

Lesson 5-1 – Interest and the Time Value of Money

Special Acknowledgment to Dr Ron Mackinnon and Dr Tamara Etmanski who helped with the development of this material.

Learning Objectives

- Understand and explain the time value of money
- Distinguish between simple and compound interest
- Utilize compound interest in economic analysis
- Solve problems by using the single payment compound interest formulas
- Distinguish and apply nominal and effective interest rates
- Explain the 'equivalence' of cash flows

Time Value of Money

- What would you rather have:

- a. \$10,000 now?

- b. \$10,000 five years from now?

Why???

Importance of Time

- Time is a critical factor in most engineering economic studies
 - There is a preference for consuming goods and services sooner rather than later
 - The stronger the preference for current consumption, the greater the importance of time in investment decisions.
 - Time is not a factor for very short-term projects
- The amount and timing of a project's cash flow (expenses and revenues), are crucial to the value of a project

Example of Time – Industrial Real Estate Development



Three+ years of this

To get something like this

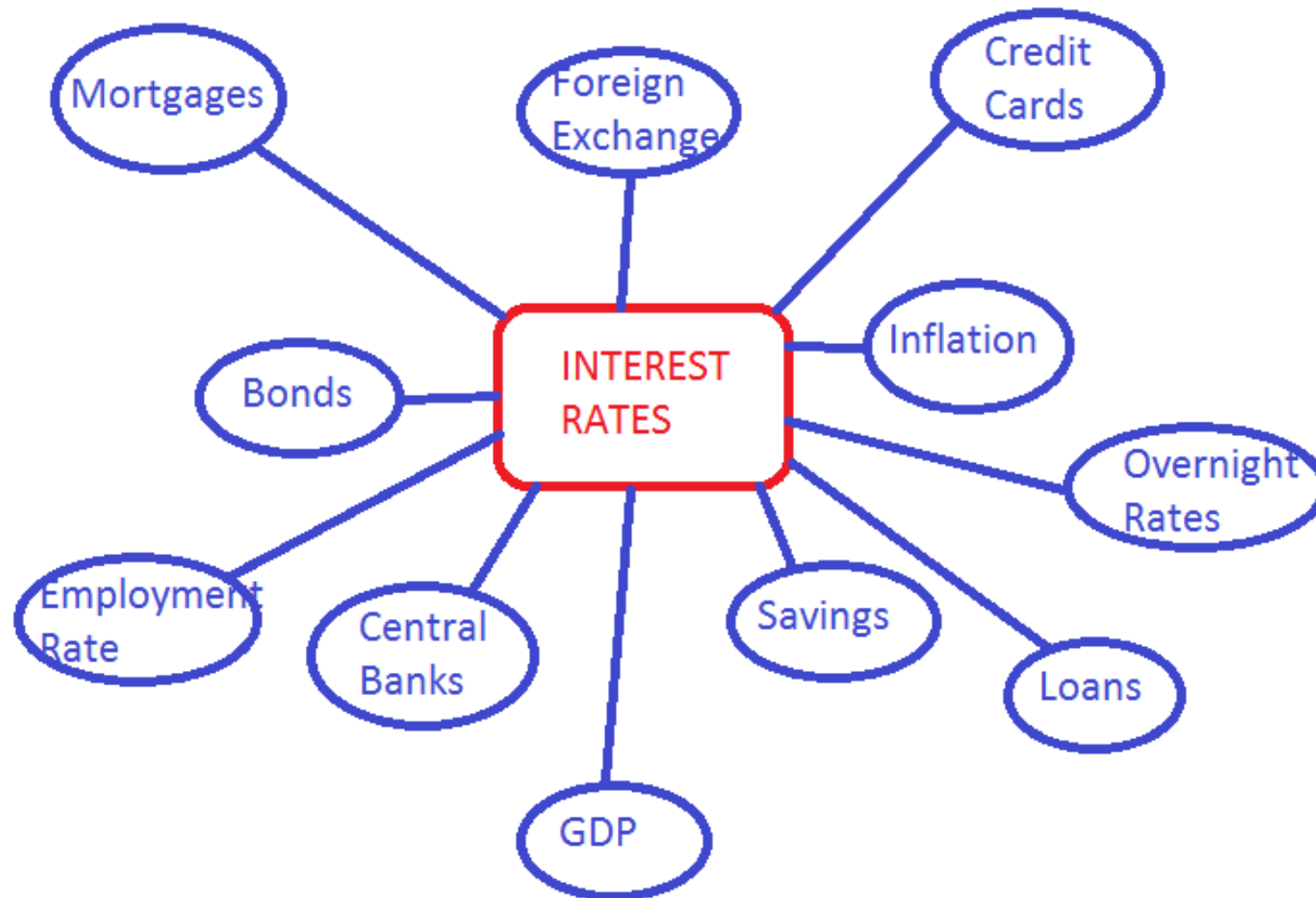
- Credit: Google Maps Street View, April, 2018



Decisions & Time/Scale

- Where economic decisions are immediate or short term, we need to consider
 - The amounts of expenditures (costs) and income (benefits)
 - Taxes (if we are performing an after-tax analysis)
- Where economic decisions occur over a considerable period of time, we also need to account for interest, inflation, depreciation and other costs

Time Value of Money - Interest



Time Value of Money

- Factors that influence the value of money over time
 - Inflation
 - Taxes
 - Depreciation
 - Opportunity Costs
- UNCERTAINTY and RISK
- Quantify this uncertainty and our response to it with INTEREST and the INTEREST RATE

Time Value of Money - Interest

- Money has value (citation needed)
- Like other things of value, money can be leased or rented
- The lease or rental payment is called interest
- The rate of interest (or interest rate) is:
 - The rate of return received by a lender for lending money
 - The rate of return paid by a borrower for the use of a lender's funds.
- We prefer to have money now as we can collect rent on it now

Time Value of Money - Inflation

- The amount of goods and services one can purchase with the same amount of money normally decreases over time (inflation).
- Therefore, the actual “value” of money changes at some rate over time.
- We prefer to have money now as it is more valuable than money later.

Time Value of Money - Depreciation

- Money can be held in the form of other assets
 - Equipment and machinery
 - Precious metals
 - Intellectual Property
- Many of these other kinds of assets lose value over time, so
- We prefer to have money now than have assets that are losing value

Time Value of Money - Taxes



Canada Revenue
Agency

Agence du revenu
du Canada

- Holding money can lead to it being taxed
- If and how much is taxed depends highly on the form of the money held
- Of course spending money often involves taxes too
- Basically when it comes to taxes, you're screwed
 - Wait for the lessons on taxes to find out just how!
- But we still prefer to have money now and pay tax on it, than not have money and not pay tax

Interest Rate

- Used to quantify how we value money over time, and calculate the rent on money
- What does a high interest rate imply?
- Low?
- Negative?

Interest and Interest Rates

- You deposit \$1000 into a savings account at your local financial institution. They pay 0.5% interest per year. What is the annual rent you collect on your money?
- After the bank closes, you realize you've made a huge mistake and owe your landlord \$1,000 in rent right now. You go to your local loan shark who agrees to lend you \$1,000 till next week, and charges you a flat fee of \$25. What is the interest rate of not having your legs broken?

Interest Rate

- For discrete cash flows, there are two types of interest:
 1. Simple Interest: interest is calculated once only and paid at the end of the term
 2. Compound Interest: interest is calculated periodically and accumulated into the balance based on the compounding periods.
 - “The Miracle of Compound Interest”
 - Interest on top of interest