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

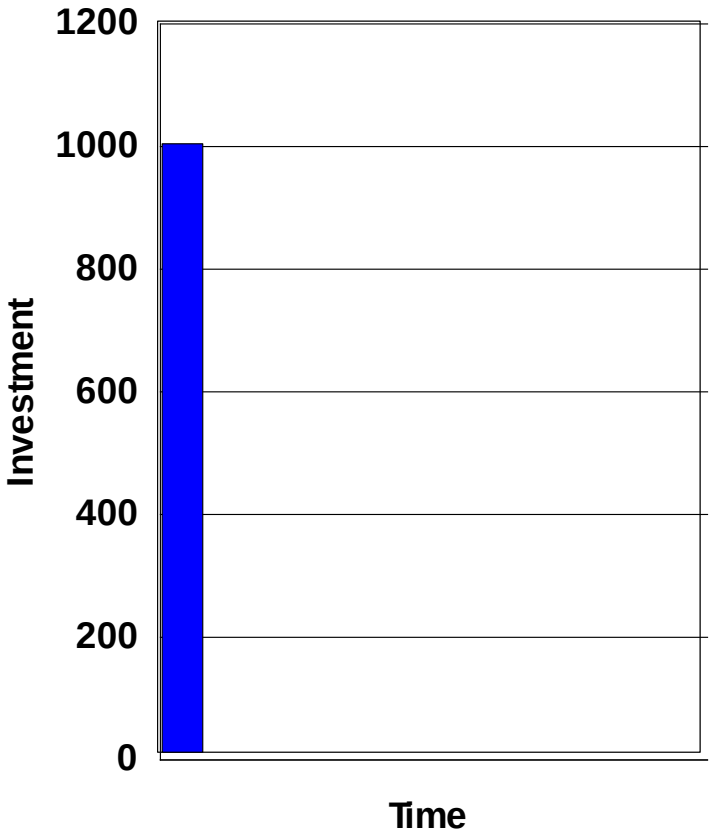
- For any arbitrary sequence of cash flows and for any interest rate i, we can find an equivalent cash flow that is much easier to work with when evaluating projects:
  - Present worth
  - Future worth, at any time t
  - An annuity for N periods begining at time 0
  - An annuity for N periods beginning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

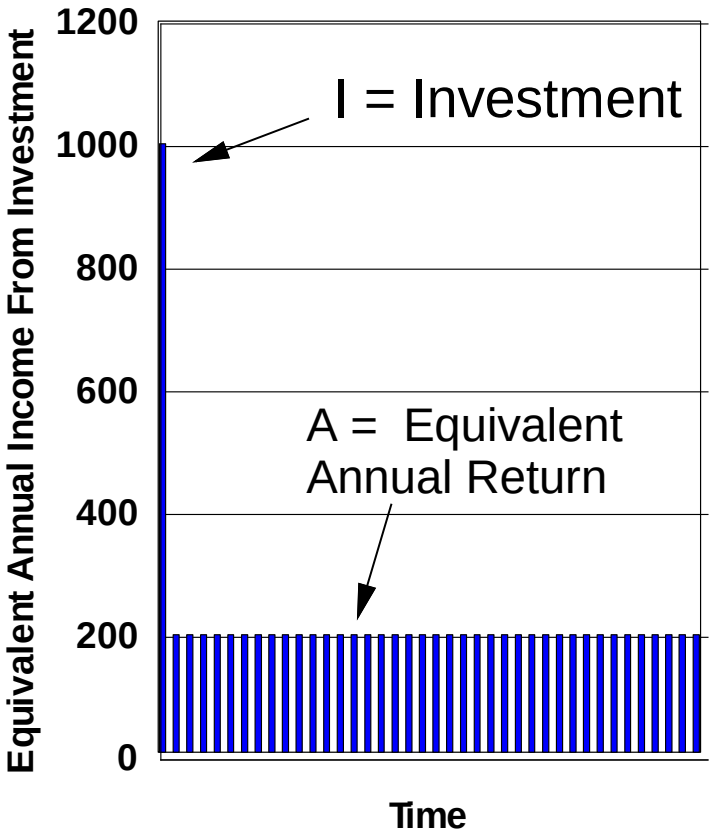
Opportunity Cost of Capital

- 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)

Minimum Acceptable Rate of Return (MARR)

- Your MARR is the lowest return that you would be willing to accept given:
  - The risks that you believe to be associated with this project
  - Your other opportunities for investment
  - Your ability to raise money

Sources of Capital

- Use internally generated funds
- Equity:
  - Issue stock
  - Raise money without committing to interest payments, but also give up a portion of ownership of the company to new stockholders
- Debt:
  - Borrow money from a bank or issue bonds
  - Commit to payments of principal and/or interest, but retain full ownership of the company

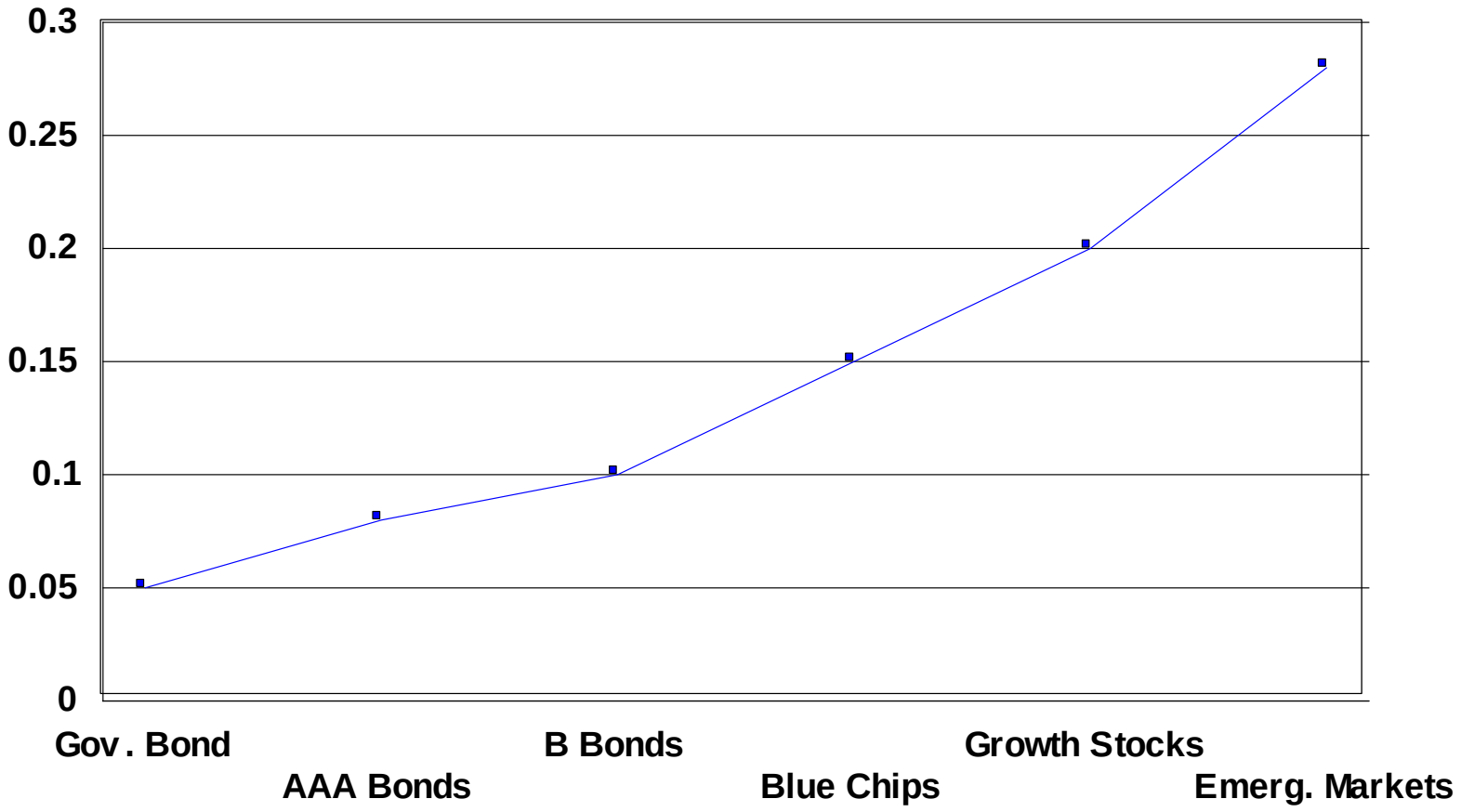
Equity Financing

- A company presents information to stockholders
  - Historical financial and operating results
  - Business plan and expectations for the future
  - Discussion of risks and opportunities
- Individuals buy if and only if current price of the stock is less than or equal to the investor's perception of the value of the stock
  - Expected cash flows (or expected future stock price)
  - Risk as perceived by the individual investor
  - Discount rate explicitly or implicitly used by investor
- Stock price is determined by the market
  - In effect, the market discounts the company's projected cash flows

Debt Financing

- A company presents information to a bank or to an investment banker
  - Historical financial and operating results
  - Business plan and expectations for the future
  - Discussion of risks and opportunities
- The amount of money that can be raised depends upon the banker's or bond purchasers' perceptions of
  - The ability of the company to pay the interest over the life of the loan or the bond and
  - The interest that can be obtained from loans or bonds with what they believe to be similar risks
- Interest rates are also determined by the market
  - Higher interest rates are necessary to attract investors to what are viewed as riskier investments

What is an Appropriate Discount Rate?
Risk vs. Expected Return



Risk vs. Value

- If you reduce the perceived risks of a project, then both you and potential investors will discount future cash flows less heavily – and the value of the project will rise.
- Some risks decline as a project progresses, so the value can increase over time.
- The entrepreneurs will likely have much different perceptions of risk than the investors.

Leveraging

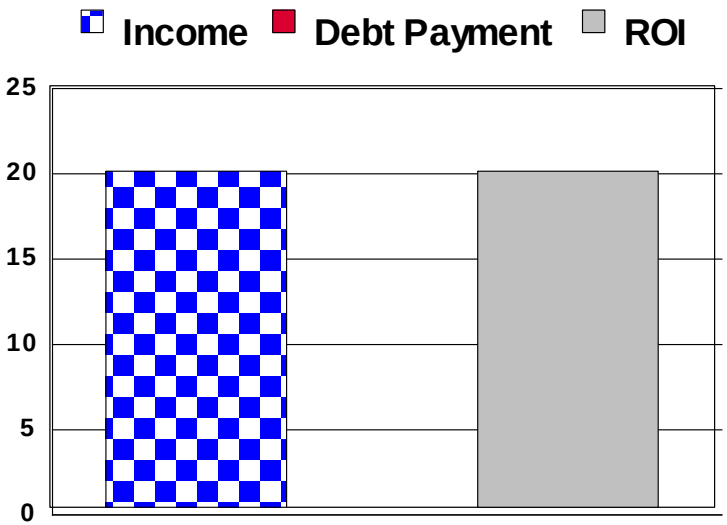
- "Leveraging" is borrowing money to increase the expected ROI for the project
- If base ROI is greater than the interest rate, then leveraging increases the return:

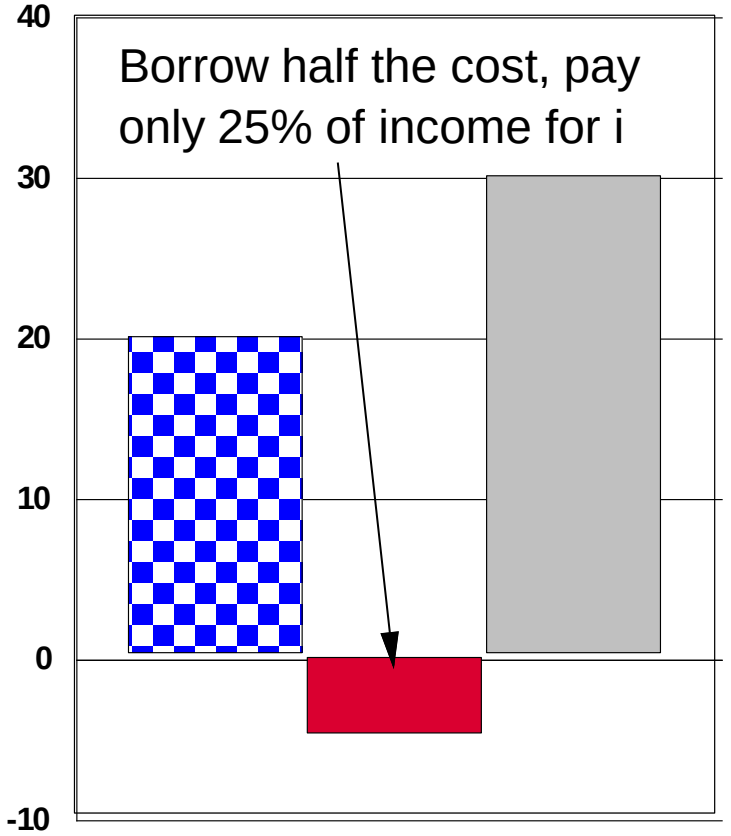
ROI = Net income/Net Investment

= (Income - i*Debt)/(Invest - Debt)

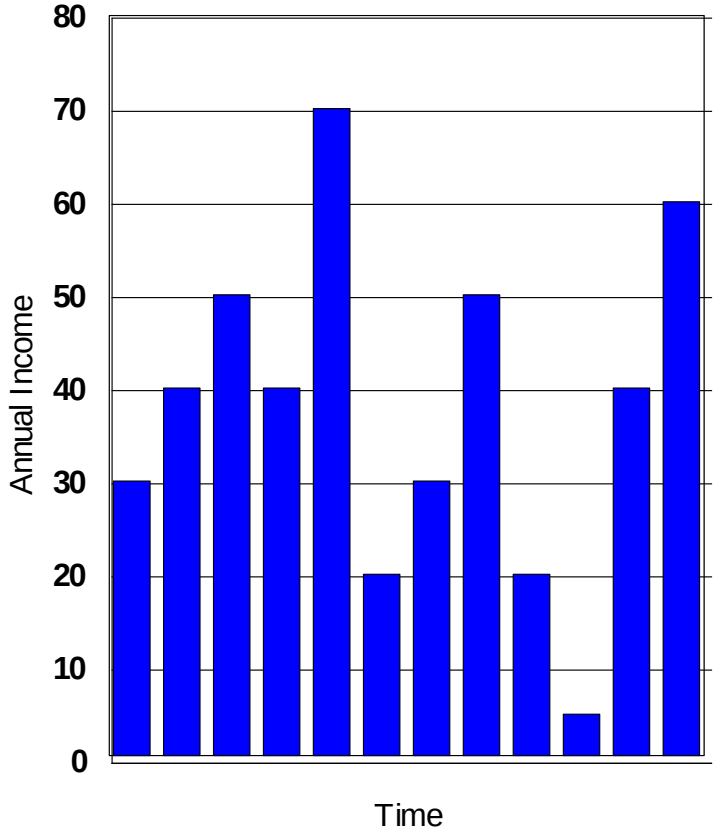
= (ROI*Invest - i*Debt)/(Invest - Debt)

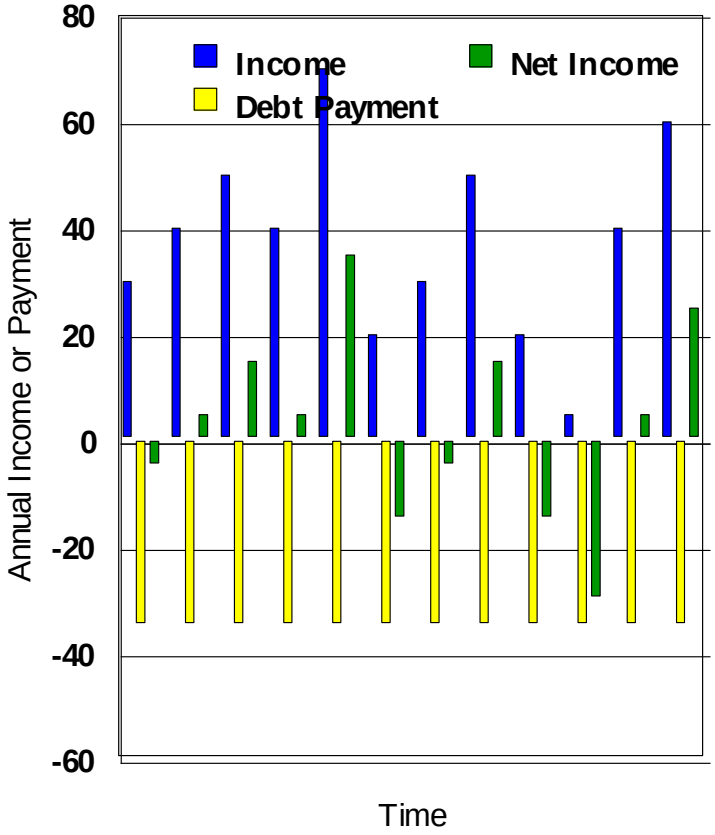
Debt Financing Increases the Expected Return of the Project if the Interest Rate is lower than the ROI





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 polical environment

Market Rates

- Discount rates reflect three factors:
  - The interest that can be earned on the safest investments if there is no inflation
  - A risk premium
  - The inflation rate

- Discount rate ~ i + r + inflation

Example

- U.S. Treasury Bonds: 5%
- Acme Construction's risk premium: 2%
- Inflation: currently 2%, but rising to 3%
- What interest rate should Acme expect to pay if it decides to sell bonds next year?

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)

Weighted Average Cost of Capital

WACC = % Debt * i + % Equity * r

Where:

i = Average interest rate for debt

r = Average return for stock (usually the inverse of the ratio of price to earnings)

Example:

WACC = 50%(0.8) + 50% (0.14) = 0.11

What is *Your* MARR?

- Your MARR must be
  - Greater than or equal to your weighted average cost of capital (not your cost of capital for this project)
    - Otherwise, you're better off paying off your debt or buying back your stock
  - Greater than or equal to your options for investing
    - Your other projects, adjusted for risk
    - Investment in the market
- Your MARR is therefore influenced by the market, but not determined by the market

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)

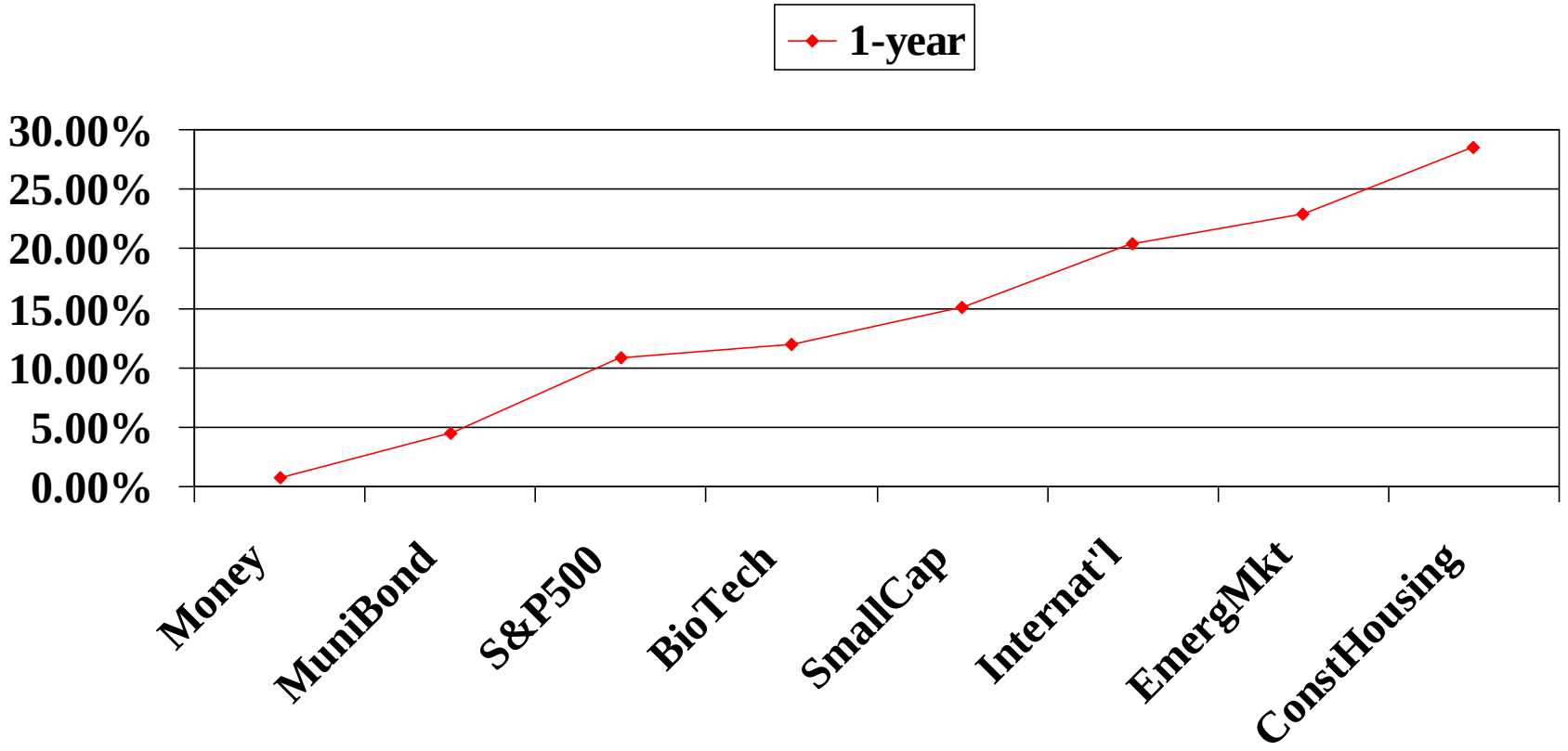
MARR for Special Government Agencies

- Agencies raise money by selling bonds, not by charging taxes
- Examples: public housing or airports
- Agencies provide broad economic benefits for region
- MARR: must exceed their cost of capital, i.e. interest rate on bonds

Choosing A Discount Rate

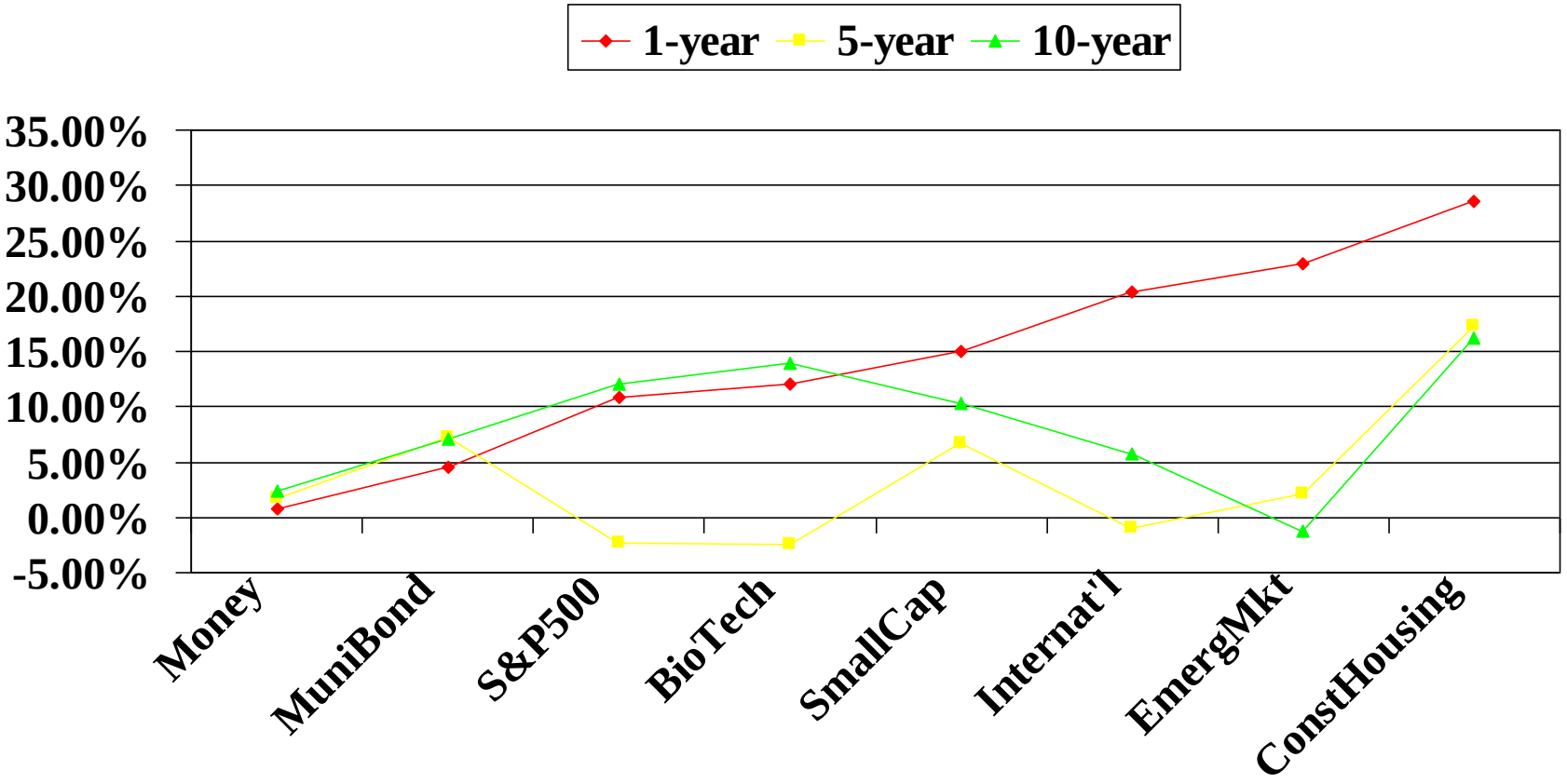
- The discount rate reflects the opportunity cost for the person or organization that will receive the cash flows (e.g. the federal government specifies a rate to be used)
- The analysis can be done with real or nominal discount rates
  - Real rates are used in constant-dollar analyses
  - Nominal rates 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?)

Example: Equity Returns, Selected Securities 2004



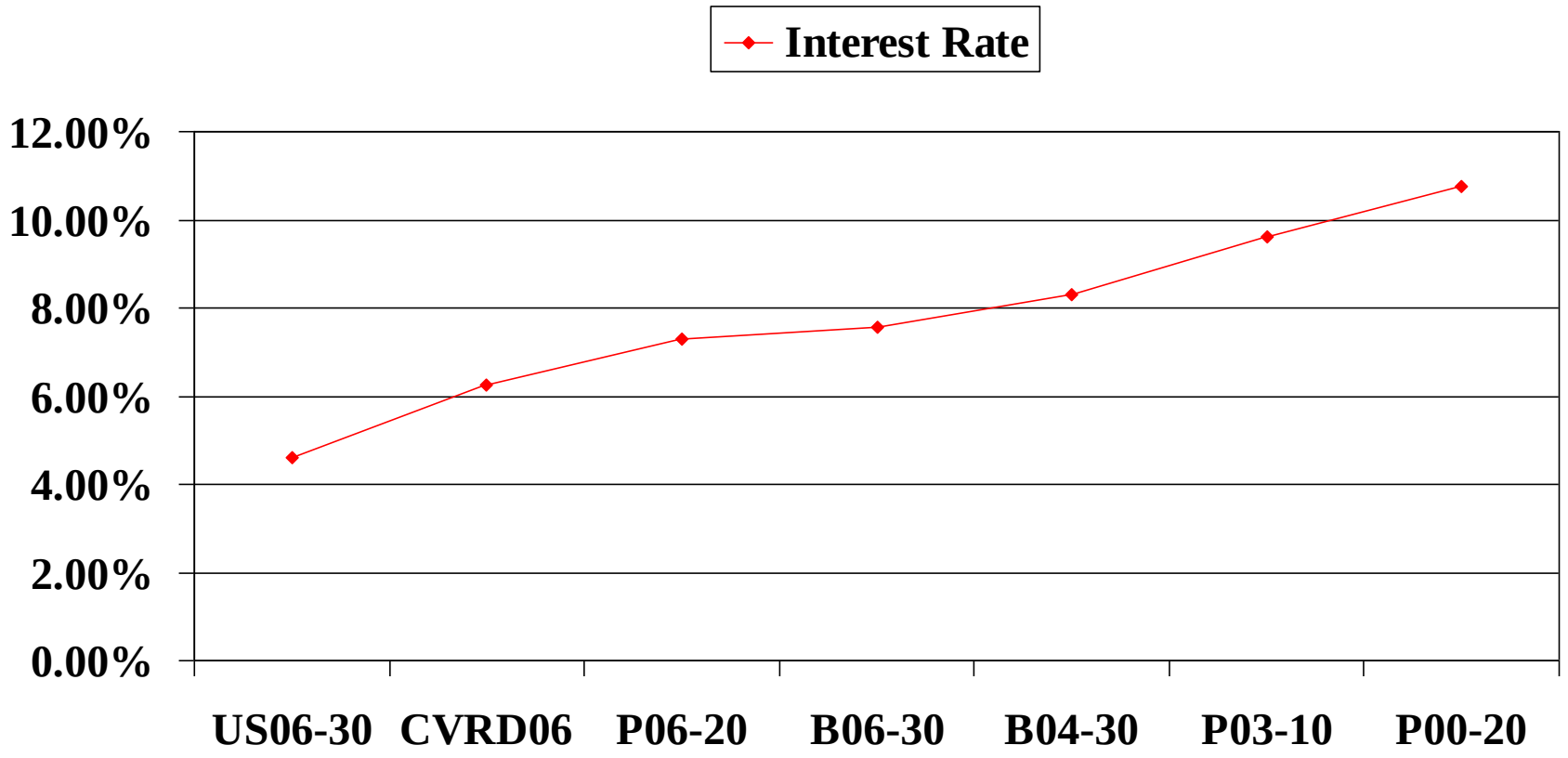
Returns in 2004 for selected indices or fidelity funds. "Fidelity Mutual Fund Performance", Fidelity, February 2005, pp. 20-27

Example: Equity Returns, Selected Securities 1995-2004



US 30-yr Treasuries; 10-yr bonds for CVRD, a large mining company in Brazil; Brazil 30-yr bonds; Panama 10- and 20-yr bonds. Source: "deals", LatinFinance, February 2006, p. 4

Example: Recent Interest Rates in the US and Latin America



US 30-yr Treasuries; 10-yr bonds for CVRD, a large mining company in Brazil; Brazil 30-yr bonds; Panama 10- and 20-yr bonds. Source: "deals", LatinFinance, February 2006, p. 4

Example: Proposed Financing for the Construction of an Office Building

- Bank One provides a loan at 10% interest to cover most of the construction costs
  - Bank One pays costs as they are incurred
  - Interest is added to the balance each month
  - The loan is paid off when the building is completed and long-term financing is obtained from Bank Two
- Bank Two provides long-term financing at 8% interest
  - Bank Two holds a mortgage on the property
  - Anticipated rents are deemed sufficient to cover the mortgage payments
- The Owner is highly leveraged and expects an IRR of 20%
  - Bank One covers most of the costs of the project
  - Rents are expected to cover mortgage payments to Bank Two

Discount Rates for Evaluating the Proposal to Construct an Office Building

- Bank One:
  - Interest rates reflect risks the construction might cost more or take longer than expected, as well as the risk that the owner might not be able to refinance the loan
  - Interest rates will be high
- Bank Two
  - Once the building is completed and tenants have signed leases, the risks associated with the project are greatly reduced
  - Interest rates will be lower than required by Bank Two
- Owner
  - The owner's cash flows depend upon project costs, timing, rents, and interest rates charged by the banks
  - The MARR depends upon the owner's other options for investment and past experience with similar projects

Discount Rates for Evaluating the Proposal to Construct an Office Building

- Each player's discount rate depends upon their perception of the risks that are related to their portion of the cash flows.
- Owners can increase their expected return through leveraging – but that increases their risks if there are problems in construction or in renting the building.
- The banks can limit their risks by limiting the amount they loan or increasing the interest rates that they charge.

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