

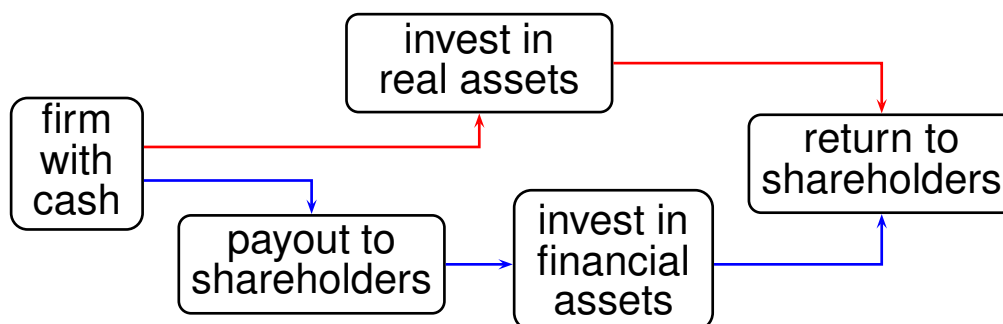
Risk, Return, and Capital Budgeting

(Text reference: Chapter 12)

- cost of equity capital
- estimation of β s
- determinants of β s
- project specific β s
- cost of capital with debt
- ways to reduce the cost of capital

Cost of Equity Capital

- recall the following diagram (from Chapter 3):



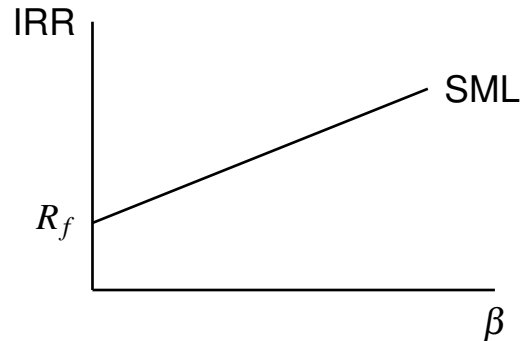
- since shareholders can invest on their own in risky financial assets, the expected return on a capital budgeting project should be at least as high as the expected return on a comparable financial asset

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- from the firm's perspective, using CAPM the cost of equity capital is

$$r_S = E(R) = R_f + \beta [E(R_M) - R_f]$$

- the firm should accept "simple" projects which have an IRR at least as high as the cost of equity capital



Estimation of βs

- in theory, calculating β is simple:

$$\beta_i = \frac{\text{cov}(R_i, R_M)}{\text{var}(R_M)}$$

- possible problems:

- βs may vary over time (e.g. due to new products or competitors, technological changes, regulatory changes)
- what is the appropriate sample size?
- βs are affected by financial leverage

- possible solutions:

- more complicated statistical procedures
- appropriate adjustments for leverage
- estimating βs for all similar firms in an industry

Determinants of β s

- in some cases we may have to make qualitative assessments about β ; the following factors should be considered:
 - cyclicality of revenues:
 - market return R_M follows the business cycle
 - a cyclical firm has revenues and NI that move strongly with the market \Rightarrow high β
 - operating leverage:
 - percentage change in EBIT for a given percentage change in sales
 - higher variable costs \Rightarrow lower operating leverage
 - higher fixed costs \Rightarrow higher operating leverage
- higher operating leverage \Rightarrow greater risk and cyclicality

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- financial leverage:
 - the extent to which a firm relies on debt (B) as opposed to equity (S)
 - levered firm: financed with debt and equity
 - unlevered firm: financed with equity only
 - higher financial leverage \Rightarrow higher risk
- we can think of a firm's assets, debt, and equity as each having their own β s (i.e. so far we have considered only equity β s (since we were considering stocks), but β can represent the systematic risk of any asset/security (debt, a particular project, etc.))

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- ignoring corporate taxes (for simplicity), the relationship between these various β s is

$$\beta_A = \frac{B}{B+S} \times \beta_B + \frac{S}{B+S} \times \beta_S$$

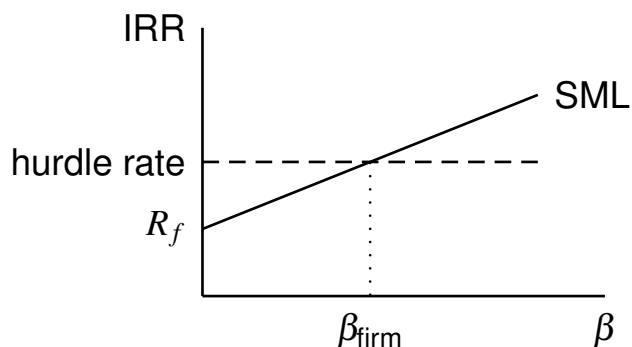
- it is commonly assumed that $\beta_B \approx 0$, so the above expression can be rearranged to obtain

$$\beta_S = \beta_A \times \left(1 + \frac{B}{S}\right)$$

- example: a firm is presently all-equity financed and has $\beta = 0.8$. Suppose it changes to a capital structure with 30% debt and 70% equity. What will its equity β become?

Project Specific β s

- the cost of capital for a project depends on the use to which funds are being put
- this implies the cost of capital depends on the risk of the project, not of the firm (of course, in many situations project risk is equal to firm risk, but this is not always the case)
- a firm using a single discount rate for all projects over time may increase the risk of the firm and reduce its value



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- project β represents a project's sensitivity to market risk
- for a project p :

$$\beta_p = \frac{\text{cov}(R_p, R_M)}{\text{var}(R_M)}$$

- estimating β_p can be complicated because historical data may not be available
- possible remedies include:
 - basing estimates on other firms with comparable projects (note: may have to adjust for differences in financial leverage)
 - using subjective or qualitative estimates based on comparisons between the project and the existing firm with regard to the determinants of β (i.e. cyclicity, operating leverage, financial leverage)

Cost of Capital with Debt

- Case 1: project has risk level equivalent to firm's risk level (β_A)

OCC = CAPM discount rate reflecting β_B and β_S

- weighted average cost of capital (WACC):

$$\text{WACC} = \frac{B}{B+S} \times r_B + \frac{S}{B+S} \times r_S$$

- proof:

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- WACC is a weighted average of the returns that investors require from various debt and equity securities issued by the firm
- WACC is related to the firm's asset β (since β_A is a weighted average of the β s of the various securities)
- WACC is the appropriate discount rate for new projects with risks identical to the firm's current risks
- if we consider corporate taxes:

$$\text{WACC} = \frac{B}{B+S} \times r_B \times (1 - T_c) + \frac{S}{B+S} \times r_S$$

- example: suppose $B/S = 0.5$, $r_B = .08$, $\beta_S = 1.3$, $E(R_M) = .14$, $R_f = .04$, and $T_c = .35$. What is WACC?

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- Case 2: project has a different level of risk (β_p) than the risk level of the firm (β_A)
 - OCC = CAPM discount rate reflecting β_B and an adjusted β_S^*
 - adjust β_S to β_S^* to reflect the risk differences between the specific project and the firm equity
 - possible qualitative adjustment based on determinants of β
- example: consider the same example as on slide 11, but suppose that the project will be riskier. In particular, suppose β_S^* is 1.8 instead of 1.3. What is WACC?
- note that we are assuming in these examples (slides 11 and 12) that the project is to be financed with the same debt-equity ratio as the existing firm

Ways to Reduce the Cost of Capital

- the basic idea so far is that the expected return on a stock and thus the firm's cost of capital increase with market risk
- can also argue that the expected return on a stock (and cost of capital) is negatively related to the liquidity of the firm's shares
- it can be hard to reduce the risk of the firm, but there may be ways to increase liquidity
- in general, liquidity can be thought of as how quickly an asset can be sold (without taking an excessively low price)
- in the case of a stock, we can think of liquidity as consisting of three types of trading costs:
 - brokerage fees
 - bid-ask spread
 - market impact costs

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- since trading costs reduce returns, investors will demand higher returns for trading in illiquid stocks \Rightarrow increasing liquidity (and reducing trading costs) can lower the firm's cost of capital
- various factors affect the liquidity of a stock, but an important one is called *adverse selection*
 - idea is that better informed traders can take advantage of specialists and other traders who have less information
 - greater heterogeneity of information \Rightarrow wider bid-ask spreads \Rightarrow less liquid stock
- to increase liquidity, the firm can
 - disclose more information to analysts and the public at large
 - use direct stock purchase plans and dividend reinvestment plans to allow investors to buy the stock cheaply
 - split the stock if the price gets too high