FINA 3070 Notes 3A

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1 Discount Rate: r

1.1 Use WACC

- r = WACC (weighted average cost of capital), which in turn is calculated by $E(r_{debt})$ and $E(r_{equity})$.
- Simple example: suppose firm's debt is 30% of firm's value at 7.5% (lower risk) and equity is 70% of firm's value at 15%.
  - Company cost of capital = 7.5 × .3 + 15 × .7 = 12.75%
- $E(r_{debt})$ is observable.
- But $E(r_{equity})$ (cost of equity) needs to be estimated – the hardest part of calculating WACC.

1.1.1 The Company Cost of Capital

- = Expected return of a portfolio of existing securities of that company.
- = the opportunity cost of capital for investment in the company's assets.
- = the appropriate r for the company's average-risk projects.
- Estimated as a "blend" of "cost of debt" (interest rate) and "cost of equity" (expected rate of return demanded by investors in firm's common stock).
- If company has "no debt outstanding", then "company cost of capital" = "expected rate of return on the company's stock".
- E.g. suppose we know that a company's common stock has a beta of value β:
  - Company's $r = r_f + \beta(r_m - r_f)$

1.1.2 When Project's Risk ≈ Equity-Market's Risk

- Opportunity cost of capital.
- Suppose $E(r_m)$ is the current expected annual return of the equity market.
- If a new project's risk is similar to the stock market's average equity risk, then its "annual discount rate" should equal $E(r_m)$.

- We can estimate $E(r_m)$ using the current r_f and historical average of differences between r_m and r_f, which is $(r_m - r_f)$.
- I.e. $E(r_m) = r_f + E(r_m - r_f)$
- r_f is the YTM of 1-year T-bill, will be in daily news.
- $E(r_m - r_f)$ is "market risk premium" (USA historically 7.7%).

1.1.3 When project's risk $\neq$ equity-market's risk

- We need a model to calculate project's suitable discount rate.
- E.g. CAPM (used by large firms and investors), APT, Fama-French 3-factor model.

2 CAPM: Capital Asset Pricing Model

2.1 Overview

- Risk: diversifiable risk and non-diversifiable (systematic) risk.
- The higher the systematic risk, the higher the required (expected) return.
- Even if a stock/project is very risk, if most of the risk is diversifiable, then it doesn't need a high discount rate.

2.2 Non-diversifiable risk: β

- Systematic risk is the sensitivity towards change in macro-economy.
- The market portfolio is represented, in practice, by the S&P 500.

2.2.1 Understanding the scatter plots (Lec Ch7. p.13-15)

- The slope is the estimated beta.
- R^2 is the percentage of non-diversifiable risk in the total risk.
  - E.g. p.13 Right figure. R^2 is 0.15, this means that 15% of the total risk can be explained by market movement, while the rest 85% was diversifiable.
- The values in parentheses (under beta) are the standard errors of each estimation, representing the possible mismeasurement.

2.2.2 Beta formula for an example stock i

- $\beta_i = \dfrac{\text{covariance of stock i's return with the market return}}{\text{variance of the market return}} = \dfrac{\sigma_{i,m}}{\sigma_m^2}$.

2.2.3 Using regression to find beta

- $r_i(t) = \alpha + \beta_i r_m(t) + e_i(t)$

2.3 TODO SCL (Security Characteristic Lines) (pp.20)

- Systematic (non-diversifiable) risk: explained by the SCL.
- Firm-specific (diversifiable) risk: unexplained by the SCL.
- $\sigma_i^2 = \beta_i^2 \cdot \sigma_m^2 + \sigma_{e_i}^2$
- Total risk = Systematic risk + Firm-specific (diversifiable) risk.
- R-square $= \dfrac{\text{systematic risk}}{\text{total risk}}$

2.4 TODO ANOVA (pp.26-)

2.5 TODO More on beta and r (last 10 pages)