

Lecture notes Asset Pricing and Capital Budgeting Lecture

Today's lecture was about applying what we have learned until so far to creating value. First, we got a summary on risk and return, followed by the topic of company cost of capital.

Creating value

The main goal of managers is to create value, which means selecting the projects that deliver a higher return than the opportunity cost capital. The opportunity cost is the return one can expect in the financial market with similar risk. When we calculate the NPV of a project, the discount rate r reflects this opportunity cost. NPV is the value you add when you start a project.

Graham and Harvey did a survey among corporations and asked them how they calculated their cost of equity capital, most of them used the CAPM method. CAPM doesn't work too well, but since it is used so much we learn it. Also, alternatives are scarce.

Risk and return

What we have learned:

The risk-return trade-off is in theory positive, the higher the return you want, the higher the risk you have to accept. However if you ask people, perceptions exist the relation is negative.

Total risk is being measured by an asset's return standard deviation, the volatility. This total risk consists of diversifiable risk and non-diversifiable risk. The benefit of diversification depends on the correlation between returns of stocks. Because unique risk can be eliminated in a well-diversified portfolio, only systematic risk is compensated in expected returns. This makes sense if we take a look at the law of one price. If the risk was also based on the diversifiable part, you could have a high return and low risk, in this way it is easy to make a profit. However this is thus not possible and the pricing is only based on the non-diversifiable risk. The systematic risk can be measured by beta, which is a security's sensitivity to macro-economic developments represented by the market portfolio. Since we cannot calculate market portfolio, we estimate it with a stock market index like the S&P500.

Furthermore, the CAPM formalizes the relationship between an asset's expected return and its systematic risk. Because the CAPM has weak empirical support, alternative asset pricing models have been developed. The best ones are the 3 factor Fama & French model and the 4 factor Fama-French-Carhart model. These four factors do quite well in explaining pricing in the financial market.

Equations

For a stock:

Return

- One period return
$$R_{it+1} = \frac{P_{it+1} - R_{it}}{P_{it}} + \frac{DIV_{it+1}}{P_{it}}$$

- Average return

- Arithmetic
$$Mean R = \frac{1}{T} (R_1 + \dots + R_T)$$

- Compounded

Risk

- Volatility (how risky is a stock)
$$\sigma = \frac{\sqrt{(R_{it} - Mean R_i)^2 + \dots + (R_{it+T} - Mean R_i)^2}}{T-1}$$

- Beta (calculates return)
$$\beta_i = \frac{COV(R_i, R_M)}{\sigma_i}$$

Portfolio

Return

- $$R_p = w_i \times R_i + w_j \times R_j$$

Risk

- Volatility
$$\sigma_p = \sqrt{w_i^2 \times \sigma_{R_i}^2 + w_j^2 \times \sigma_{R_j}^2 + 2 \times w_i \times w_j \times \rho_{R_i, R_j} \times \sigma_{R_i} \times \sigma_{R_j}}$$

- Beta
$$R_p = w_i R_i + w_j R_j$$

Risk and returns in the market

- CAPM
$$E(r_i) = r_f + \beta_i (E(r_M) - r_f)$$

- 4 factor FF-Carhart model

$$E(r_i) = r_f + \beta_i^m (E(r_M) - r_f) + \beta_i^{smb} (E(r_{smb})) + \beta_i^{hml} (E(r_{hml})) + \beta_i^{pr1yr} (E(r_{pr1yr}))$$

Smb = small minus big

Hml = high minus low

Company cost of capita

- Cost of equity capital $r_e = \text{risk free rate} + \text{risk premium} (\beta_i (E(r_M) - r_f))$
- Cost of debt capital $d_e = \text{risk free rate} + \text{risk premium} (\text{default spread})$
- Company cost of capital $r_{wacc} = (1 - T_c) r_d \frac{D}{D + E} + r_e \frac{E}{D + E}$

The r_{wacc} can become very long, you can include all capital and debt. We use the r_{wacc} when computing the NPV. Mind that you can use wacc only if the company is carbon identical. If the company wants to make an atypical project, the NPV cannot be used. Assumes new project is financed in the same way the whole firm is financed. If this is not the case, this wacc isn't appropriate. You will have to take a different approach. All weights are market values, so do not take from the balance sheet, these are the book values.