Overview of Concepts and Notation

(BUSFIN 4221: Investments) - Fall 2016

1 Main Concepts

This section provides a list of questions you should be able to answer. The main concepts you need to know are embedded into these questions (or answers to these questions). However, this is not an exhaustive list of questions you should know how to answer.

1.1 Module 1 - Introduction to Investments

- What is (i) a real investment and (ii) a financial investment?
- What are financial markets and why to they exist? (think of the demand and supply of capital)
- What is the difference between asset allocation and security selection? How do these relate to the Top-down and Bottom-up approaches to portfolio construction?
- What are institutional investors (come up with two examples)? Why are they so important? Are they becoming more or less important in financial markets (in terms of their direct holding of securities relative to households)
- What are (i) Brokered Markets; (ii) Dealer (or Over the Counter – OTC) markets and (iii) Auction Markets?
- What are bids and asks? What is a bid-ask spread?
- What is the function of Dealers in Financial Markets?
- Can you describe the 2007-08 Financial Crisis? It was a disruption on the supply of capital, but how did it happen?
- Did the financial crisis affect only financial institutions or it also had an effect on the real economy (meaning actual production and real investments by companies)?

1.2 Module 2 - Portfolio Theory

- How to measure performance of financial investments (returns, average returns, geometric average returns, inflation, effective annual rate...)?
- What are the basic properties of the Normal distribution and how they relate to risk and return?
- How are risk and reward defined within the context of Portfolio Theory? (you should also know the problems of defining risk the way we do it and when it is ok to do so)
- What does diversification mean and how is it related to the correlation among financial assets?
- What is the Minimum-Variance Frontier and the Efficient Frontier? How do they relate to each other?
- What are the two steps in the portfolio formation process? What do you need to know in order to tackle each step (the main inputs to each step)?
- What are the "tangent portfolio" (portfolio o) and the "complete portfolio" (portfolio $o*$)? How do we find them?
- What makes two investors decide to hold identical/different portfolios o and/or $o*$?
- What is the Sharpe Ratio and why is it so important? How does it relate to the steps in Portfolio Theory? How/Why should we use it to compare portfolios?
- How does risk aversion relate to Portfolio Theory? What should a risk averse investor do in Step 2 of the portfolio formation process?
- What are the main pitfalls of Portfolio Theory? When/Why is Portfolio Theory an incomplete approach?
- What are systematic and firm-specific risk? Why does it matter?
- What is the index model? Why do we use it? What are its key advantages and what assumption are we making when using it?
- What happens to portfolio o when we use an index model to estimate the inputs used in Portfolio Theory?

1.3 Module 3 - Factor Models

- What is the key CAPM equation and how to interpret it?
- Under the CAPM, what portfolio is the tangent portfolio?
- What is the market risk-premium and how it varies with investor risk aversion and market volatility?
- What does the CAPM imply regarding risk-adjusted returns, α?
- How is the CAPM used when evaluating active managers? ($\alpha = 0$ prediction is the key here)
- How is the CAPM used to calculate the Net Present Value of a project?
- How must investors behave for the CAPM to be valid?
- What is the "Non-Arbitrage principle"?
- What is the key equation from the Arbitrage Pricing Theory (APT) and how it differs from the key equation of the CAPM?
- How must investors behave for the APT to be valid?
- How do the CAPM and APT differ in terms of the economic assumptions underlying each theory?
- What are multifactor models?
- What does the empirical evidence say regarding the validity of the CAPM?

1.4 Module 4 - Market Efficiency

- The Efficient Market Hypothesis (EMH) states that "Prices correctly incorporate all relevant information available". What do we mean by (i) "correctly incorporate" and (ii) "relevant information"?
- If the EMH holds, we have $\widehat{CF}_{t+h} = \mathbb{E}_t [CF_{t+h}]$, which implies $\mathbb{E}_t [r] = dr_t$. What does this mean for investors?
- How can you take advantage of situations in which $\widehat{CF}_{t+h} > \mathbb{E}_t [CF_{t+h}]$ or $\widehat{CF}_{t+h} < \mathbb{E}_t [CF_{t+h}]$?
- What is relevant information under (i) weak-form EMH; (ii) Semistrong-form EMH and (iii) Strong-form EMH?
- If the EMH holds, what must be true regarding predictability of returns? Does the evidence support this claim?
- If the EMH holds, what must be true regarding active investing? Does the evidence support this claim?
- If the EMH holds, what must be true regarding systematic trading strategies? Does the evidence support this claim?
- What is Behavioral Finance?
- What are the two conditions necessary for Behavioral Finance to have an effect of prices of financial securities?
- Can you cite three aspects of financial markets that limit the action of smart investors?

1.5 Module 5 - Debt Securities

- What is a debt security?
- What is a zero-coupon bond?
- What is the key distinction between treasuries and corporate bonds?
- If interest rates (yields) go up, what happens to bond prices and returns?
- What does it mean for a bond to be (i) at par; (ii) a discount bond; (iii) a premium bond?
- What are the two key sources of risk in debt securities?
- What is duration? Why/how is it useful?
- If interest rates go down, is it better to hold high or low duration bonds in your portfolio?
- What is credit rating? How does it relate to the bond probability of default?
- Is the average return of a corporate bond (if you intend to hold it until maturity/default) higher, equal or lower than its yield to maturity?
- What is a default premium?
- What is a Credit Default Swap (CDS)?

1.6 Module 6 - Equity Securities

- What is asset allocation and why macroeconomics/industry analysis is important when making your asset allocation decision?
- What is the "state of the economy" and how can we think about the current state of the economy?
- Why do demand and supply shocks affect the state of the economy? How do they differ? How can the government induce artificial shocks into the economy?
- What is a business cycle and why is it important?
- What is a cyclical/defensive industry and when do you want to invest in each type?
- What is an equity security?
- What are the cash flows you receive if you buys an equity security?
- What is a dividend discount model (DDM)
- Besides current dividends, two key inputs are important when valuing equity. What are those and how do they affect equity value?
- Suppose you use current prices to get the "market implied discount rate" (or long-term expected return) based on a DDM. How should you use this information? How does (expected) growth and dividend yield affect this long-term expected return? Are these predictions valid in the data?
- Why do investors use "Valuation Ratios" (or "Price Multiples") to compare prices across stocks.
- There are two key effects driving the valuation ratio of any given stock. What are these? Based on that, when is it reasonable to conclude that divergence in valuation ratios implies mispricing?
- What is return on assets (ROA) and return on equity (ROE). How are they related?
- How (and under what conditions) is ROE related to earning growth and dividend growth?
- What are the key components of ROA and ROE? How are they related to ROA and ROE variation over the business cycle?
- What is firm liquidity (this is not trading liquidity)? Why is it important?

1.7 Module 7 - Derivative Contracts

- What is a derivative contract?
- Should you view derivatives as a risk management tool or a risk taking tool (or both)?
- What is a future contract?
- What is the payoff of a long (and a short) position in a future contract?
- How can investors close a future position before expiration?
- What are the similarities and differences between future and forward contracts?
- How can you replicate the payoff of a stock using future contracts (and treasury securities)? How can you use this "synthetic stock position" to find the price of a future contract?
- What is a Swap contract? How are the payoffs of these type of contracts structured?
- What is an "plain vanilla" interest rate Swap and how it can be used for risk management?
- Define counterparty risk in the context of Swap contracts. Is the counterparty risk higher or lower than trading the underlying positions separately?
- How can the trading mechanism of Swap contracts induce systemic risk?
- What is an option contract? How calls and puts differ?
- What are the four basic positions you can have using option contracts?
- What are the cash flows paid/received by each of the four positions at time 0 (when the position is initiated) and at time T (the expiration date)?
- What is a "protective put" position and why is it useful for risk management?
- What is a call/put "in the money", "at the money" and "out of the money"?
- How can you use options to speculate? For instance, how can you bet on volatility increasing?

2 Notation & Formulas

2.1 Module 1 - Introduction to Investments

- Fundamental Valuation Equation:

$$PV_t = \sum_{h=1}^{\infty} \frac{\mathbb{E}_t\left[CF_{t+h}\right]}{(1 + dr_{t,h})^h}$$

PV_t is the present value of the investment at time t (i.e., the current price)

$\mathbb{E}_t\left[CF_{t+h}\right]$ is the time t expectation of the future cash flow to be received at time $t + h$

$dr_{t,h}$ is the discount rate (or required rate of return) investors apply at time t to an expected future cash flow to be received at time $t + h$

2.2 Module 2 - Portfolio Theory

a) Notation

- i, t and p as subscripts: represent (i) a given security; (t) a time or time period and (p) a given portfolio
- P_t: price of a financial asset at time t
- CF_t: cash flow paid by a financial asset at time t
- $r_t = r_{i,t}$: financial return of asset i over period t (i.e., from time $t-1$ to time t)
- $\bar{r}$: (arithmetic) average return over a given interval of T periods
- $\bar{r}_G$: geometric average return over a given interval of T periods
- ear_t: effective annual rate of return (with n periods in a year – for instance, $n = 12$ if we use monthly returns to find aer_t)
- i_t: rate of inflation over period t (i.e., from time $t-1$ to time t)
- r_t^{real}: real financial return over period t (i.e., from time $t-1$ to time t). This represents the increase in consumption power over the period since it accounts for inflation
- s: possible economic scenario over a future period
- $\mu = \mathbb{E}[r] = \mathbb{E}[r_t]$: statistical expectation of a return (also called the "expected return")
- $\sigma = \sigma[r] = \sigma[r_t]$: standard deviation of returns (also called the "volatility")
- $\widehat{x}$: estimated value for given x variable. For instance, $\widehat{\mu}$ represents the estimated expected return
- $r_t \sim N(\mu, \sigma)$: same as "returns r_t follow a normal distribution with mean μ and standard deviation σ"
- $r_{p,t}$: financial return of portfolio p over period t (i.e., from time $t-1$ to time t)
- w_i: weight of asset i in a given portfolio (weights must add to 1)
- $Cov[r_A, r_B]$: covariance between assets A and B
- $\rho[r_A, r_B]$: correlation between assets A and B (correlation varies between -1 and 1)
- r_f: risk-free rate. The following holds: $\mathbb{E}[r_f] = r_f$ and $\sigma[r_f] = 0$
- SR_p : Sharpe Ratio of portfolio p
- A : investor risk aversion
- portfolio o: tangent portfolio or "optimal risky portfolio"

- portfolio $o*$: complete portfolio with $r_{o*} = w_o \cdot r_o + (1 - w_o) \cdot r_f$
- β_i: "beta" or systematic exposure of asset i
- α_i: "alpha" or risk-adjusted return of asset i
- $r_{M,t}$: market portfolio financial return (think of an index like the S&P 500)
- $e_{i,t}$: firm-specific component of asset i financial returns
- R^2 : proportion of $\sigma^2 [r_{i,t}]$ that is due to the firms systematic risk: $\beta_i \cdot \sigma^2 [r_M]$

b) Formulas

$$r_t = \frac{(P_t + CF_t) - P_{t-1}}{P_{t-1}} \qquad \bar{r} = \frac{r_1 + r_2 + ... + r_T}{T} \qquad \bar{r}_G = \{(1 + r_1) \times (1 + r_2) \times ... \times (1 + r_T)\}^{1/T}$$

$$1 + ear_t = (1 + r_t)^n \qquad 1 + r_t^{real} = \frac{1 + r_t}{1 + i_t} \qquad r_{p,t} = w_1 \times r_{1,t} + w_2 \times r_{2,t} + ... + w_N \times r_{N,t} \qquad SR_p = \frac{\mathbb{E}[r_p] - r_f}{\sigma [r_p]}$$

$$\mu = \sum_s p(s) \times r(s) \qquad \widehat{\mu} = \bar{r} \qquad \sigma = \sqrt{\sum_s p(s) \times \{r(s) - \mu\}^2} \qquad \widehat{\sigma} = \sqrt{\frac{1}{T-1} \times \sum_{t=1}^{T} \{r - \bar{r}\}^2} \qquad \rho [r_A, r_B] = \frac{Cov [r_A, r_B]}{\sigma [r_A] \times \sigma [r_B]}$$

$$Cov [r_A, r_B] = \sum_s p(s) \times \{r_A(s) - \mu_A\} \times \{r_B(s) - \mu_B\} \qquad \widehat{Cov} [r_A, r_B] = \frac{1}{T-1} \times \sum_{t=1}^{T} \{r_{A,t} - \bar{r}_A\} \times \{r_{B,t} - \bar{r}_B\}$$

For portfolios of 2 assets : $\sigma_p^2 = w_A^2 \cdot \sigma_A^2 + w_B^2 \cdot \sigma_B^2 + 2 \cdot w_A \cdot w_B \cdot \underbrace{\sigma_A \cdot \sigma_B \cdot \rho [r_A, r_B]}_{Cov[r_A, r_B]}$ $\qquad \mathbb{E}[r_p] = w_A \cdot \mathbb{E}[r_A] + w_B \cdot \mathbb{E}[r_B]$

The index model : $r_{i,t} - r_f = \alpha_i + \beta_i \cdot (r_{M,t} - r_f) + e_{i,t}$ $\qquad \mathbb{E}[r_{i,t}] = r_f + \alpha_i + \beta_i \cdot (\mathbb{E}[r_{M,t}] - r_f)$

The index model : $\sigma^2 [r_{i,t}] = \beta_i \cdot \sigma^2 [r_M] + \sigma^2 [e_{i,t}]$ $\qquad Cov [r_A, r_B] = \beta_A \cdot \beta_B \cdot \sigma^2 [r_M]$ $\qquad R^2 = \frac{\beta_i \cdot \sigma^2 [r_M]}{\sigma^2 [r_{i,t}]}$

The index model : $r_o = \underbrace{w_A \cdot r_A}_{Active} + \underbrace{(1 - w_A) \cdot r_M}_{Passive}$ $\qquad w_A^0 = \frac{\alpha_A / \sigma^2 [e_A]}{(\mathbb{E}[r_M] - r_f) / \sigma_M^2}$ $\qquad w_A = \frac{w_A^0}{1 + w_A^0 \cdot (1 - \beta_A)}$

2.3 Module 3 - Factor Models

a) Notation

- i, t and p as subscripts: represent (i) a given security; (t) a time or time period and (p) a given portfolio
- P_t: price of a financial asset at time t
- CF_t: cash flow paid by a financial asset at time t
- $r_t = r_{i,t}$: financial return of asset i over period t (i.e., from time $t-1$ to time t)
- $\bar{r}$: (arithmetic) average return over a given interval of T periods
- $\mu = \mathbb{E}[r] = \mathbb{E}[r_t]$: statistical expectation of a return (also called the "expected return")
- $\sigma = \sigma[r] = \sigma[r_t]$: standard deviation of returns (also called the "volatility")
- $\widehat{x}$: estimated value for given x variable. For instance, $\widehat{\mu}$ represents the estimated expected return
- $r_{p,t}$: financial return of portfolio p over period t (i.e., from time $t-1$ to time t)
- w_i: weight of asset i in a given portfolio (weights must add to 1)
- $Cov[r_A, r_B]$: covariance between assets A and B
- $\rho[r_A, r_B]$: correlation between assets A and B (correlation varies between -1 and 1)
- r_f: risk-free rate. The following holds: $\mathbb{E}[r_f] = r_f$ and $\sigma[r_f] = 0$
- SR_p : Sharpe Ratio of portfolio p
- A : investor risk aversion
- portfolio o: tangent portfolio or "optimal risky portfolio"
- β_i: "beta" or systematic exposure of asset i
- α_i: "alpha" or risk-adjusted return of asset i
- $r_{M,t}$: market portfolio financial return (think of an index like the S&P 500)
- $e_{i,t}$: firm-specific component of asset i financial returns
- R^2 : proportion of $\sigma^2[r_{i,t}]$ that is due to the firms systematic risk: $\beta_i \cdot \sigma^2[r_M]$
- HML: High minus Low Factor. It is a long-short strategy with long position on a portfolio of high Book-to-Market companies and a short position on a portfolio of low Book-to-Market companies. Book-to-Market is a measure of "Value"

- SMB: Small minus Big Factor. It is a long-short strategy with long position on a portfolio of small companies and short position on a portfolio of big companies (as measured by market equity)

b) Formulas

$$r_t = \frac{(P_t + CF_t) - P_{t-1}}{P_{t-1}} \qquad \bar{r} = \frac{r_1 + r_2 + ... + r_T}{T} \qquad r_{p,t} = w_1 \times r_{1,t} + w_2 \times r_{2,t} + ... + w_N \times r_{N,t} \qquad SR_p = \frac{\mathbb{E}[r_p] - r_f}{\sigma[r_p]}$$

CAPM : $$\mathbb{E}[r_{i,t}] = \underbrace{r_f}_{Risk-Free\ Reward} + \underbrace{\beta_i}_{Risk\ Exposure} \cdot \underbrace{(\mathbb{E}[r_{M,t}] - r_f)}_{Risk\ Premium} \qquad \beta_i = \frac{Cov[r_i, r_M]}{\sigma^2[r_M]} = \frac{\sigma[r_i]}{\sigma[r_M]} \cdot \rho[r_A, r_B]$$

CAPM : $$\mathbb{E}[r_{M,t}] - r_f = A \cdot \sigma^2[r_M] \qquad \alpha_i = \mathbb{E}[r_{i,t}] - [r_f + \beta_i \cdot (\mathbb{E}[r_{M,t}] - r_f)] = 0$$

APT & index model : $$r_{i,t} - r_f = \alpha_i + \beta_i \cdot (r_{M,t} - r_f) + e_{i,t} \qquad \mathbb{E}[r_{i,t}] = r_f + \alpha_i + \beta_i \cdot (\mathbb{E}[r_{M,t}] - r_f)$$

APT & index model : $$\underbrace{\mathbb{E}[r_{p,t}] = r_f + \beta_p \cdot (\mathbb{E}[r_{M,t}] - r_f)}_{for\ Well\ Diversified\ Portfolio} \qquad \sigma^2[r_{i,t}] = \beta_i \cdot \sigma^2[r_M] + \sigma^2[e_{i,t}] \qquad R^2 = \frac{\beta_i \cdot \sigma^2[r_M]}{\sigma^2[r_{i,t}]}$$

Multifactor Equilibrium Models : $$\mathbb{E}[r_{p,t}] = r_f + \beta_p \cdot (\mathbb{E}[r_{M,t}] - r_f) + \beta_A \cdot \mathbb{E}[r_{A,t} - r_{a,t}] + ...$$

Multifactor Index Model : $$r_{i,t} - r_f = \alpha_i + \beta_i \cdot (r_{M,t} - r_f) + \beta_A \cdot (r_{A,t} - r_{a,t}) + ... + e_{i,t}$$

Multifactor APT : $$\underbrace{\mathbb{E}[r_{p,t}] = r_f + \beta_p \cdot (\mathbb{E}[r_{M,t}] - r_f) + \beta_A \cdot \mathbb{E}[r_{A,t} - r_{a,t}] + ...}_{for\ Well\ Diversified\ Portfolio}$$

Fama & French 3−Factor Model : $$\mathbb{E}[r_{i,t}] = r_f + \beta_i \cdot (\mathbb{E}[r_{M,t}] - r_f) + \beta_i^{HML} \cdot \mathbb{E}[HML] + \beta_i^{SMB} \cdot \mathbb{E}[SMB]$$

2.4 Module 4 - Market Efficiency

- P_t: price of a financial asset at time t
- $\mathbb{E}_t\left[CF_{t+h}\right]$: time t expectation of the future cash flow to be received at time $t+h$
- $\widehat{CF}_{t+h}$: time t forecast of the future cash flow to be received at time $t+h$
- r_t: financial return of over period t (i.e., from time $t-1$ to time t)
- $\mathbb{E}_t\left[r\right]$: expected rate of return to be received for holding a given asset
- dr_t: rate of return investors require in order to hold a given asset (this is called the required rate of return or discount rate)

$$r_t = \frac{(P_t + CF_t) - P_{t-1}}{P_{t-1}} \qquad P_t = \sum_{h=1}^{\infty} \frac{\mathbb{E}_t\left[CF_{t+h}\right]}{\left(1 + \mathbb{E}_t\left[r\right]\right)^h} \qquad P_t = \sum_{h=1}^{\infty} \frac{\widehat{CF}_{t+h}}{\left(1 + dr_t\right)^h}$$

Efficient Market Hypothesis : $\qquad \widehat{CF}_{t+h} = \mathbb{E}_t\left[CF_{t+h}\right] \implies \mathbb{E}_t\left[r\right] = dr_t$

2.5 Module 5 - Debt Securities

- P_t: bond price at time t
- F: bond face value
- c: bond annual coupon rate value
- r: bond return over a given period (period should be clear from the context)
- dr_t: rate of return investors require in order to hold the bond (required rate of return or discount rate)
- y_H: yield to maturity of a zero-coupon bond with maturity in H years
- y: yield to maturity of a given bond
- Δy: change in yield to maturity of a given bond
- D: bond duration (D^* is the modified duration)
- y^{df}: yield to maturity of a bond that is identical to the given bond except that it has no probability of default
- p: annual probability of default of a given bond
- LGD: loss given default (investors lose LGD $\cdot$ 100% of current bond price if the bond defaults)

Zero−Coupon Bond :

$$P_t = \frac{F}{(1+y_H)^H} \qquad y_H = \left(\frac{F}{P_t}\right)^{1/H} - 1 \qquad D = H \qquad 1 + \mathbb{E}_t\left[y_1\right] = \frac{(1+y_2)^2}{(1+y_1)}$$

Debt with no Default Risk :

$$P_t = \frac{F}{(1+y)^H} + \sum_{h=1}^{H} \frac{c \cdot F}{(1+y)^h} = \frac{F}{(1+y_H)^H} + \sum_{h=1}^{H} \frac{c \cdot F}{(1+y_h)^h} \qquad dr_t = y$$

Debt with no Default Risk :

$$r = -\underbrace{\frac{D}{1+y}}_{D^*} \cdot \Delta y \qquad D = \sum_{h=1}^{H} w_h \cdot h \quad \text{with} \quad w_h = \begin{cases} \frac{c \cdot F}{(1+y)^h} / P_t & \text{for } h < H \\ \frac{c \cdot F}{(1+y)^h} / P_t & \text{for } h = H \end{cases}$$

Debt with Default Risk :

$$P_t = \frac{F}{(1+y)^H} + \sum_{h=1}^{H} \frac{c \cdot F}{(1+y)^h} \qquad \underbrace{dr_t - y^{df}}_{\text{effective default premium}} \cong \underbrace{\left(y - y^{df}\right)}_{\text{default premium}} - \underbrace{p \cdot \text{LGD}}_{\text{adjustment for losses}}$$

2.6 Module 6 - Equity Securities

- P_t: equity price at time t
- D_{t+h}: dividend (per share) to be received h years from now
- $\widehat{g}_t$: (estimated or expected) dividend growth over period t. Without the t subscript, it refers to the long-run (or stable) estimated dividend growth.
- r: equity return over a given period (period should be clear from the context)
- dr_t: rate of return investors require in order to hold the equity (required rate of return or discount rate). Without the t subscript, it refers to the long-run investors require.
- E: earnings per share
- PV_{GO}: present value of growth opportunities
- PV_{NG}: present value of company if there would be no growth in dividends/earnings
- b: plowback ratio (fraction of earnings that are retained in the company)
- ROA: return on assets (combined profitability of debt and equity holders)
- ROE: return on equity (profitability of equity holders)
- EBIT: earnings before interest and taxes
- EBT: earnings before taxes

Dividend Discount Model : $$P_t = \frac{D_0 \cdot (1+\widehat{g}_1)}{(1+dr)^1} + \frac{D_0 \cdot (1+\widehat{g}_2)}{(1+dr)^2} + ... \qquad P_t = D_0 \cdot \frac{1+\widehat{g}}{dr-g} \qquad dr = \frac{D_0 \cdot (1+\widehat{g})}{P_0} + \widehat{g}$$

Valuation Ratios & Growth $$\text{PV}_{\text{NG}} = \frac{E}{dr} \qquad P = \text{PV}_{\text{NG}} + \text{PV}_{\text{GO}} \qquad \frac{P}{E} = \frac{1}{dr} \cdot \left[1 + \frac{\text{PV}_{\text{GO}}}{\text{PV}_{\text{NG}}}\right] \qquad g = \text{b} \cdot \text{ROE}$$

Fin Statement Analysis : $$\text{ROA} = \frac{\text{EBIT}}{\text{Assets}} \qquad \text{ROE} = \frac{\text{E}}{\text{Equity}} \qquad \text{ROE} = \text{ROA} + (\text{ROA} - \text{Interest Rate}) \cdot \frac{\text{Debt}}{\text{Equity}}$$

Fin Statement Analysis : $$\text{ROE} = \underbrace{\frac{\text{Assets}}{\text{Equity}}}_{\text{Leverage}} \cdot \underbrace{\frac{\text{Sales}}{\text{Assets}}}_{\text{Turnover}} \cdot \underbrace{\frac{\text{EBIT}}{\text{Sales}}}_{\text{Profit Margin}} \cdot \underbrace{\frac{\text{EBT}}{\text{EBIT}}}_{\text{Interest burden}} \cdot \underbrace{\frac{\text{E}}{\text{EBT}}}_{\text{Tax burden}} \qquad \text{ROA} = \underbrace{\frac{\text{Sales}}{\text{Assets}}}_{\text{Turnover}} \cdot \underbrace{\frac{\text{EBIT}}{\text{Sales}}}_{\text{Profit Margin}}$$

2.7 Module 7 - Derivative Securities

- T: expiration date of a Future, Forward or Option contract
- H: horizon of a swap contract
- F_t: Future/Forward price at time t
- S_t: price of a given underlying asset at time t
- y: yield to maturity of a given bond (r_f if the yield curve is flat)
- PV_{CF}: present value of cash flows paid until the maturity of a future contract
- N: notional value of a given derivative contract
- P_{swap}: value of a swap contract (this is zero at issuance date)
- K: strike price of an option contract

PS: the payoff/value of a short position in a given derivative is equal to the negative of the payoff/value of the respective long position (it is a zero sum game)

$$\text{Future/Forward Contracts :} \qquad \text{Long position payoff at expiration} = S_T - F_0 \qquad \text{Long position value at t} = F_t - F_0$$

$$\text{Future/Forward Contracts :} \qquad F_0 = (S_0 - PV_{CF}) \cdot (1+y)^T$$

$$\text{Plain Vanilla Interet Rate Swap Contract :} \qquad P_{swap} = \underbrace{\left[\frac{\text{N}}{(1+y)^H} + \sum_{h=1}^{H} \frac{(\text{fixed rate}) \cdot \text{N}}{(1+y)^h}\right]}_{\text{Fixed rate bond value}} - \underbrace{N}_{\text{Floating rate bond value}}$$

$$\text{Option Contracts :} \qquad \text{Long call payoff at expiration} = \begin{cases} S_T - K & if\ S_T > K \\ 0 & if\ S_T \leq K \end{cases}$$

$$\text{Option Contracts :} \qquad \text{Long put payoff at expiration} = \begin{cases} 0 & if\ S_T > K \\ K - S_T & if\ S_T \leq K \end{cases}$$