FN 201: Lecture 5
Introduction to valuation: The time value of money

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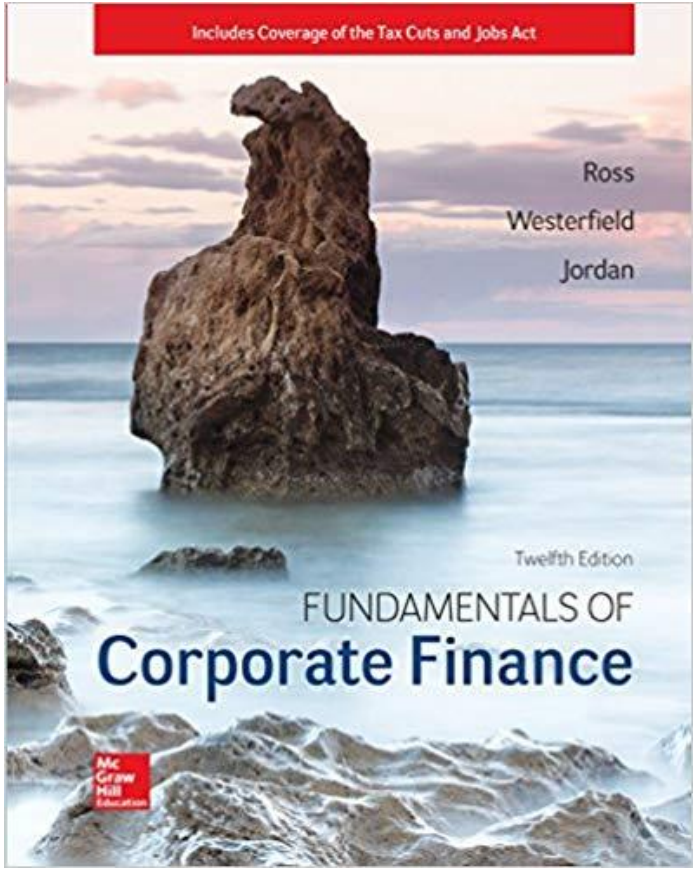
Reading

- Ross, S.A., Westerfield, R.W., Jordan, B.D., (2012). Fundamentals of Corporate Finance. 10th Edition. New York: McGraw-Hill/Irwin.

Chapter 5 and 6



Key Concepts and Skills

- Determine the future value of an investment made today
- Determine the present value of cash to be received at a future date
- Determine the future and present value of investments with multiple cash flows

Outline

1. Future Value and Compounding
2. Present Value and Discounting
3. Future and Present Values of Multiple Cash Flows
4. Valuing Level Cash Flows: Annuities and Perpetuities

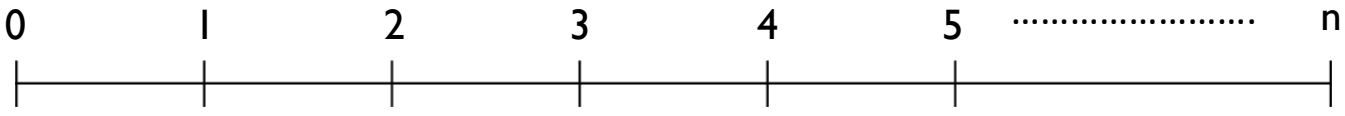
Future Value vs. Present Value

Investment time line

Present cash flow

Compound

Future Value = Amount to which an investment will grow after earning interest



Present Value = Value today of a future cash flow.

Discount

Future cash flow

Basic Definitions

- Present Value – earlier money on a time line
- Future Value – later money on a time line
- Interest rate – “exchange rate” between earlier money and later money
  - Discount rate
  - Cost of capital
  - Opportunity cost of capital
  - Required return

Note on Cash Flows Pattern

1. Single sum

2. Uneven cash flows

3. Annuity

4. Perpetuity

Note on Interest Rate

- Simple interest vs. Compound interest
- Consider the previous example
  - FV with simple interest = 1,000 + 50 + 50 = 1,100
  - FV with compound interest = 1,102.50
  - The extra 2.50 comes from the interest of .05(50) = 2.50 earned on the first interest payment.

1. Future Value and Compounding (Single Sum)

Future Value

- Suppose you invest $1,000 for one year at 5% per year. What is the future value in one year?

- Suppose you leave the money in for another year. How much will you have two years from now?

Future Values: General Formula

- $FV = PV(1 + r)^t$
  - FV = future value
  - PV = present value
  - r = period interest rate, expressed as a decimal
  - t = number of periods

- Future value interest factor = $(1 + r)^t$

2. Present Value and Discounting (Single Sum)

Present Value

- How much do I have to invest today to have some amount in the future?
  - $FV = PV(1 + r)^t$
  - Rearrange to solve for $PV = FV / (1 + r)^t$
- When we talk about discounting, we mean finding the present value of some future amount.
- When we talk about the “value” of something, we are talking about the present value unless we specifically indicate that we want the future value.

Present Value –Example 1

- Suppose you need $10,000 in one year for the down payment on a new car. If you can earn 7% annually, how much do you need to invest today?

- PV = 10,000 / $(1.07)^1$ = 9,345.79

- Calculator

Present Value – Example

- You want to begin saving for your daughter's college education and you estimate that she will need $150,000 in 17 years. If you feel confident that you can earn 8% per year, how much do you need to invest today?
- Your parents set up a trust fund for you 10 years ago that is now worth $19,671.51. If the fund earned 7% per year, how much did your parents invest?

Note: Number of Periods – Example 1

- You want to purchase a new car, and you are willing to pay $20,000.
  - If you can invest at 10% per year and you currently have $15,000, how long will it be before you have enough money to pay cash for the car?

- Suppose you want to buy a new house.
  - You currently have $15,000, and you figure you need to have a 10% down payment plus an additional 5% of the loan amount for closing costs.
  - Assume the type of house you want will cost about $150,000 and you can earn 7.5% per year.
  - How long will it be before you have enough money for the down payment and closing costs?

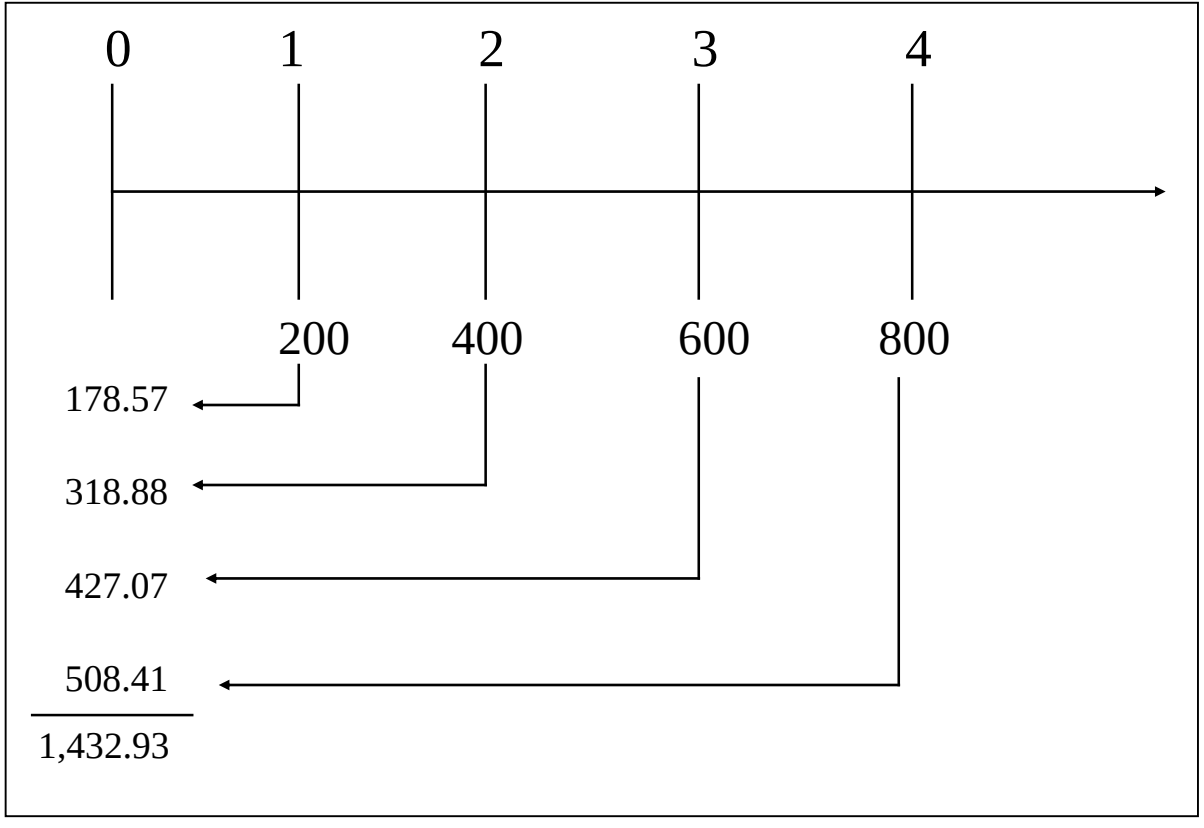
3. Future and Present Values of Multiple Cash Flows (Uneven Cash Flows)

Multiple Cash Flows – FV

- Suppose you plan to deposit $100 into an account in one year and $300 into the account in three years.

Multiple Cash Flows - PV

- Find the PV?



Note: Multiple Uneven Cash Flows – Using the Calculator

- Another way to use the financial calculator for uneven cash flows is to use the cash flow keys.
  - Press CF and enter the cash flows beginning with year 0.
  - You have to press the “Enter” key for each cash flow.
  - Use the down arrow key to move to the next cash flow.
  - The “F” is the number of times a given cash flow occurs in consecutive periods.
  - Use the NPV key to compute the present value by entering the interest rate for I, pressing the down arrow and then compute.
  - Clear the cash flow keys by pressing CF and then 2nd CLR Work.

Example

- Your broker calls you and tells you that he has this great investment opportunity.
  - If you invest $100 today, you will receive $40 in one year and $75 in two years.
  - If you require a 15% return on investments of this risk, should you take the investment?
- You are offered the opportunity to put some money away for retirement.
  - You will receive five annual payments of $25,000 each beginning in 40 years.
  - How much would you be willing to invest today if you desire an interest rate of 12%?

4. Valuing Level Cash Flows (Annuities and Perpetuities)

Annuities and Perpetuities Defined

- Annuity – finite series of equal payments that occur at regular intervals
  - If the first payment occurs at the end of the period, it is called an ordinary annuity.
  - If the first payment occurs at the beginning of the period, it is called an annuity due.
- Perpetuity – infinite series of equal payments

Annuities and Perpetuities – Basic Formulas

- Perpetuity: PV = C / r

- Annuities:

$$PV = C\left[\frac{1-\frac{1}{(1+r)^t}}{r}\right]$$

$$FV = C\left[\frac{(1+r)^t - 1}{r}\right]$$

Note: Annuities and the Calculator

- You can use the PMT key on the calculator for the equal payment.
- The sign convention still holds.
- Ordinary annuity versus annuity due
  - You can switch your calculator between the two types by using the 2nd BGN 2nd Set on the TI BA-II Plus.
  - If you see “BGN” or “Begin” in the display of your calculator, you have it set for an annuity due.
  - Most problems are ordinary annuities.

Example

- After carefully going over your budget, you have determined you can afford to pay $632 per month toward a new sports car.
  - You call up your local bank and find out that the going rate is 1 percent per month for 48 months.
  - How much can you borrow?
- Suppose you win the Publishers Clearinghouse $10 million sweepstakes.
  - The money is paid in equal annual installments of $333,333.33 over 30 years.
  - If the appropriate discount rate is 5%, how much is the sweepstakes actually worth today?

Example: Finding the Number of Payments

- You ran a little short on your spring break vacation, so you put $1,000 on your credit card.
  - You can afford only the minimum payment of $20 per month.
  - The interest rate on the credit card is 1.5 percent per month.
  - How long will you need to pay off the $1,000?

Question?