

Commerce Mentorship Program

COMM 298 – Introduction to Finance Review – Answers

Three key conceptual items to cover:

1. DCF
2. Estimating Cash Flows
3. Calculating a discount rate [the WACC method]

Review Question Answers:

1. You place \$100 in a bank account for 10 years, and the interest rate on your deposit is 5%, how much do you have at the end of the holding period?

Answer

$$FV = PV (1+r)^t$$

$$FV = 100(1.05)^{10}$$

$$FV = \$ 162.89$$

2. You deposit \$500 in a savings account and wait for it to grow to \$1,000. How long will this take if interest rates are 10%?

Answer

$$FV = PV (1+r)^t$$

$$1,000 = 500 (1.1)^t$$

$$2 = 1.1^t$$

$$[\text{Log } 2] / [\text{Log } 1.1] = t$$

$$T = 7.27 \text{ years}$$

3. What would you rather have?
 - a. \$1,000 per year forever, if interest rates were 10%
 - b. \$10,000 for 5 years if interest rates are 3%

Answer

Option A:

$$PV = D/r$$

$$PV = 1000/0.1$$

$$PV (\text{Option A}) = \$10,000$$

Option B:

$$PV \text{ Option B} = (C/r)(1 - (1/(1+r)^t))$$

$$PV = (10,000/0.03) (1 - (1/(1.03^5)))$$

PV = \$45,797.10 ← You would pick Option B because of the higher present value

4. If I were to buy 50 shares of General Motors [GM] at \$20.00 a share, and then sell them for \$15.00 a share 1 year later, what would my total return over 1 year be?
 - a. What if after investing in the company, GM offered to convert my investment into an annuity that would pay me \$500 a year for 5 years, then \$1500 a year beginning the year after that. Assume interest rates are 5%. Would I want to go with this option or would I rather want to keep my original investment in shares?

Answer

First Part of Question:

$$\text{Holding Period Return} = [\text{Ending Price} + \text{Dividends} - \text{Beginning Price}] / [\text{Beginning Price}]$$

$$\text{Holding Period Return} = [15.00 - 20.00] / [20]$$

$$\text{Holding Period Return} = (-25\%)$$

Second Part of Question:

Present value of an annuity + discounted value of a permanent dividend

$$PV = (C/r)(1 - (1/(1+r)^t)) + ([D/r] / 1.05^5)$$

$$PV = (500/0.05) (1 - (1 / (1.05^5))) + ([1,500/0.05] / 1.05^5)$$

$$PV = \$25,670.52$$

Obviously you would go for the second investment option, as your original \$1,000 investment [50 shares @ \$20/share] would result in cash flows with a present value of over \$25,000!

5. What is the current price of a bond that has a face value of \$1,000, YTM of 5%, 2% annual coupon, and matures in 5 years?

Answer

$$\text{Price of a bond} = (C/r) [1 - (1 / (1+r)^t)] + (FV) / ((1+r)^t)$$

$$\text{Price} = (20/0.05) [1 - (1/(1.05^5))] + (1000)/(1.05^5)$$

$$\text{Price} = \$ 870.12$$

6. The year is 2013. You are a project manager for a construction company that is considering constructing a tower in downtown Vancouver. Before beginning the construction of the tower, the company CEO has asked you to determine the expected net present value [NPV] of the project, so that he can let the shareholders know the amount of value the project is expected to generate. He has supplied the following information for you to consider:
- The company will be using equipment that was bought in 2005 for a price of \$3,000,000
 - The tower will take 5 years exactly to complete from the start date
 - It will \$20,000,000 each year to build the tower – various capital expenditures
 - Once the tower is complete, it is expected that it will be sold for \$135,000,000

The CEO has also provided information related to the company's cost of capital:

- The company's market value is \$500,000,000 of which:
 - \$200,000,000 is Equity
 - \$150,000,000 is Debt
 - \$150,000,000 is Preferred Stock
- The company faces a 40% tax rate – *for the purposes of this question, only use the tax rate to calculating the discount rate- do not tax the income from sale of the building!*
- The yield on the company's publicly traded debt is 5%
- The company's preferred stock pays out a \$5 dividend, and trades at \$25/share

- i. The risk free rate is 2%, the beta of the company's stock is 2, and the expected return on the market is 30%

The CEO cannot do math well at all. Please determine for him what the NPV of the company's project will be, by projecting free cash flow and discounting the cash flow back using the WACC method.

Answer

In an exam setting it is possible that a grid will be provided for you to fill out, in that case recall some key points that will help you in solving these sorts of questions.

- Only use relevant cash flows – cash flows that are incremental!
 - The equipment bought in 2005 is not an incremental/relevant cash flow, so don't include it in your calculations
- Capital expenditure [capex] is always to be included in your calculations of cash flows

WACC Calculations

Value of firm = Market Value of Equity + Market Value of Debt + Market Value of Preferred Shares

$$\text{WACC} = [E/V][Re] + [D/V][Rd][1 - Tc] + [P/V][Rp]$$

The **CAPM formula** allows you to find "Re" which is the return required on equity

$$Re = Rf + \beta (E[Rm] - Rf)$$

$$Re = 0.02 + 2(0.30 - 0.02)$$

$$Re = 0.58$$

$$\text{WACC} = [2/5][0.58] + [1.5/5][0.05][1 - 0.4] + [1.5/5][0.2]$$

$$\text{WACC} = 0.301 \rightarrow 30.1\%$$

Using the discount rate that you calculated, discount back the cash flow from the sale of the building:

$$PV = \$135,000,000 / (1.301^5)$$

$$PV \text{ of cash inflows} = \$ 36,219,903.23$$

$$PV \text{ of cash outflows} = (C/r)(1 - (1/(1+r)^t))$$

$$PV \text{ outflows} = (20,000,000/0.301)(1 - (1/(1.301^5)))$$

$$PV \text{ outflows} = 48,618,233.92$$

$$NPV = PV \text{ Cash Inflows} - PV \text{ Cash Outflows} \rightarrow \$ 36,219,903.23 - \$ 48,618,233.92$$

$$\text{Project NPV} = (- 12,398,330.69)$$

7. Calculate the weighted average cost of capital for Silicon Valley Penguins:
- The yield on government t-bills is 2%
 - The yield on commercial bonds is 6%
 - The YTM of Penguin's publicly traded debt is 4.5%
 - The tax rate that the company faces is 20%
 - Market pundits expect a market return of no less than 35% this year based on historical estimates and the fact that the Canucks playoffs run is over #Sad
 - The systematic risk of the stock is such that it moves 2 units for every 1 unit movement in the market index
 - The yield on the company's preferred debt is 10%
 - The capital structure of the company is divided into equal thirds (1/3 equity, 1/3 debt, 1/3 preferred shares)

Answer

This sort of question could very well be the first question on the final exam. Use the CAPM formula to calculate the required return on equity. Note that the risk free rate "Rf" is based on the yield on government debt – the only type of debt instruments that are considered risk free. Do not use commercial bond yields as the risk free rate, for the purposes of the CAPM formula.

$$WACC = [E/V][Re] + [D/V][Rd][1 - Tc] + [P/V][Rp]$$

$$Re = Rf + \beta (E[Rm] - Rf)$$

$$Re = 0.02 + 2 (0.35 - 0.02)$$

$$Re = 0.68$$

$$WACC = [1/3][0.68] + [1/3][0.045][1 - 0.2] + [1/3][0.1]$$

$$WACC = 0.272 \rightarrow 27.20\%$$

8. What is the only type of risk that a market portfolio has, and why is this?

Answer

The only type of risk that a market portfolio [a fully diversified portfolio whose movements match those of the market] is systematic risk. This is because that once a portfolio matches a market's movements perfectly [hence the term "market portfolio], diversification eliminates all risk other than that inherent to the market itself.

9. You are a fund manager that is invested in 3 different stocks, please calculate the overall return on your portfolio, given:
- Stock A Return: 25%
 - Stock B Return: 10%
 - Stock C Return: (-13)%

In addition, stock A consists of 20% of the portfolio, stock B consists of 25% and stock C 55%.

Answer

The overall return on a portfolio [Rp] is the weighted average of returns across all holdings.

$$R_p = (\text{Weight A})(\text{Return A}) + (\text{Weight B})(\text{Return B}) + (\text{Weight C})(\text{Return C})$$

$$R_p = (0.2)(0.25) + (0.25)(0.1) + (0.55)(-0.13)$$

$$R_p = 0.0035 \rightarrow 0.35\%$$

Note that despite 2/3 of stocks doing well in the portfolio, being heavily weighted in favor of one stock that did poorly resulted in very low returns for the portfolio as a whole.

10. It is now 2014. Your company is evaluating two projects that involve an equal degree of risk- you just have to decide which project is worth doing. You can only pick one of the two. See information below:

Project A

- A development project in Toronto, on land that we have owned since 1990, and was purchased at a cost of \$20,000,000
- The CEO's salary is \$4,000,000, and was set by the Board of Directors in 2012
- We expect to make \$100,000 a year for 5 years off of this project, beginning 10 years from now
- The expected capital expenditures will be \$150,000 a year for 10 years – until completion
- The WACC is 10%

Project B

- We will invest all of our money [\$450,000] into a permanent preferred share being offered by the government
- We will have to pay for it immediately, but we will not receive preferred share dividends until 5 years from now
- The dividends will be \$20,000 per year, forever
- The appropriate discount rate is 10%

Answer: This question touches a few topics, and should be useful as a refresher. Compare the projects:

Project A:

The original cost of the land is a sunk cost, therefore we do not include it in our calculations!

Same goes for the CEO's salary!

What we will do is calculate the present value of the cash flows, and compare with the present value of expenses.

$$\text{PV of Cash Inflows} = [(100,000/0.1)(1-(1/(1.1^5)))] / (1.1^9)$$

$$\text{PV of Cash Inflows} = \$ 160,766.36$$

Note that I discounted the annuity present value by 9 years – the cash inflows begin on the 10th year, thus the annuity present value formula will give the present value of the cash flows as of the 9th year.

$$\text{PV of Cash Outflows} = (150,000/0.1)(1-(1/(1.1^{10})))$$

$$\text{PV of Cash Outflows} = \$ 921,685.07$$

$$\text{NPV} = \text{PV Cash Inflows} - \text{PV Cash Outflows}$$

NPV = (- \$760,918.71) → you take a massive loss on this project!

Project B:

For the alternative investment in the permanent dividend, essentially all we have to do is to calculate the value of the permanent dividend and discount it back to the present. Once you have the discounted value of the permanent dividend (cash inflow), then you can compare that value with the investment required (cash outflow).

Note that I discount back the permanent dividend's value by only 4 years – as the [D/r] formula provides the value of the income stream the year before the first dividend payment.

$$\text{PV Permanent Dividend} = (D/r) / (1.1^4)$$

$$\text{PV Permanent Dividend} = (20,000/0.1) / (1.1^4)$$

$$\text{PV Permanent Dividend} = \$ 136,602.69$$

$$\text{Present value of Cash Inflows} = \$ 136,602.69$$

$$\text{Present Value of Cash Outflows} = \$450,000$$

NPV = (- \$313,397.31) → In the bigger picture of things, you take a lesser loss with this investment, pick this one over the other one for sure!