L4: Estimating the Cost of Capital

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Cost of capital for a new project

- Say you want to evaluate a new project for your firm.
- What should we use as the cost of capital in our DCF analysis?
- Recall the CAPM formula from last time $r_i = r_f + \beta_i(\mathbb{E}[r_m] - r_f)$.
- What is the right value of β_i to use?
- Two options:
  - Estimate the β corresponding to the firm's equity and go with that.
  - Use something else...
- The answer depends on the particular project we're considering.

β in corporate finance v.s. investments

- The β you would have estimated in investments class generally would tell us the sensitivity of the firm's **equity** to the market risk premium.
- Our purpose here though is to think about **new projects** that the firm might be considering.
- To use CAPM for a new project, we must use a β that is appropriate to the specific incremental cash flows under consideration.
- May differ considerably from the equity β!
- New projects aren't traded assets! So we need to do a bit more work in corporate finance than in investments.

The trio of βs for a firm

- We usually think of there being **three** β coefficients for a firm.
  - Assets β_A: how do the firm's project cash flows move with the market?
  - Equity β_E: how does the value of firm's equity move with the market?
  - Debt β_D: how does the value of the firm's debt move with the market?

So what do we do?

- If the firm is expanding its **current** business activities, then using its β_A is appropriate.
  - Follows from the fact that the cash flows from the expansion are likely to be of similar risk to its current projects.
  - Obviously requires that our firm has been trading for a reasonable amount of time though.

- If the firm is branching-out into a **new** business activity, then we need to use what's called a **comparable** firm.
  - The new cash flows may not be of the same risk as the firm in question's current activities.
  - So we need to find a comparable firm's β_A that will give us similar risk as the cash flows of the new project.

Relationships between firm βs (1)

- When the firm is **all equity** financed, then there is no debt and so $\beta_A = \beta_E$.
  - Since only equity has claim on the firm's project cash flows, so they have the same **degree of systematic risk**.
- When the firm also has debt, the systematic risk of the firm's projects is the depends on both the debt and equity betas.
- When taxes are present, the firm's **debt policy** affects the formula for β_A. Two potential policies are:
  - Fixed level of debt.
  - Fixed leverage ratio.

Relationships between firm βs (2)

- With a **constant leverage ratio**, β_A is a weighted average of the debt and equity betas.

$$\beta_A = \frac{E}{D+E}\beta_E + \frac{D}{D+E}\beta_D. \tag{1}$$

- We can also express equation (1) as

$$\beta_E = \underbrace{\beta_A}_{\text{Project risk}} + \underbrace{\frac{D}{E}(\beta_A - \beta_D)}_{\text{Financial risk}}$$

- **Financial risk**: higher leverage means higher default risk; less chance of equity receiving a payout.

Relationships between firm βs (3)

- With a **constant level of debt**, the formula for β_A is given by

$$\beta_A = \frac{E}{D(1-\tau^C)+E}\beta_E + \frac{D(1-\tau^C)}{D(1-\tau^C)+E}\beta_D.$$

where τ^C is the corporate tax rate.

Trio of firm returns

- Given that we have three βs associated with the firm, we must necessarily have three returns, which fall-out from the CAPM formula.
  - r_A: return on the firm's assets.
  - r_E: return on the firm's equity.
  - r_D: return on the firm's debt.

- Again the return on the firm's assets is given as the **weighted average** of the returns to the two types of stakeholders

$$r_A = \frac{E}{D+E} r_E + \frac{D}{D+E} r_D$$

For a new project in the **same** business line

(1) Estimate **your** firm's β_E by regressing your stock returns on the proxy for the market return, (assuming it's publicly traded).

(2) Make an **assumption** regarding the β_D of your firm.

- **Can't** run a regression like we can for β_E — corporate debt is not traded in such a liquid manner.
- Use the average β_D for your rating class.
- Fama & French (1993).

Rating/bond type	**Estimated β_D**
Treasury (1 – 5 year maturity)	0.08
Treasury (6 – 10 year maturity)	0.13
Corporate Aaa	0.20
Corporate Aa	0.20
Corporate A	0.21
Corporate Baa	0.23
Corporate junk	0.31

(3) Use the formula relating β_A to β_E and β_D.

(4) Plug β_A into the CAPM formula to get r_A.

(5) Discount away!

For a new project in a **different** business line

- Find a **comparable firm**.
  - This firm needs to be in the **same or similar** business as the new project we're considering.
  - The riskiness of the comparable firm's cash flows is the **only** consideration when choosing an appropriate twin.
  - Don't choose twins based on financial considerations!
- The idea is that firms with the **same** systematic project risk will have the **same** β_A under the CAPM formula.
- Then this implies that they will have the same r_A.
- Once you've found an appropriate comparable, use the method with steps (1) – (5) outlined on the previous slide to find the comparable's β_A.
- The r_A that comes from the comparable's β_A is the discount rate you should use for **your firm's** new project.
- The process of finding the comparable firm's β_A is called **unlevering** the comparable's β_E.

Pros/cons of the comparable method

- Relies on the assumptions of the CAPM model.
- If you lack data for your own company's equity, can use a similar company's as a comparable to estimate your own β_A.
- Need reliable estimates of the market return and riskless rate — these can be volatile.
- No perfect comparable exists!
- We need to unlever the comparable's β_E by making assumptions about β_D.
  - We need to do this since their financial risk may differ from our own due to different leverage ratios.

Firm as a collection of projects

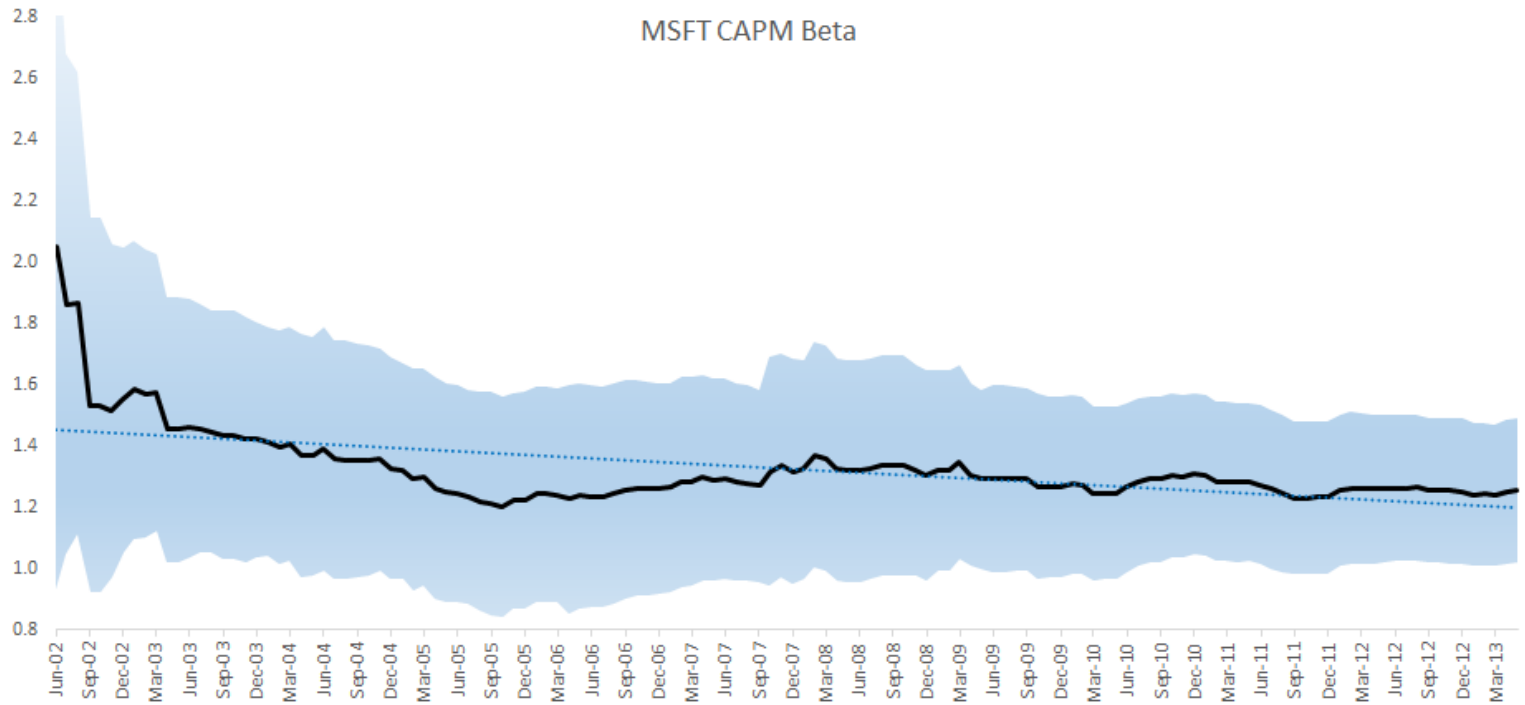
- Referring back to the firm as a collection of distinct projects, we can also think the firm's **overall** β_A as a weighted sum of **individual** project βs.

$$\beta_A = \sum_{j=1}^{n} \frac{A^j}{A} \beta_A^j$$

where A is overall assets, A^j is assets devoted to project $j \in \{1, 2, ..., n\}$ and β_A^j captures the systematic risk of project j's cash flows.

β and time variance

- β for an asset can change over time.
- E.g. β_E can change for a company's stock as either the **business** or **financial** risk changes.
- If the firm moves into riskier businesses or assumes more debt, then the β_E can rise.
- Microsoft — maybe they've moved into safer businesses since the DOT COM bubble burst.



Example A

- Apple is thinking about buying a local football (soccer) club in Palo Alto.
- They've never been in this business before.
- The club they're looking to buy is not publicly listed; it's decently-sized though and will generate positive cash flows from the purchase.
- Manchester United F.C. has the following information:
  - $\beta_E = 0.51$.
  - $A = 2.05$B (assets).
  - $D = 1.30$B (debt).
  - $E = 0.75$B (equity).
- The prevailing riskless rate is 2% and the expected market risk premium is 7%.
- What is the appropriate discount rate to use for the potential purchase?

Example A solution

- Use United as the comparable firm.
- Their debt is unrated so we need to make an assumption about its riskiness.
- $\frac{D}{A}$ ratio is quite high — 64%.
- According to Moody's rating agency[1], the median leverage ratio of Ba bonds is about 50% and that for B bonds is 69%.
- We can assume it sits somewhere between the two ratings — let's assume $\beta_D = 0.31$.
- The β_A for United is estimated as $\beta_A = 0.64(0.31) + (1 - 0.64)(0.51) = 0.382$.
- Google should use $r_A = 0.02 + 0.382(0.07) = 0.0467$ as the discount rate for buying the football team!

[1] https://www.moodys.com/sites/products/DefaultResearch/2005700000436062.pdf.

Example B

- Your firm is about to undertake a **leveraged recapitalisation**.
- This involves issuing more debt and then using it to repurchase shares.
- It's purely a financial transaction — it won't affect the business risk of the firm's projects.
- Has implications for the financial risk though!
- Assume that debt to assets was originally 10% and it goes to 50% after the re-cap.
- Take the initial β_D to be zero.
- The β_E goes from 0.65 to 0.95 after the re-cap.
- What is the new β_D?

Example B solution

- Start by finding the firm's original β_A.
- $\beta_A = 0.9(\beta_E) = 0.9(0.65) = 0.585$.
- We can solve the β_A equation for the new β_D.

$$\begin{aligned} \beta_A &= \frac{D}{A}\beta_D + \frac{E}{A}\beta_E \\ \Rightarrow \beta_D &= \beta_A + \frac{E}{D}(\beta_A - \beta_E) \\ &= 0.585 + (1)(0.585 - 0.95) \\ &= 0.22. \end{aligned}$$

Takeaways

- Two components to finding the NPV of a project:
  - Expected cash flows.
  - Discount rate.
- The appropriate discount rate is **project** specific.
  - Fine to use the firm's β_A if the new project is in the **same** line of business.
  - Need to use a **comparable firm** otherwise.
- Comparable method involves **unlevering** the other firm's β_E to get **your** β_A.
- The r_A this gives us corresponds to a firm that is **all equity** financed. We'll generalise this shortly.