

# Effects of Compound Interest





# Compound Interest:

## A Blessing and a Curse

- “Compound interest is the 8th wonder of the world. He who understands it, earns it... He who doesn't... pays it.” ~Albert Einstein
- Compound interest is a blessing when you are saving money; a curse when you are paying off debt.



# The Power of Compound Interest

- In 1461, King Edward IV borrowed \$384 from New College of Oxford. He repaid \$160, but never repaid the remaining \$224.
- In 1996 (535 years later), an administrator asked that the Queen repay the debt, with 4% interest compounded annually.
- Any guesses on the new amount of the debt...?



# The Power of Compound Interest

- The Queen owed **~\$290 billion!**
- The administrator suggested cutting the interest rate to 2%.
- The new amount to be paid was now?
- **~\$8.9 million**



# The Power of Compound Interest

- Compound interest makes huge differences in the long run.
- (For example, cutting the interest rate by half cut the amount of debt by a lot more than half.)



# Borrowing Money

There are different ways in which we borrow money:

- Using credit cards
- Taking out a loan or mortgage (i.e., a loan for a house)



# How Do Credit Cards Work?

- When you use a credit card, you are essentially borrowing money from the credit card company.
- The credit card company pays for you until the end of the month, when you have to pay the money all at once.
- If you pay the full balance on your card, you're good!



# How Do Credit Cards Work?

- If you do not pay the full balance, the remaining balance rolls over to the next month, with **compound interest**.
- If you still don't pay the full amount the next month, interest is again applied to what remains.
- If you miss a payment, your interest rate is increased significantly, making it harder to pay off the debt!





# Citi Diamond Preferred Card

- 0% Intro APR (annual percentage rate) - no interest is applied for the first 12 months
- Regular APR is 14.49% - 24.49%, “variable”
- After 12 months, interest accrues until your debt is paid in full.



# Example

- Let's say I receive my credit card bill for \$525, but I only have enough to pay the minimum payment of \$25. The remaining debt is \$500.
- Suppose the APR is 18%. The monthly rate is then  $(18/12)\% = 1.5\%$ .
- The next month I will have to pay \$500 with 1.5% interest. How much do I now owe?



# Example

- I now owe  $\$500 + \$7.50 = \$507.50$ , but I can only pay the minimum payment of \$25. I still owe \$482.50.
- The next month I will have to pay \$482.50 with 1.5% interest. How much do I now owe?
- I now owe  $\$482.50 + \$7.24 = \$489.74$ .



# Example

- In two months I have paid \$50, but my debt has only decreased by about \$35.
- This is because I have had to pay interest, not just the original debt of \$525.
- What if I miss the next payment? My APR will skyrocket, probably to 29.99%, which will be applied to my \$489.74. How much will I owe the fourth month?



# Example

- I will owe  $\$489.74 + \mathbf{\$12.24} = \$501.98$ .
- I've now paid \$50 and my debt has only decreased by \$23.

The longer you wait to pay off the full amount, the faster your debt will grow!



# Another Example

- It's not really realistic to think that I won't spend any more money on your credit card once I have some debt.
- If we repeat the previous scenario, except this time I spend an extra \$525 each month, the amount I owe by the fourth month will be **\$2,111.29!**



# The Danger of Credit Cards

- Credit cards are only convenient if you know you will be able to pay the full balance each month!
- If you get stuck in this cycle for too long, you will be trapped paying only interest and the original debt will just get bigger.



# Mortgages

- A mortgage is a loan for a house.
- We recently bought a house for \$225,000 and we got a \$180,000 mortgage from the bank. The bank paid the seller's side the \$180,000; now we have to repay the bank...





# Mortgages

- For our loan, we have to repay the debt making monthly payments over 30 years, with 4.375% interest.
- Once we pay off the principal amount of \$180,000, we will have repaid the loan!



# Mortgages

- The bank draws up an amortization schedule, which details each loan payment we have to make:

| Date        | Interest | Principal | Balance   |
|-------------|----------|-----------|-----------|
| May 2018    | \$656    | \$242     | \$179,758 |
| June 2018   | \$655    | \$243     | \$179,514 |
| July 2018   | \$654    | \$244     | \$179,270 |
| August 2018 | \$654    | \$245     | \$179,025 |



# Mortgages

- Notice we're paying lots of interest and only a little principal.
- In 4 months, we've paid about \$3,600 and only made \$975 headway - no wonder it takes 30 years!
- If we follow this schedule, we will end up paying about \$324,000 (\$144,000 of which is just interest...)



# How Can We Waste Less Money?!

- Pay a little extra each month!
- Any extra amount that we pay each month is applied directly to the principal, getting us closer to our goal and lowering the amount of interest the next month.



# How Can We Waste Less Money?!

- Ex: If we pay \$100 extra each month, we will pay off the loan in just 24 years, paying only \$114,000 in interest.
- Ex: If we pay \$200 extra each month, we will pay off the loan in 21 years and pay only \$95,000 in interest.



# Auto Loans

- Auto loans work in the same way that mortgages do, but they're usually smaller and paid over a shorter period of time.
- However, there's an important difference: houses keep their value, cars don't.
- The moment you drive a car off the lot, it loses between 10%-50% of its value.



# Auto Loans

- So by the time you pay off the loan, the car is worth a fraction of what you paid for it - and if you can't pay off the loan, the car will often not make up the difference of the remaining debt.
- So pay that loan off as fast as possible!



# Savings Accounts

- We need to save money for a lot of different things: emergencies, college, big purchases (car, house, etc.), having kids, and (the biggest!) retirement.





# Savings Accounts

- Consider the following scenario:
- Ben, 19, invests \$2,000 per year compounded annually at 12% until he is 26 years old.
- For the next 39 years, until he is 65, Ben invests not one penny more.



# Savings Accounts

- Arthur, 27, invests \$2,000 per year compounded annually at 12% for 39 years until he is 65 years old.
- At age 65, who will have more money?...
- Arthur will have \$1,532,166.
- Ben will have **\$2,288,996** (1.5 times more!)
- Because of the power of compound interest, time is of the essence! Start saving now!



# Saving for Retirement

We will talk about 3 options:

1. 401(k)
2. IRA
3. Roth IRA



# 401(k)

- A 401(k) is a retirement plan provided by some employers. It is basically just like a savings account (on your employer's terms).
- A portion of your paycheck is saved before taxes (i.e., you don't pay taxes on the amount you put in).



# 401(k)

- Sometimes your employer will match what you contribute.
- When you retire and you withdraw money, you must pay taxes on the money (as your “income”).



# IRA

- IRAs are accounts that you open yourself and contribute money to.
- Like with 401(k)s, you don't pay taxes on the money you contribute, but you do pay taxes once you withdraw the money.
- Any growth from interest doesn't count as income to be taxed (until you withdraw).



# Roth IRA

- Roth IRAs are, again, accounts that you open yourself and contribute money to.
- Main difference: the money that you contribute to a Roth IRA is taxed.
- But, you do not pay taxes when you retire and withdraw money.



# IRA vs. Roth IRA

- What it comes down to is when do you want to pay taxes? When you contribute or when you withdraw money?
- Well, on average, tax rates increase over time, so the Roth IRA looks like the better option! (You will end up paying less in taxes.)





# Summary

- Compound interest works against you when paying off debt. If you get in debt, pay as quickly as possible so you avoid the growth of interest.
- Save early! Compound interest shows the most effect over a long period of time, so you need to start saving now to fully utilize it.
- Consider using plans such as 401(k)s or Roth IRAs to save for retirement.