds and move out the yield curve to purchase long-term treasury bonds (10-years to maturity) shifting the demand for t-bonds to the right.

Assume that both markets begin in equilibrium at point \( A \) in Figure 1. The leftward shift of the t-bill demand curve results in an excess supply \( = Q_1 - Q' \) of t-bills. Excess supply drives the price of t-bills down to the new equilibrium price, \( P_2 \). And, with a lower equilibrium price, the yield to maturity on t-bills has necessarily increased (see equation (1)).

In contrast, the rightward shift of the t-bond demand curve results in an excess demand \( = Q'' - Q_1 \) of t-bonds. Excess demand drives the price of t-bonds up to the new equilibrium price, \( P_2 \). And, with a higher equilibrium price, the yield to maturity on t-bonds will decrease.

Finally, it is important to note that as of the announcement, none of these Fed operations has yet occurred, but bond traders expect this is what will occur beginning in October. If bond
traders expect interest rates on t-bonds to fall and prices to rise, then they want to purchase bonds today to take advantage of the possible capital gain. In other words, if bond traders bet on their expectations, they will shift the demand curves as illustrated in figure (1) today and cause prices and yields to move as expected.

2. Given your answer to question (1) show graphically and provide a detailed explanation of the impact the FED’s announcement might have on the exchange rate between the euro and the dollar.

In the short run, the value of the dollar is determined by the supply and demand for dollar deposits. Figure (2) below plots the supply of dollar assets versus the demand for dollar assets in a graph with the Euro/Dollar exchange rate on the vertical axis and the quantity of dollar assets on the horizontal axis. The supply curve is vertical because of the assumption that the supply of dollar denominated deposits is fixed in the very short run. In contrast, the demand curve is downward sloping. The downward slope of the demand curve is based on the assumption that foreign bank deposits and domestic bank deposits are perfect substitutes. When capital is mobile and bank deposits are perfect substitutes, it must be true that there is no difference in the expected returns on domestic and foreign deposits. In other words,

\[ i^D = i^F - \frac{E_{t+1}^e - E_t}{E_t}, \]  

(2)

where \( i^D \) is the domestic interest rate, \( i^F \) is the interest rate on foreign deposits, \( E_t \) is the exchange rate (units of foreign currency per unit of domestic currency) at time \( t \) (today), and \( E_{t+1}^e \) is the expected value of the exchange one period in the future.

In equation (2), the left hand side of the equation is the domestic investors expected return from holding domestic deposits, i.e. the interest rate paid on domestic deposits. The right hand side of equation (2) is the domestic investors expected return from holding foreign deposits, i.e. the interest rate paid on foreign deposits minus the expected appreciation of the
domestic currency (depreciation of the foreign currency). Notice that an increase in the spot exchange rate, i.e. an appreciation of the dollar, causes the RHS of equation (2) to increase—increasing the expected return on foreign deposits—and therefore lowering the quantity of dollar assets demanded. Thus, the demand for dollar deposits is downward sloping in E and Q space.

To see why this equality must hold, suppose that the expected return from holding dollars was greater than the expected return on foreign deposits. As a result, investors would only want to hold dollars, and their attempt to purchase dollar deposits would create an excess demand for dollars, causing the dollar to appreciate. As the spot exchange rate appreciates (holding the expected future exchange rate constant), the “expected appreciation” of the dollar, \( \frac{E_{t+1} - E_t}{E_t} \), will decline so that the expected foreign return would increase. This upward pressure on the value of the dollar would continue until investors are indifferent between holding dollars and foreign currency, i.e. equation (2) holds again.

So, what is the effect of the Fed’s action described in part (1) above? The Fed selling short-term t-bills will likely put some upward pressure on interest rates on domestic deposits. At today’s spot exchange rate (and holding the expected future exchange rate unchanged) the expected return from dollar deposits is now higher than that on foreign deposits resulting in an increase in the demand for domestic deposits and shifting the demand curve to the right from \( D_1 \) to \( D_2 \).

The higher return on domestic deposits leads to an excess demand for the dollar (excess supply for the foreign currency). The excess demand \((Q_{D2} - Q_{D1})\) of dollar deposits leads to an increase in the price of dollar deposits, i.e. an appreciation of the dollar from \( E_1 \) to \( E_2 \). As the spot exchange rate increases, for a given future expected exchange rate, \( E_{t+1}^e \), the expected appreciation of the dollar \( \frac{E_{t+1}^e - E_t}{E_t} \) declines, and the expected foreign return rises.

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1 Equation 2 is not required for answering this question, but the concept of equal expected returns is.
This increase in the expected foreign return is a movement up the demand schedule from point A towards the new equilibrium where \( Q_s = Q_d \) again. The end result is that higher domestic interest rates lead to an appreciation of the domestic currency. Finally, given that at the time of the announcement, the Fed had not yet reduced its demand for t-bills, bond traders expecting the future higher yields would likely drive up yields today, and currency traders expecting an appreciation of the dollar would buy the dollar now causing expectations to be fulfilled.

3. Write down an equation representing the liquidity premium theory of the term structure of interest rates. Explain the intuition behind your equation, i.e. what forces insure that your equation holds? Explain how the FEDs policy action is attempting to "twist" the yield curve.

The liquidity premium theory is based on the assumption that bonds of different maturities are not perfect substitutes. Investors care about both expected returns and the term to maturity of their portfolios. The liquidity premium theory of the term structure posits that longer term bond yields are equal to the expected return from holding a portfolio of short term bonds (approximately equal to the simple average of current and future short term yields) plus a liquidity premium which compensates investors for holding the longer term, less liquid, security. This relationship may be written as,

\[
i_{nt} = \frac{i_{1t} + e_{1t+1} + \cdots + e_{1t+n-1}}{n} + l_{nt},
\]

where \( i_{nt} \) is today's (time period \( t \)) yield on a bond with \( n \) years to maturity, \( e_{1t+n-1} \) is the expected yield on a one-year bill bought \( n-1 \) years from today, and \( l_{nt} \) is the premium earned for holding the \( n \)-year bond instead of the more liquid portfolio of one-year bills. The intuition behind the equality in equation (3) is quite simple. Suppose that the yield on \( n \)-year bonds was higher than the expected return from holding the one-year bills plus the liquidity premium. Investors would rush to buy the \( n \)-year bond (some of them selling one year bills to do so). The increased relative demand for the longer term security would push its price up and the price on the one-year bill down. As a result, the \( n \)-year yield would decrease and the return on the portfolio of one-year bills would increase until the liquidity adjusted returns are the same.

Given the results from part (1), bond traders expect one-year bill rates to rise now and at least next year. Note they may also raise their expected one-year bill rates in the future given the persistence of short term interest rates. So, if the Fed was not purchasing long-term bonds, its reduced demand for t-bills would lead to both an increase in short term interest rates as well as some increase in longer term rates; the yield curve would both flatten and shift up slightly. But instead, the Fed would like to twist the yield curve so that long-term rates decline rather than increase as would occur with only an increase in short term yields. To do this they are going to purchase long-term bonds and effectively reduce the liquidity premium required on longer term bonds. Because traders know their will be an increase in the Fed’s purchases of long-term bonds, they may treat this as an increase in the liquidity of the long-bond market. With a reduced liquidity premium, \( l_n \), the \( n - period \) bond yields can fall even while current and future expected short term interest rates are rising.