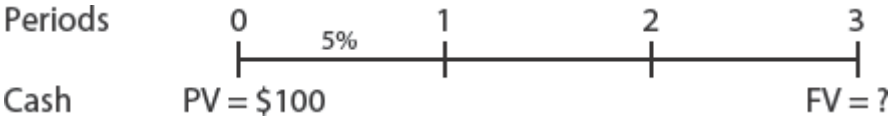
Chapter 5 Notes

Time Value of Money

Time Lines



- Ticks represent units of time
- Number underneath the line represent cashflows at a given period
- ?'s are used to determine the opints at which we need to solve for

Future Values

The process of going from a **present value (PV)** to a **Future Value (FV)** is called **compounding**.

Compound Interest Formula

$FV_N = PV(1 + I)^N$

Where **I = interest** and **N = Number of Periods**

Simple Interest on the other hand, does not earn interest on the interest.

- Usually used only in legal procedings because the law moves slowly

  $FV = PV + PV(I)(N)$

Working with a Financial Calculator

Five basic keys on a financial calculator for calculating time value of money:

- N (Number of Periods)
- I/YR (interest rate per period)
- PV (Present Value)
- PMT (payment, used when there are equal or constant payments)
- FV (Future Value)

Working With Spreadsheets

- use the FV function
- FV(rate, nper(N), pmt, pv, type)
- Use the PV function
- PV(rate,nper, pmt,fv,type)

- type is refering to when paymetns come out (type=0, end of year payments; type=1, beginning of year payments)

Discounting

Finding **Present Values** is called **Discounting**. The formula is a reorganization of the Future Value Formula
$PV = \frac{FV_N}{(1+I)^N}$

- Spreadsheets use PV(rate,nper,pmt,fv,type)

Finding the Number of Years

- Spreadsheets use NPER(rate,pmt,pv,[fv],[type])

Annuities

- **Ordinary Anuities** are payments that occur anually at the *end* of each year (type=0)
- **Annuity Due** are payments that occur at the *beginning* of each year
  Formula

Finding Future Value

$$FVA_N = PMT(I+1)^{N-1} + PMT(I+1)^{N-2} + ... = PMT[/frac(1+I)^N - 11]$$

- FV(rate,nper,pmt,pv,type)
- $FVA_{due} = FVA_{ordinary}(1+I)$

Finding Present Value

- $PVA_N = PMT/(I+1)^1 + PMT/(I+1)^2 = PMT[1 - \frac{\frac{1}{(1+I)^N}}{I}]$
- PV(rate,nper,pmt,[fv],[type])

Finding Annuity Payments

-PMT(rate,nper,pv,[fv],[type])

- type 0 for end of year
- type 1 for beggining of year

Finding the number of Periods

- NPER(rate,pmt,pv,[fv],[type])

Finding the Interest Rate

- RATE(rate,pmt,pv,[fv],[type],[guess])

Perpetuities

A Perpetuity is an annuity with no end date.
$PV of Perpetuity = \frac{PMT}{I}$

Uneven Cashflows

In two seperate categories:

1. a stream of annuity payments with a final lump sum
2. All other uneven streams
   Examples:

- Common stock (dividends increase over time)
- Captial Equiptment investments
  CF_t is the term for Cashflow

Formula:
Find PV of each, then Sum
$PV = \frac{CF_1}{(1+I)^1} + CF_2(1+I)^2 + ...or$\Sigma_{t=1}{\frac {CF_{t}} {(1+I)^{t}}}$
Find FV of each, then sum
Find Interest Rate
IRR

Semi-Annual Compounding Periods

- Interest compounded once a year is **Annual Compounding**
- Interest compounded twice a year or more is **Semi-Annual** compounding interest
  Step by step process:

1. Convert Interest rate to "Periodic Rate"
2. Convert number of years to number of periods

Formula's:
Periodic Rate (I_{PER})= $\frac{I}{numPaymentsPerYear}$
Number of Periods = (Number of years)(Periods per Year) = NM

Comparing Interest Rates

- **Nominal Interest Rate** (I_{NOM}) is also called **Annual Percentage Rate** and is the quoted rate of lenders, but not the true rate (a monthly APR equivalent to a Quarterly APR costs more)
- **Effective Annual Rate** or EFF is the rate that would produce the same future value under annual compounding

- If a loan is annual compounding, the EFI and APR are the same
- if a loan compounds more than once a year, the EFF% is higher than the APR

Formula's:
Effective annual Rate (EFF%) = $\left[1 + \frac{I_{NOM}}{M}\right]^{M} - 1.0$

- where M = periods per year
  EFFECT(nomina_rate,npery)

Amortized Loans

- A loan that must be repaid on a monthly, quarterly, or annual basis is called an **amortized loan**