Problem Set 4
Econ 136, Spring 2024

This problem set is due on March 18th, by 5PM (on Gradescope).

1. **Bank runs**

   Toxic Limited is an investment bank with the following balance sheet:

Assets	Liabilities
illiquid CMOs	equity
\$20 cash	\$200 short term debt

   The CMOs can be sold at $t = 1$ for a price of $P_1 = 160$, but if held until $t = 2$, their value rises to $P_2 = 210$. Short term debt is in the form of demand deposits, and is held by 200 investors, each of whom has \$1. At $t = 1$, Toxic promises a 5% net return to each of these investors if they keep their money in the bank until $t = 2$. Assume that 5% is high enough that if an investor is confident that the bank will remain solvent, then it is optimal to keep the money in the bank.

   (a) Suppose that all investors keep their money in the bank until $t = 2$. Will they get the promised 5% return? If you are one of the 200 investors, and know that the other 199 keep their money in the bank, should you withdraw at $t = 1$? Will a bank run take place in this scenario?

   (b) Now suppose you know for certain that 180 other investors want to withdraw at $t = 1$. Should you keep your dollar in the bank in this case? [If withdrawals exceed available funds, money is shared evenly by the withdrawing depositors.] Will there be a bank run now? Explain.

   (c) Now suppose that a wealthy investor injects \$250 cash in the bank, in exchange for new equity. Suppose that, as in (b), you know that 180 other investors want to take their money out at $t = 1$. Should you keep the money in the bank now? Given this result, would the other 180 investors find it optimal to withdraw? Do you expect a bank run now?

   (d) Now assume that due to a change in market conditions, the value of CMOs at $t = 2$ drops to $P_2 = 175$. Suppose that, as in (a), all investors keep their money in the bank until $t = 2$. Do they get their money back? If you know that all other investors keep their money in the bank, should you withdraw at $t = 1$? How should the other investors think? What outcome do you expect? Do you think a wealthy investor will want to step in in this scenario?

2. **Stock valuation I**

Consider company ABC whose stock pays an initial dividend per share next year of \$30 and has expected dividend growth rate of 2% per year when the discount rate is 10% per year.

(a) What is the price of a share of ABC?

(b) If expected dividend growth rises to 3%, what would happen to the share price?

(c) Now go back to the assumption of 2% dividend growth. ABC has the expected dividend growth of 2% because its return on equity is 8% and management retains 25% of earnings. What is the earnings per share of ABC next period? What is the present value of growth opportunities per share of ABC?

(d) Suppose ABC is about to announce that it will immediately increase its retention ratio to 50%. What will be the new value of the stock after the change in policy? Suppose the market is still unaware of ABC's decision. How would you invest to profit from this fact?

(e) Suppose the current management is fired, and you are hired as chief financial officer (CFO). If your objective is to increase the share price and shareholder value as much as possible, what new retention ratio B would you recommend to the CEO? What would be the new stock price under your recommended new financial policy?

3. **Stock valuation II**

Company XYZ pays no dividends for the next seven years. In year 8, the dividend is expected to be $D_8 = \$20$, and in subsequent years, annual dividend growth will be $g = 4\%$. The discount rate is $R = 6\%$.

(a) What is the price of a share of XYZ in year 7 (i.e., what is P_7)?

(b) What is the price of a share of XYZ today (i.e., what is P_0)?

(c) Now let's consider the growth of XYZ's price per share. What is the annual growth rate of XYZ's price during the time between today and year 7? (Note: you can answer this directly, or by computing P_1 and comparing it to P_0.) Is it smaller, larger or equal to the discount rate? Why?

(d) What is the annual growth rate of XYZ's stock price in the years after year 7? (As above, you can answer this directly, or by comparing P_8 and P_7.) Is it smaller, larger or equal to the discount rate? Why?

(e) Would an investor buying a share of XYZ earn a higher annual expected return in the years before year 7 or in the years after year 7? Why?

4. **Two-stage growth**

Consider a company with expected earnings per share next year of \$60, whose ROE for the next 6 years is 15%, and retains all earnings for the next 6 years. Suppose that after these 6 years, ROE falls to 5%, and beginning with year 7, the company chooses to pay out all earnings as dividends. The annual discount rate is 8%. Our goal is to value this company.

(a) If the price of one share of this company in year 6 is P_6, what is the price today (i.e., express P_0 using P_6)?

(b) What is the rate of earnings growth during the first six years of the company? Express E_6 as a function of earnings next year E_1 and $ROE = 15\%$. Calculate E_6.

(c) Calculate the capital stock today (K_0) and in year 6 (K_6). (Recall, $E_{t+1} = ROE \cdot K_t$)

(d) Compute earnings E_7, keeping in mind that ROE falls to 5% at the end of year 6.

(e) Calculate D_7 using the fact that the company pays out all earnings starting year 7. Given all earnings are paid out, what is the growth rate of dividends from year 7 on?

(f) Calculate P_6, the price in period 6, using the Gordon growth formula (recall, you need to use dividends a period ahead in the Gordon model).

(g) Calculate P_0, the stock price today.