EE431: Economics of financial market and institutions

Semester 1/2017

Assignment 4: Term structure of interest rate and Theory of stock market

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Instruction: Attempt all the ***even-number questions***. (All the odd-number questions are your own practice problem set. No need to turn in.)

1. Discuss the similarities and differences between Expectation hypothesis and Liquidity premium theory.

2. *Assuming the pure expectations theory is correct, an upward-sloping yield curve implies:
   a. Interest rates are expected to increase in the future.
   b. Longer-term bonds are riskier than short-term bonds.
   c. Interest rates are expected to decline in the future.

Under the pure expectation theory, bonds with different maturity are treated to be identical. Hence, the difference in bond rates over time-to-maturity is not related to risk. Investors only care about the expected return from the investment because they are risk-neutral investor.

Based on the theorem, long-term interest rate is an average of the future short-term interest rates. Having observed an upward-sloping yield curve then suggests that an average of the future short-term rates must be higher than the level of current short-term rate. As a result, upward-sloping yield would suggest an anticipated rise in the future short-term rates. So, the answer is a.

3. Under the liquidity preference theory, if inflation is expected to be falling over the next few years, long-term interest rates will be higher than short-term rates. True/false/uncertain? Why?

4. *Following the Liquidity premium theory, if yield curve has become flat, what do you think it could be inferred from the movement the yield curve?

   Following the liquidity premium theory, long-term interest rate is the sum between the average of future short-term interest rates and the term premium. Flattening yield curve can occur because of either lowering in the term

premium at a particular long-horizon or a decline in the average of future short-term rates, or the combination of both. Declining in the term-premium is usually related to structural changes, such as a decline in the perceived risk of long-term inflation volatility. A more common explanation used to explain the flattening of yield curve is related to the movement of future short-term interest rates. Flattening yield curve suggests that market anticipates a decline in future interest rates. Such an anticipation could arise from an expectation on a moderately decline in the level of economic activities, which can lower demand for funding in the future.

5. During the US subprime crisis, credit spread had been rising rapidly, and term spread had become negative. The US Federal Reserve has then responded to the situation by adopting many unconventional monetary policies. Under the policy, Federal Reserve expands the type of fixed instrument asset that it purchases under the open market operation program. That is, not only does the FED conventionally purchase short-term government bond, it has also purchased other forms of fixed instrument assets including long-term government bond and private credit bond during the crisis period. Use the analytical framework discussed in class to explain the plausible impact of the unconventional monetary policies on the movement of US yield curve and cred spread.

6. *(Moderate) The following is a list of prices for zero-coupon bonds of various maturities. Calculate the yields to maturity of each bond and the implied sequence of forward rates.

Maturity (Years)	Price of Bond
1	$943.40
2	898.47
3	847.62
4	792.16

First calculate implied yield for each type of bonds. (This is to suppose that each type of bonds has its face value equal to $1000.)
1-year rate: i1(t) = 5.99% (1+i1) = 1000/943.40
2-year rate: i2(t) = 5.49% (1+i2)^2 = 1000/898.47

3-year rate: i3(t) = 5.66% (1+i3)^3 = 1000/847.62
4-year rate: i4(t) = 5.99% (1+i4)^4 = 1000/792.16

From the pure expectation hypothesis, we know that

i4(t) = (i1(t) + i1(t+1) + i1(t+2) + it(t+3))/4
i3(t) = (i1(t) + i1(t+1) + i1(t+2))/3
i2(t) = (i1(t) + i1(t+1))/2

Sequentially solving for i1(t+1), i1(t+2), i1(t+3), we obtain that the sequence of implied one-year forward rates is 4.99%, 6%, 6.98%.

7. (Moderate) Consider the following $1,000 par value zero-coupon bonds:

Bond	Years to Maturity	YTM(%)
A	1	5%
B	2	6%
C	3	6.5%
D	4	7%

According to the expectations hypothesis, what is the expected 1-year interest rate 3 years from now?

8.* (Hard) The yield to maturity on 1-year zero-coupon bonds is currently 7%; the YTM on 2-year zeros is 8%. The Treasury plans to issue a 2-year maturity *coupon* bond, paying coupons once per year with a coupon rate of 9%. The face value of the bond is $100.

a. At what price will the bond sell?

b. What will the yield to maturity on the bond be?

c. If the expectations theory of the yield curve is correct, what is the market expectation of the price that the bond will sell for next year?

d. Recalculate your answer to (*c*) if you believe in the liquidity preference theory and you believe that the liquidity premium is 1%.

a) By the principle of equivalent asset, we know that
Price = 9/(1+0.07) + 109/(1.08)^2 = 8.411 + 93.449 = 101.86.
This is, bond will be sold at premium.
b) 2-year coupon yield can be calculated by solving for i2 such that

101.86 = 9/(1+i2) + 109/(1+i2)^2.

We obtain that i2 = 7.958%.

c) *One-year zero coupon rate is 7% and 2-year zero coupon is 8%. Based on the expectation hypothesis, this implies that one-year zero coupon will be 9% in the next year. Hence, price of the 2-year coupon bond in the next year would be equal to 109/(1+0.09) = $100*

d) *One-year zero coupon will be 8% in the next year if liquidity premium for 2-year zero coupon bond is 1%. Hence, price of the 2-year coupon bond in the next year would be equal to 109/(1+0.08) = $92.59*

9. Basic DFC model

Suppose that a company paid a recent dividend of $2.40 per share, and shareholders expect that dividend will be growing at the rate of 6%. What is the fair price of the shock of company A if the required rate of return is 10.2%

10. *Basic CAPM

Suppose that the risk-free rate is now equal to 5%, and the average return of market portfolio is equal to 14% as well. Calculate the expected rate of return for the asset whose beta is equal to 0.5 and 0, respectively.

When beta is 0.5, required rate of return is equal to 5% + 0.5(14%-5%) = 9.5%.*

When beta is zero, required rate of return is equal to 5% + 0(14%-5%) = 5%*

11. In the most recent meeting, company paid the dividend of $4 per share. According to study, investors believe that dividend is supposed to grow at the rate of 3% per annual. Consider the following problems.

a) Calculate the required rate of return of the stock if current price is equal to $103

b) Following (a), if the risk-free rate is equal to 5% and the market portfolio return is equal to 10%, calculate the beat coefficient of this stock.

12. ***XYZ** corporations' stock recently paid a dividend of $4 per share (D0 = $4). The company has a constant growth rate of g = 6% and a beta equal to 1.8. The required rate of return on the market is 8% and the risk-free rate is 4%. The company is considering a change of policy, which will increase its beta to 2. If market conditions remain unchanged, what new constant growth rate will cause the common stock price remain the same?

D0 = 4; g = 6%; beta = 1.8; rf = 4%; and rm=8%

*P = E(D1) / (rj - g) = (1+0.06)*4 / (rj – 0.06)*

rj = rf + beta(rm-rf) = 0.112 (11.2%)

P = 4.24 / 0.052 = $81.53

Now, given that beta is changed to 2. The required rate of return is then 0.12 (12%). To fix the same price, g must be changed then to g' (new g). (Otherwise, price would have dropped.) Under new beta, g must solve for 81.53 = 4(1+q') / (0.12 – g').*

That is we must have g' = 0.067 (6.7%).

13. A company paid a recent dividend of $2 per share. (D0 = $2) and it had a beta of 1.8 before a reevaluation of company's risk. Before reevaluation, company's stock price was $100. After the revaluation, the stock price dropped to $80 due to a change in its beta. The dividend growth rate "g" is constant and it remained the same after reevaluation. The *market risk premium* is 5% and the risk-free rate is 4%: What is the new beta of the company that caused the price increase?

14.*Read the question carefully.

IBM's year-end dividend is expected to be $2.15, the growth rate will be 11.2% forever, and your required return is 15.2%

a) What is the intrinsic value now?

b) If the market is efficient, what's the next year's expected price?

c) If you buy it now and sell it after dividend payment, what's your expected capital gain, dividend yield, and holding period return?

a) P = E(D1) / (rj – g) = 2.15 / (0.152 – 0.112) = 2.15 / 0.04 = $53.75

b) Rj = required rate of return.

$$rj = \{ E(D1) + P(t+1) - P(t) \} / P(t)$$

We knew from "a" that P(t) = $53.75, and the required rate of return is 0.152. Given this, P(t+1) must be set in the way makes the above equation consistent in the equilibrium.

$$0.152 = \{ 2.15 + P(t+1) - 53.75 \} / 53.75$$

$$P(t+1) = \$59.77$$

c) Dividend yield is expected to be 2.15/59.77 = 0.036 (3.6%) and capital gain is expected to be 0.116 (11.6%). Holding period return is then equal to 15.2%, which is expected to be equal to required rate of return.

15. What will the dividend growth rate be if a company's ROE is 14%, and it retains 91% of its earnings (i.e., 9% dividend payout ratio.)

16. * If a corporation announces that it expects quarterly earnings to increase by 25% and it actually sees an increase of 22%, what should happen to the price of the corporation's stock if the efficient markets hypothesis holds, everything else held constant? Describe that price dynamic that you are supposed to observe if the efficient market hypothesis is efficient.

Prior to the announcement, market expected a 25% increase in earning. Price would have risen to the level that is consistent with the information. However, when the actual earning comes out to be lower than expected, price would be suddenly adjusted to correct the error in forecasting. If the market is efficient, one should see a sudden decrease in price after investors see the new data.

17. On the end of year 2016, the four-year-ahead forecasts for SAMSUNG's dividend are 0.17, 0.183, 0.197, and 0.21. After the fourth year, most analysts believe that Apple's dividend would grow at 12.74%. Suppose that the required return of SAMSUNG stock is 13.8%. Use the multi-stage growth model to calculate the current fair price of SAMSUNG stock.

18.* You are considering acquiring a common share of Sahali Shopping Center Corporation that you would like to hold for one year. You expect to receive both $1.25 in dividends and $35 from the sale of the share at the end of the year. The maximum price you would pay for a share today is _____ if you wanted to earn at least a 12% return.

A) $31.25 B) $32.37 C) $38.47 D) $41.32

rj = { E(D1) + P(t+1) – P(t) } / P(t)
0.12 = { 1.25 + 35 – P(t) } P(t)
P(t) = 32.37
So, maximum price is then equal to $32.37