



\$10 Today vs. \$10 Next Year?

- Most people would rather have \$10 today rather than waiting to be paid \$10 next year
- 3 main reasons:
 - *Risk*
 - You may not get paid in the future!
 - *Inflation*
 - As prices increase, that \$10 will buy less in the future
 - *Opportunities*
 - You can do something with that \$10 today
 - Save, pay down loans, invest, spend, donate, etc.

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Time Value of Money

- Having money in hand today is more valuable than waiting to maybe receive money in the future
 - *RIO (Risk, Inflation, Opportunities)*
- This is called the "time value of money"

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Compound Interest

- Powerful financial tool!
- Compounding means:
 - "Earning interest on top of interest"
 - The interest you earn in period 1 will earn interest in period 2...
- Example: You invest \$1,000 today in an account that earns 10% annual return
 - How much will you earn over the next 3 years?

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Compound Interest

- Year 1: $\$1,000 \times 10\% = \100 of interest
- Year 2: $(\$1,000 + \$100) \times 10\% = \$110$ of interest
 - Notice you earned \$10 more dollars of interest in Year 2
 - The \$100 of interest in Year 1 is treated as principal for the Year 2 calculation
- Year 3: $(\$1,000 + \$100 + \$110) \times 10\% = \121 of interest

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Compound Interest

- Year 1 = \$100 earned
- Year 2 = \$110 earned
- Year 3 = \$121 earned
- Total interest earned = \$331
- If you earned "simple interest" you would only earn \$300 of interest
 - $\$1,000 \times 10\% \times 3 \text{ years} = \300

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Terms

- Lump Sum = a one-time investment
 - Ex. You invest \$500 today and invest nothing else after that
- Annuity = stream of regular payments
 - Ex. Car loan payments – they are the same amount every month for a stated number of years
- Future Value = what you will have in your account in the future
- Present Value = what something is worth today



Types of Time Value Problems

- Future Value of a Lump Sum
 - Determines how much money an investment will be worth in the future if you invest money today
- Present Value of a Lump Sum
 - Determines how much you would rather have today instead of waiting to be paid (maybe) in the future
 - Also, it determines how much you need to invest today to reach a specific future value



Types of Time Value Problems

- Future Value of an Annuity
 - Determines how much you will have in your account in the future if you invest regularly over time
 - Example: You invest \$500/year into a retirement account that earns 8% return. How much will you have in your account after 50 years?



Solving Time Value Problems

- 4 methods:
 - Time Value of Money tables
 - Excel spreadsheets
 - Financial calculators
 - Time Value of Money formulas
 - We will focus on the tables and spreadsheets



Using the Time Value Tables

- Same as the annual loan payment table
- Look up the column with the interest rate
- Follow the column down to the row with the number of years
- Multiply that factor by the dollar amount of the investment



Future Value of a Lump Sum

- Use Table 1
- Example: You invest \$1,000 today in an account that earns 5%. How much will you have in your account after 5 years?
 - Factor for 5% for 5 years = 1.2763
 - $FV = 1.2763 \times \$1,000 = \underline{\$1,276.30}$
 - Your \$1,000 grew to almost \$1,300 in 5 years!!



Future Value of a Lump Sum

- Assume that you leave your money in the account for 40 years
 - you do Not add any more money. How much will you have in your account after 5 years at a 5% return?
- Factor for 5% for 40 years = 7.0400
- $FV = 7.0400 \times \$1,000 = \underline{\$7,040.00}$
 - Your initial investment of \$1,000 grew to more than \$7,000!!



Present Value of a Lump Sum

- Use Table 2
- PV is the "opposite" of FV
- Example: You want to have \$10,000 available after 5 years for a down payment on some land. How much do you need to invest today to reach this goal at a 6% return?
- Factor for 6% for 5 years = 0.7473
- $PV = 0.7473 \times \$10,000 = \underline{\$7,473}$



Present Value of a Lump Sum

- From this example:
 - If you invest \$7,473 today
 - It earns 6% each year (compound interest)
 - It will grow to \$10,000 in 5 years



Future Value of an Annuity

- Use Table 6
- Example: You invest \$1,000/yr for 30 years. It earns 7% return. How much will you have after 30 years?
 - You might think somewhere around \$30,000
 - $\$1,000/\text{yr} \times 30 \text{ yr} = \$30,000$
- Factor for 7% for 30 years = 101.0730
- $FV = \$101.0730 \times \$1,000/\text{yr} = \underline{\$101,073}$
 - That's a lot more than the \$30,000 you invested!!



Using a Time Value Spreadsheet

- Spreadsheets are great for analysis!
 - You can change key factors to see the impact
- For Future Value calculations
 - Click on the "FV Calculator" tab
 - You can change any number with a blue font
 - It will automatically recalculate the FV



Future Value Spreadsheet

- Example: You want to invest \$300/yr at 6%. What will you have after 5 years?
 - Number of Years Cell C3 Enter 5
 - Annual Rate (%) Cell C7 Enter 6
 - Annuity Cell C9 Enter 300
 - Present Value Cell C10 Enter 0
 - $FV = \$1,792.60$
 - What is your FV if you earn 10% instead of 6%?
 - Simply change Cell C7 (Annual Rate) to 10



Present Value Spreadsheet

- Click on the "PV Calculator" tab
- Use the same as the FV calculator
- Example: You want to have a future value of \$40,000 after 10 years. How much do you need to invest today earning 7%?
 - Years = 10
 - Annual Rate = 7%
 - Annuity = 0
 - FV (Lump Sum) = 40,000
 - PV = \$20,333.97



Keep in Mind

- Lump sum = only investing 1 time
- Annuity = several constant investments
- If you know the FV, solve for the PV
- If you know the PV, solve for the FV

- If it helps, draw a timeline
 - *This can help you figure out what to solve for!*

