FINC 430 TA Review Session 3
Stock Valuation and Bond Valuation
Solutions

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Question 2 (6-14 in the Textbook)

Suppose you purchase a 30-year, zero-coupon bond with a yield to maturity of 6%. You hold the bond for five years before selling it.

(a) If the bond's yield to maturity is 6% when you sell it, what is the internal rate of return of your investment?

(b) If the bond's yield to maturity is 7% when you sell it, what is the internal rate of return of your investment?

(c) If the bond's yield to maturity is 5% when you sell it, what is the internal rate of return of your investment?

(d) Even if a bond has no chance of default, is your investment risk free if you plan to sell it before it matures? Explain.

Suppose you purchase a 30-year, zero-coupon bond with a yield to maturity of 6%. You hold the bond for five years before selling it.

(a) If the bond's yield to maturity is 6% when you sell it, what is the internal rate of return of your investment?

Purchase price = $100 / 1.06^{30} = 17.41$.

Sale price = $100 / 1.06^{25} = 23.30$.

Return = $(23.30 / 17.41)^{1/5} - 1 = 6.00\%$.

Since YTM is the same at purchase and sale, IRR = YTM.

(b) If the bond's yield to maturity is 7% when you sell it, what is the internal rate of return of your investment?

Purchase price = $100 / 1.06^{30} = 17.41$.

Sale price = $100 / 1.07^{25} = 18.42$.

Return = $(18.42 / 17.41)^{1/5} - 1 = 1.13\%$.

Since YTM rises, IRR < initial YTM.

(c) If the bond's yield to maturity is 5% when you sell it, what is the internal rate of return of your investment?

Purchase price = $100 / 1.06^{30} = 17.41$.

Sale price = $100 / 1.05^{25} = 29.53$.

Return = $(29.53 / 17.41)^{1/5} – 1 = 11.15\%$.

Since YTM falls, IRR > initial YTM.

(d) Even if a bond has no chance of default, is your investment risk free if you plan to sell it before it matures? Explain.

Even without default, if you sell prior to maturity, you are exposed to the risk that the YTM may change.

Question 4 (9-6 in the Textbook)

Summit Systems will pay a dividend of $1.50 this year (at t=1). If you expect Summit's dividend to grow by 6% per year, what is its price per share (at t=0) if its equity cost of capital is 11%?

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$P = 1.50 / (11\% - 6\%) = \$30$

Question 5 (9-8 in the Textbook)

Canadian-based mining company El Dorado Gold (EGO) suspended its dividend in March 2016 as a result of declining gold prices and delays in obtaining permits for its mines in Greece. Suppose you expect EGO to resume paying annual dividends in two years time, with a dividend of $0.25 per share, growing by 2% per year. If EGO's equity cost of capital is 10%, what is the value of a share of EGO today?

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The price in one year is

$P(t+1) = Div(t+2)/(r - g) = 0.25/(.10 - .02) = \$3.125$

The price today is

$P(t) = P(t+1)/(1+r) = \$3.125/1.1 = \$2.84$

Question 6 (9-12 in the Textbook)

Proctor and Gamble paid an annual dividend of $1.72 in 2009. You expect P&G to increase its dividends by 8% per year for the next five years (through 2014), and thereafter by 3% per year. If the appropriate equity cost of capital for Proctor and Gamble is 8% per year, use the dividend-discount model to estimate its value per share at the end of 2009.

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Since dividends are growing at the cost of capital over the next 5 years, the present value of the next 5 years' dividends are:

$$PV_{1-5} = \frac{1.72 \times 1.08}{1.08} + \frac{1.72 \times 1.08^2}{1.08^2} + \cdots \frac{1.72 \times 1.08^5}{1.08^5}$$

$$= 5 \times 1.72 = \$8.60$$

Value on date 5 of the rest of the dividend payments:

$$PV_5 = \frac{1.72 \times 1.08^5(1.03)}{0.08 - 0.03}$$

$$= \$52.06$$

Discounting this value to the present gives

$$PV_0 = \frac{52.06}{1.08^5} = \$35.43$$

So the value of Gillette is:

$$P = PV_{1-5} + PV_0 = 8.60 + 35.43 = \$44.03$$

Question 7 (9-32 in the Textbook)

Roybus, Inc., a manufacturer of flash memory, just reported that its main production facility in Taiwan was destroyed in a fire. While the plant was fully insured, the loss of production will decrease Roybus' free cash flow by $180 million at the end of this year and by $60 million at the end of next year.

(a) If Roybus has 35 million shares outstanding and a weighted average cost of capital of 13%, what change in Roybus' stock price would you expect upon this announcement?

(Assume the value of Roybus' debt is not affected by the event.)

(b) Would you expect to be able to sell Roybus' stock on hearing this announcement and make a profit? Explain.

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PV(change in FCF) = $-(180 / 1.13) - (60 / 1.13^2) = -206$

Change in V = –206, so if debt value does not change,

P drops by 206 / 35 = $5.89 per share.

(b) Would you expect to be able to sell Roybus' stock on hearing this announcement and make a profit? Explain.

If this is public information in an efficient market, share price will drop immediately to reflect the news, and no trading profit is possible.

Inflation Question

Suppose Mr. and Mrs. Smith are both 25 years old and have just started working. The Smiths' combined annual (nominal) salary will be $80,000 at the end of this year (i.e. at age 26). Inflation is expected to be 4% per year. Currently, the nominal interest rate for borrowing and lending and for mortgages is 6.08% per year. Ignore taxes.

(a) The Smiths decide to buy a house such that the first (nominal) mortgage payment is 40% of their combined salary of $80,000 at age 26. Given this, what is the (largest) house price the Smiths can afford if they buy a house at age 25 (time 0) and take out a 30 year mortgage with annual mortgage payments where the first payment is at age 26 (time 1)? (Annual mortgage payments are constant in nominal terms).

(b) The Smiths expect their combined salary to increase by 1% per year in real terms and plan to work until age 65. What is the PV of the Smiths' salary income as of today (age 25)? Hint: Start by working out the real interest rate and the real value of the nominal $80,000 salary they receive at age 26.

(c) The Smiths buy the most expensive house they can afford (you worked out its price in (a)) and start thinking about retirement planning. They expect to live until age 85 and plan to live in the house until then and bequeath it to their children. They would like to consume a constant real amount, C, each year on items other than their house. The first consumption will be at age 26 and the last at age 85. What real amount, C, can they afford to consume per year based on their salary and their mortgage payments?

Suppose now that inflation increases to 5% per year and that the real interest rate stays un affected (you calculated what it was in (b)). Let us think about how this would affect house prices. Assume that the first salary of $80,000 is unaffected by the increase in inflation.

(d) What is the nominal interest rate (and thus the interest rate on mortgages) now using these new assumptions? What is the largest house price the Smiths can afford now if their first (nominal) mortgage payment is to remain at 40% of their combined salary of $80,000 at age 26? (Note: You have just worked out how much house prices may fall if nominal interest rates increase!)

(a) The Smiths decide to buy a house such that the first (nominal) mortgage payment is 40% of their combined salary of $80,000 at age 26. Given this, what is the (largest) house price the Smiths can afford if they buy a house at age 25 (time 0) and take out a 30 year mortgage with annual mortgage payments where the first payment is at age 26 (time 1)? (Annual mortgage payments are constant in nominal terms).

Mortgage payment: 0.4 x $80, 000 = $32, 000.

House price = PV of mortgage payments

$$= \frac{\$32{,}000}{0.0608}\left(1 - \frac{1}{1.0608^{30}}\right)$$

=$436,729.60

(b) The Smiths expect their combined salary to increase by 1% per year in real terms and plan to work until age 65. What is the PV of the Smiths' salary income as of today (age 25)? Hint: Start by working out the real interest rate and the real value of the nominal $80,000 salary they receive at age 26.

The real interest rate is $\frac{1+r_{nom}}{1+i^e} - 1 = \frac{1.0608}{1.04} - 1 = 0.02$

PV of salary income = $\underbrace{\frac{\$80{,}000}{1.04}}_{\text{First salary in real terms}} \frac{1}{0.02-0.01}\left(1 - \left(\frac{1.01}{1.02}\right)^{40}\right)$

=$2,505,445.27

(c) The Smiths buy the most expensive house they can afford (you worked out its price in (a)) and start thinking about retirement planning. They expect to live until age 85 and plan to live in the house until then and bequeath it to their children. They would like to consume a constant real amount, C, each year on items other than their house. The first consumption will be at age 26 and the last at age 85. What real amount, C, can they afford to consume per year based on their salary and their mortgage payments?

PV of annual real consumption = PV of salary income - PV of mortgage payments

$$\frac{C}{0.02}\left(1-\frac{1}{1.02^{60}}\right) = \$2{,}505{,}445.27 - \$436{,}729.60$$

$$C = \$59{,}512.74$$

Suppose now that inflation increases to 5% per year and that the real interest rate stays unaffected (you calculated what it was in (b)). Let us think about how this would affect house prices. Assume that the first salary of $80,000 is unaffected by the increase in inflation.

(d) What is the nominal interest rate (and thus the interest rate on mortgages) now using these new assumptions? What is the largest house price the Smiths can afford now if their first (nominal) mortgage payment is to remain at 40% of their combined salary of $80,000 at age 26? (Note: You have just worked out how much house prices may fall if nominal interest rates increase!)

New nominal interest rate :

$(1 + r_{nom}) = (1 + r_{real})(1 + i^e) = 1.02 \times 1.05 = 1.071 \leftrightarrow r_{nom} = 7.10\%$

House price = $\frac{\$32{,}000}{0.071}\left(1 - \frac{1}{1.071^{30}}\right)$ = $ 393,132.73

EXTRA QUESTIONS SOLUTIONS

Question 1 (6-6 in the Textbook)

Suppose a 10-year, $1000 bond with an 8% coupon rate and semiannual coupons is trading for a price of $1034.74.

(a) What is the bond's yield to maturity (expressed as an APR with semiannual compounding)?

(b) If the bond's yield to maturity changes to 9% APR, what will the bond's price be?

Suppose a 10-year, $1000 bond with an 8% coupon rate and semiannual coupons is trading for a price of $1034.74.

(a) What is the bond's yield to maturity (expressed as an APR with semiannual compounding)?

$$\$1034.74 = \frac{40}{(1+\frac{YTM}{2})} + \frac{40}{(1+\frac{YTM}{2})^2} + \cdots \frac{40+1000}{(1+\frac{YTM}{2})^{20}}$$

YTM=7.5%

Alternatively, using Excel,

RATE(20,40,-1034.74,1000)=3.75%

Therefore, YTM = 3.75% × 2 = 7.50%

(b) If the bond's yield to maturity changes to 9% APR, what will the bond's price be?

$$PV = \frac{40}{(1+\frac{0.09}{2})} + \frac{40}{(1+\frac{0.09}{2})^2} + \cdots \frac{40+1000}{(1+\frac{0.09}{2})^{20}}$$

$$= \$934.96$$

Alternatively, using Excel,

PV(0.045,20,40,1000) $= \$934.96$

Question 3 (6-22 in the Textbook)

Assume zero-coupon yields on default-free securities are as summarized in the following table:

Maturity (years)	1	2	3	4	5
Zero-coupon YTM	4.00%	4.30%	4.50%	4.70%	4.80%

Consider a five-year, default-free bond with annual coupons of 5% and a face value of $1000.

(a)Without doing any calculations, determine whether this bond is trading at a premium or at a discount. Explain.

(b)What is the yield to maturity on this bond?

(c)If the yield to maturity on this bond increased to 5.2%, what would the new price be?

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Maturity (years)	1	2	3	4	5
Zero-coupon YTM	4.00%	4.30%	4.50%	4.70%	4.80%

Consider a five-year, default-free bond with annual coupons of 5% and a face value of $1000.

(a)Without doing any calculations, determine whether this bond is trading at a premium or at a discount. Explain.

The bond is trading at a premium because its yield to maturity is a weighted average of the yields of the zero-coupon bonds. This implied that its yield is below 5%, the coupon rate.

(b)What is the yield to maturity on this bond?

To compute the yield, first compute the price.

$$P = \frac{CPN}{1 + YTM_1} + \frac{CPN}{(1 + YTM_2)^2} + \cdots \frac{CPN + FV}{(1 + YTM_N)^N}$$

$$= \frac{50}{1+0.04} + \frac{50}{(1+0.043)^2} + \frac{50}{(1+0.045)^3} + \frac{50}{(1+0.047)^4} + \frac{50+1000}{(1+0.048)^5}$$

$$= \$1010.05$$

The yield to maturity is:

$$P = \frac{CPN}{1 + YTM} + \frac{CPN}{(1 + YTM)^2} + \cdots \frac{CPN + FV}{(1 + YTM)^N}$$

$$1010.05 = \frac{50}{1 + YTM} + \frac{50}{(1 + YTM)^2} + \cdots \frac{50 + 1000}{(1 + YTM)^N}$$

$$YTM = 4.77\%$$

(c)If the yield to maturity on this bond increased to 5.2%, what would the new price be?

If the yield increased to 5.2%, the new price would be:

$$P = \frac{CPN}{1 + YTM} + \frac{CPN}{(1 + YTM)^2} + \cdots \frac{CPN + FV}{(1 + YTM)^N}$$

$$= \frac{50}{1 + 0.052} + \frac{50}{(1 + 0.052)^2} + \frac{50}{(1 + 0.052)^3} + \frac{50}{(1 + 0.052)^4} + \frac{50 + 1000}{(1 + 0.052)^5}$$

$$= \$\,991.39$$

Question 8

You are given the following prices of U.S. Treasury Strips

	1-year	2-year	3-year
Price (B_j)	95	90	85

(a) Calculate the yield to maturity on the 3-year bond (y_3).

(b) What would you be willing to pay for a coupon bond with a face value of $1000, 10% coupons and maturity at time 3?

You are given the following prices of U.S. Treasury Strips

	1-year	2-year	3-year
Price (B_j)	95	90	85

(a) Calculate the yield to maturity on the 3-year bond (y_3)

$$y_3 = \left(\frac{100}{85}\right)^{\frac{1}{3}} - 1 = 5.57\%$$

(b) What would you be willing to pay for a coupon bond with a face value of $1000, 10% coupons and maturity at time 3?

$$P = 95\% \times 100 + 90\% \times 100 + 85\% \times 1100 = \$\,1120$$