

1.011 Project Evaluation

Choosing a Discount Rate

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- Rate of Return on an Investment
- Minimally Acceptable Rate of Return
- Capital Markets - Risk vs. Return
- Weighted Average Cost of Capital
- Leveraging

A Basic Question

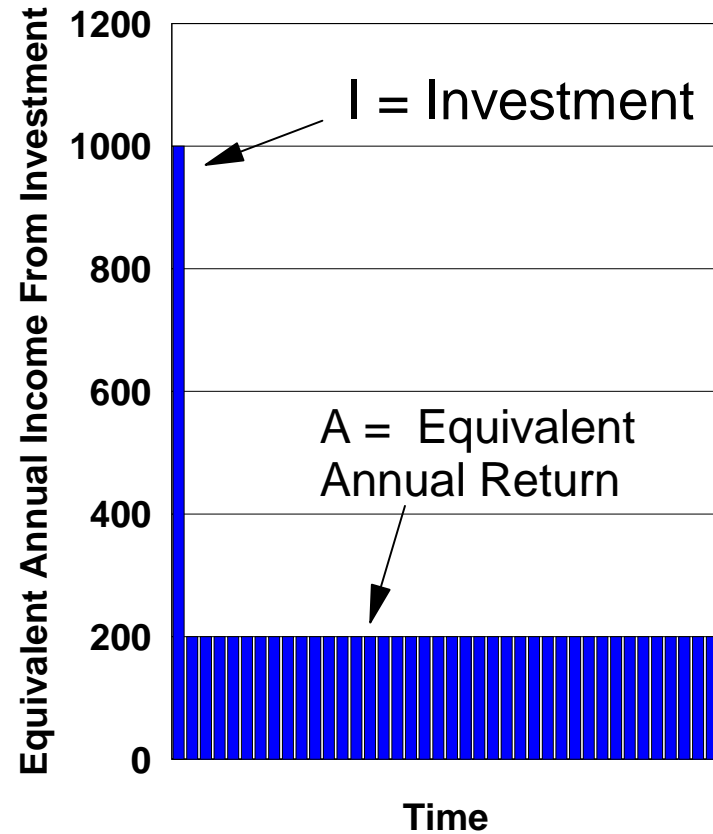
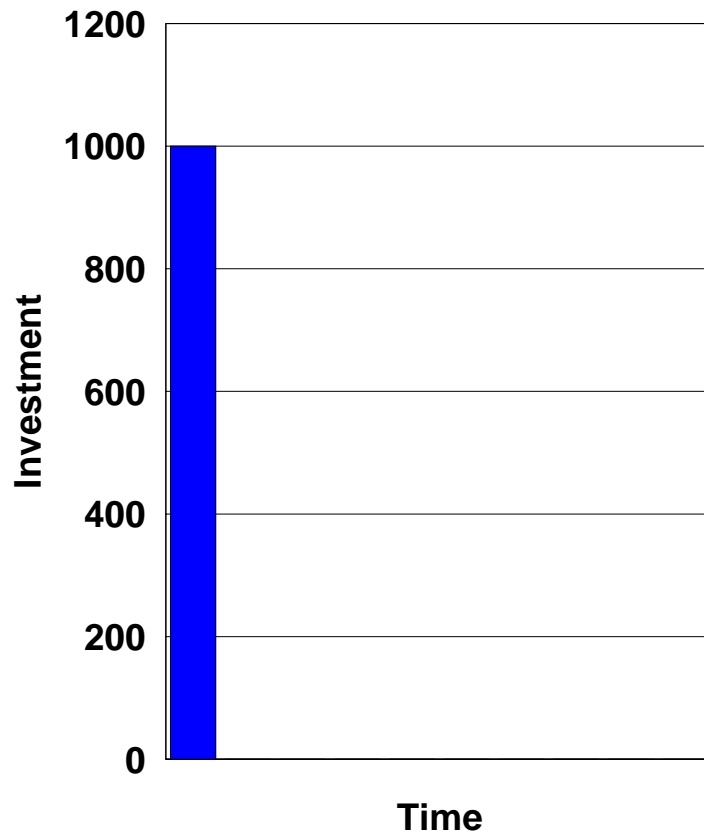
- For any arbitrary sequence of cash flows and for any interest rate i , we can find an equivalent cash flow that is much easier to work with when evaluating projects:
 - ▶ Present worth
 - ▶ Future worth, at any time t
 - ▶ An annuity for N periods beginning at time 0
 - ▶ An annuity for N periods beginning at any future time
- But - ***how do we choose i ?***

Opportunity Cost of Capital

- What else could we do with our money?
 - ▶ Give it away
 - ▶ Spend it on food, Red Sox games, movies, or clothes
 - ▶ Put it in the bank
 - ▶ Buy government bonds or corporate
 - ▶ Buy blue chip stocks
 - ▶ Buy growth stocks
 - ▶ Buy emerging markets mutual funds
- The opportunity cost depends upon what other options are available to us given our own situation and current market conditions

Return on Investment = A/I

(where A is the annual income from the investment over a long time horizon)



Minimum Attractive Rate of Return

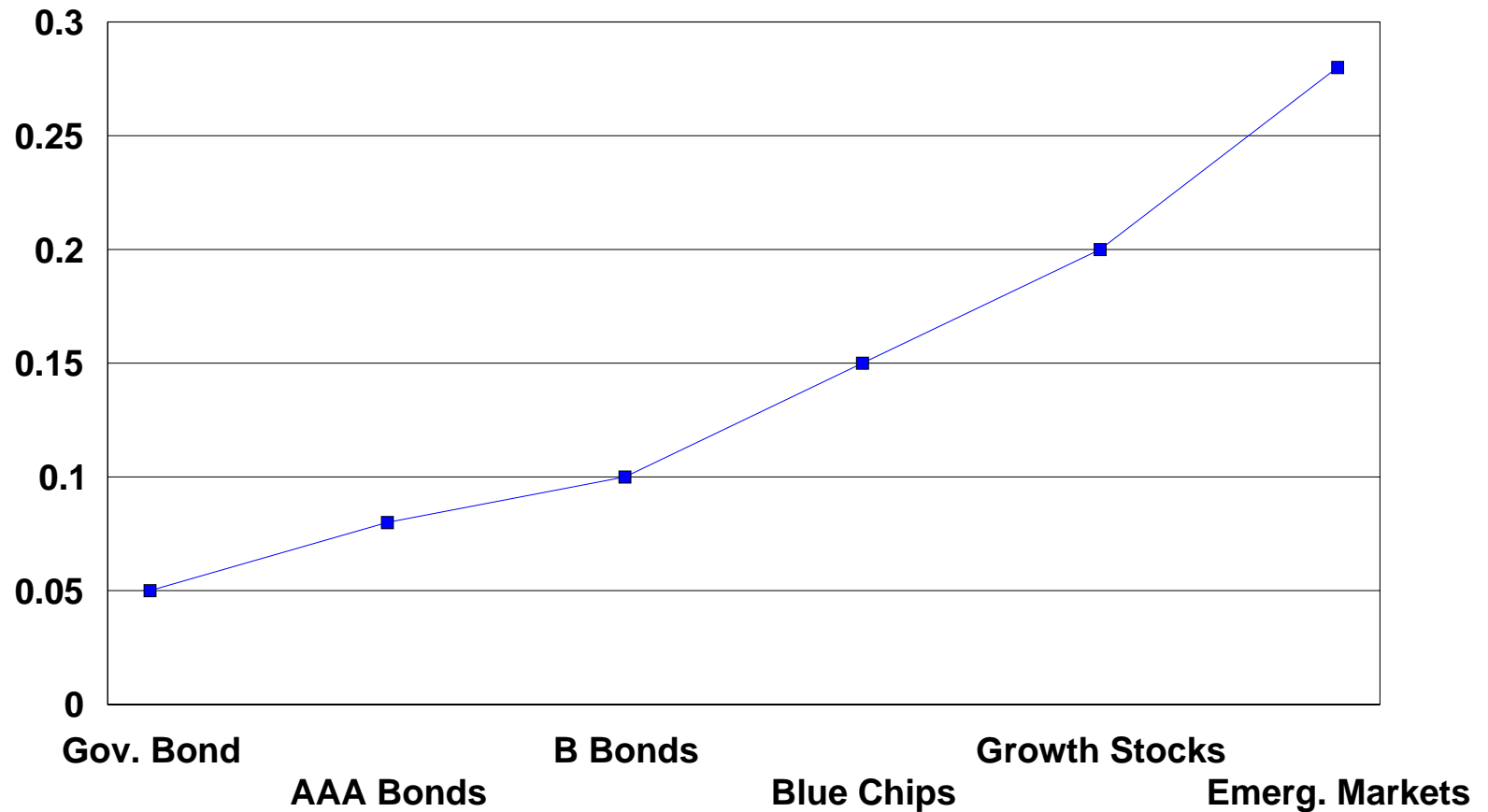
- The MARR is the lowest return that you would be willing to accept given:
 - ▶ The risks associated with this project
 - ▶ The other opportunities for investment
- In general, we can look at the capital markets to find out what kinds of return are available for different kinds of investment
 - ▶ Interest rates for bonds
 - ▶ Historical rates or return (i.e. growth rates) for stocks (assuming that stocks are priced today such that they will offer new owners similar rates of return in the future)

Cost of Capital

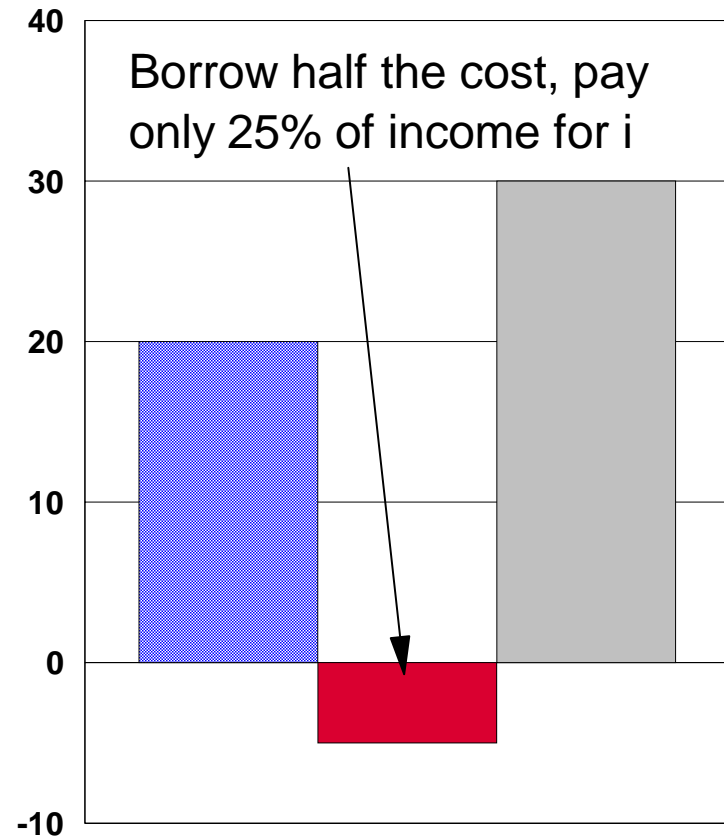
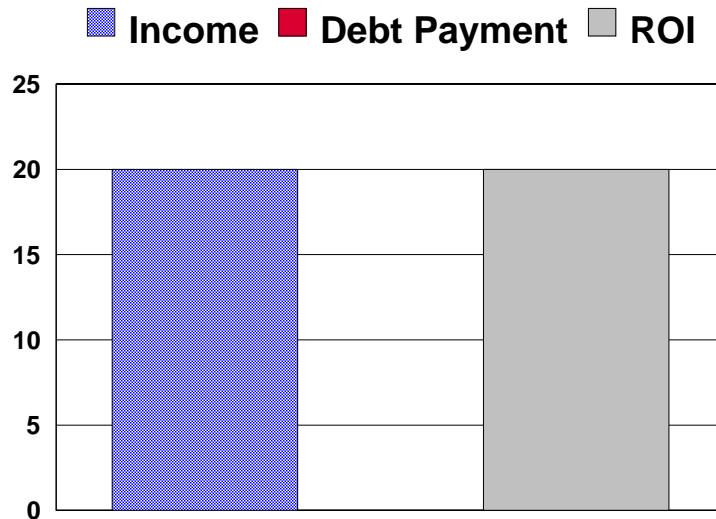
- ▶ A company has various potential sources of funds in addition to using its own funds and losing opportunities to invest those funds elsewhere)
- ▶ Debt: borrow money from a bank or issue bonds (pay a defined payment of principal plus interest rate per period, but retain complete ownership of the company)
- ▶ Sell stock (raise money without committing to interest payments, but also give up ownership of the company)

What is an Appropriate Discount Rate?

Risk vs. Expected Return



Debt Financing Increases the Expected Return of the Project if the Interest Rate is lower than the ROI



Leveraging

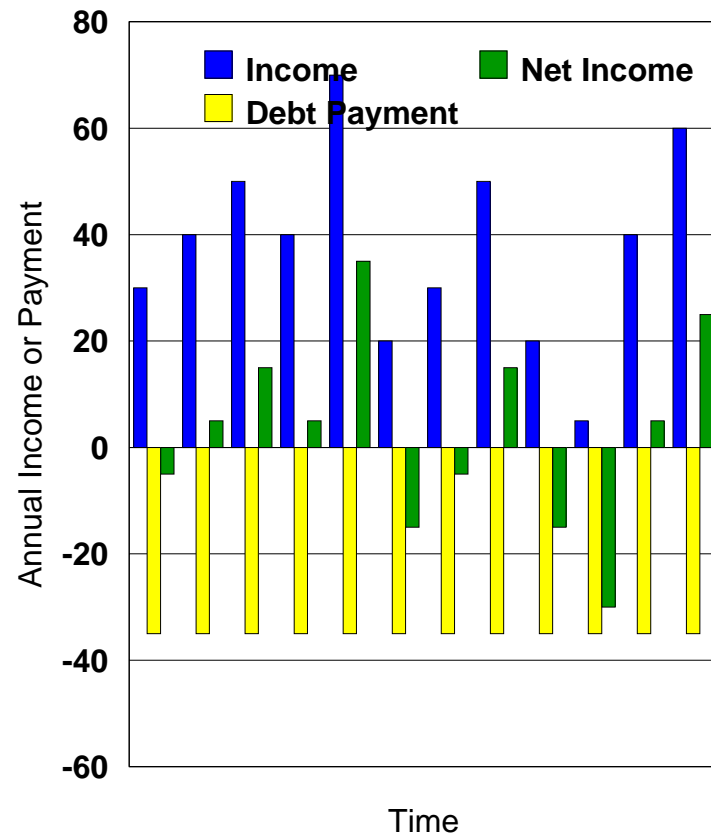
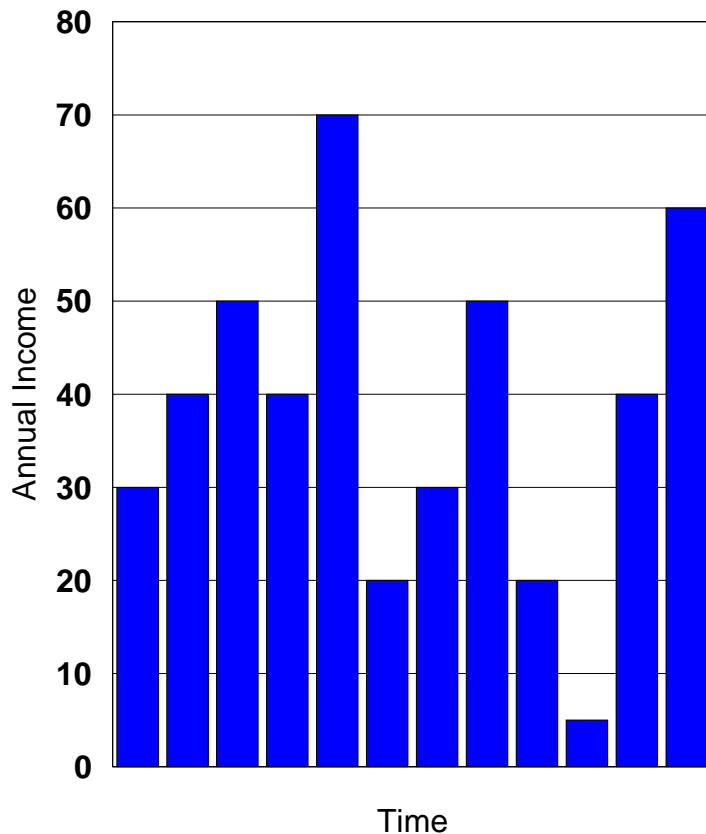
- "Leveraging" is borrowing money to increase the expected ROI for the project
- If base ROI is greater than the interest rate, then leveraging increases the return:

$$\text{ROI} = \text{Net income} / \text{Net Investment}$$

$$= (\text{Income} - i * \text{Debt}) / (\text{Invest} - \text{Debt})$$

$$= (\text{ROI} * \text{Invest} - i * \text{Debt}) / (\text{Invest} - \text{Debt})$$

Debt Financing Increases Risks of a Projects, Because Principal & Interest Must be Paid When Due



Limits on Leveraging

- Banks may limit debt to a percentage of the total project costs (typically 80% for a real estate project)
- Banks may increase interest rates for highly leveraged companies
- Investors may shun stock of highly leverage companies
- Owners may limit debt in highly volatile industries to limit risk of bankruptcy

Cost of Capital for Debt Financing

- Interest rates will be determined by the capital markets and the credit of the company (NOT the quality of the project)
- Rates will be higher if:
 - ▶ Interest rates in general move higher (as happens in times of inflation)
 - ▶ If company is perceived as a credit risk
 - ▶ If company relies too much on debt financing
 - Risk bankruptcy by having high levels of interest payments
 - ▶ If company is in a risky industry
 - ▶ If company operates within a risky political environment

Cost of Capital for Equity Financing

- To sell stock, you must persuade investors that the value of the company will grow fast enough to provide investors with a suitable return
- In principal, investors can value the company at some future time, select an appropriate discount rate, and determine the maximum price that they would be willing to pay today
- In practice, investors often look at the ratio of price to current earnings in comparison to P/E ratios for other companies with similar anticipated growth rates (Note: if earnings are stable, the P/E is the inverse of the return on investment)

Public Sector Financing

- The public can raise money by issuing bonds guaranteed by the government and backed up by the power of the government to raise taxes if necessary to meet its obligations
- The government may make income on some government bonds tax-free
- BUT - the government also is raising money from individuals and the private sector by taxation - the opportunity cost is what they could do with the money
- SO - there is pressure on government not to use discount rates that are too low (or too high)

Choosing a Discount Rate

- The discount rate (i.e. the interest rate that you use in finding equivalent values) should be
 - ▶ greater than or equal to your average cost of capital (not necessarily your cost of capital for a particular project)
 - ▶ at least as high as your other investment opportunities (adjusted for risk)
- The discount rate therefore will equal equal your "minimum acceptable rate of return"

Choosing A Discount Rate

- The discount rate reflects the opportunity cost for the person or organization that will receive the cash flows (e.g. the federal government specifies a rate to be used)
- The analysis can be done with real or nominal discount rates
 - ▶ Real rates are used in constant-dollar analyses
 - ▶ Nominal rates reflect expected inflation (market interest rates are therefore "nominal" interest rates)
- The discount rate is not the same as the interest rate obtained to finance the project
- Higher risks will require a higher discount rate
 - ▶ Project risks (e.g. can we build this on budget and on schedule?)
 - ▶ Market risks (e.g. will the market for real estate remain strong?)
 - ▶ Economy risks (e.g. will there be a recession?)
 - ▶ Country risks (e.g. will the government remain stable and supportive of new infrastructure projects?)