Notes of the Finance course in coursera

Week 1: Time value of money

- p: the original amount of money
- n: number of periods (months, years etc)
- r: interest rate in one period

Future value

The future value of p is $\mathrm{FV}(r, n, 0, p) = p(1+r)^n$.

Present value

The present value of p is $\mathrm{PV}(r, n, 0, p) = \frac{p}{(1+r)^n}$.

Week 2: Multiple Payments Annuities

- C: Cashflow
- PMT: Payment

The Future Value of a Stream of Cash flows

The Future Value of a Stream of Cash flows as of n Periods from now: $\mathrm{FV} = \sum_{k=1}^{n} C_k (1+r)^{n-k}$.

The Present Value of a Stream of Cash flows

$\mathrm{PV} = \sum_{k=1}^{n} \frac{C_k}{(1+r)^k}$

The Future Value of an Annuity

The Future Value of an Annuity paying C at the *End* of each of n Periods: $\mathrm{FV} = C\,\mathrm{FAF}(r, n)$ where FAF is the FV Annuity Factor.

$\mathrm{FAF}(r, n) = \frac{(1+n)^n - 1}{r}$

The Present Value of an Annuity

The Present Value of an Annuity is: $\mathrm{FV} = C\,\mathrm{PAF}(r, n)$ where PAF is the PV Annuity Factor.

$\mathrm{PAF}(r, n) = \frac{1}{r}\left(1 - \frac{1}{(1+r)^n}\right)$

The Present Value of a growing Annuity

The Present Value of an Annuity growing at rate g is: $\mathrm{PV} = C\,\mathrm{PAF}(r, n, g)$.

$\text{PAF}(r, n, g) = \frac{1}{r-g}\left(1 - \frac{(1+g)^n}{(1+r)^n}\right)$.

The Effective Annual Rate

The Effective Annual Rate (EAR) of k payments in a year is: $\text{EAR} = \left(1 + \frac{r}{k}\right)^n - 1$.

The Present Value a Perpetuity

The Present Value of a Perpetuity is: $\text{PV} = \frac{C}{r}$.

The Present Value of a Constant Growth Perpetuity is: $\text{PV} = \frac{C_1}{r-g}$.

Week 3: Net Present Value

- C_k : Cashflow at time k
- C_0 : Initial investment (likely to be negative)

The Net Present Value of a Stream of Cash flows

$\text{NPV} = \sum_{k=0}^{n} \frac{C_k}{(1+r)^k}$.

The Internal Rate of Return

The IRR is the rate r that will give a $\text{NPV} = 0$.

For a perpetuity, the IRR can be written as: $\text{IRR} = \frac{\text{Profit}}{\text{Investment}}$.

Week 5: Bonds

Discount Bonds (zero coupon bonds)

In a discount bond, the government borrows money P at time 0 and returns Face Value at the end of n periods.

The price of a discount bond is: $P = (\text{Face Value})\ \text{PV}(r, n) = \frac{\text{Face Value}}{(1+r)^n}$.

The rate r of a zero coupon bond is called Yield to Maturity.

Week 5: Stocks

The Stock Price Formula

The price of a share is: $P_0 = \sum_{k=1}^{n} \frac{\text{DIV}_k}{(1+r)^k} + \frac{P_n}{(1+r)^n}$.

Growth

- EPS : cash flow per share
- PVGO : PV of Growth Opportunities

The price of a share is: $P_0 = \frac{\text{EPS}}{r} + \text{PVGO}$.

Week 8: Diversification

Diversification

The risk of an n asset portfolio is: $\sigma^2(R_p) = \sigma_p^2 = \sum_i x_i^2\sigma_i^2 + \sum_{i\neq j} 2x_ix_j\sigma_{ij}$.

Risk and Return: CAPM

The relationship between risk (beta) and return is linear, with the following form:
$r_i = r_f + (r_m - r_f)\beta$, where:

- r_i : expected rate of return on the equity of the project/idea/firm i
- r_m : expected rate of return on the "market" portfolio
- $r_m - r_f$: average market risk premium

Week 9: Debt and Cost of Capital

Cost of Capital

- $E(R_d)$: required rate of return on debt
- $E(R_e^L)$: required rate of return on the leveraged equity of the firm

Under perfect capital markets, $E(R_a)$ is just the weighted average of the equity and debt cost of capital, or the weighted average cost of capital (WACC):

$$\text{WACC} = E(R_a) = \frac{D}{E_L+D}E(R_d) + \frac{E_L}{E_L+D}E(R_e^L)$$.

The expected rate of return on equity of a levered firm increases in proportion to the debut-equity ratio (D/E), expressed in market values: $E(R_e^L) = E(R_a) + \frac{D}{E_L}(E(R_a) - E(R_d))$.

Similarly, the risk of equity is: $\beta_e^L = \beta_a + \frac{D}{E_L}(\beta_a - \beta_d)$.

Or written in a different form: $\beta_a = \beta_e^L\frac{E_L}{E_L+D} + \beta_d\frac{D}{E_L+D}$.