Alternative Investment Criteria

In the news:

Musk: One of the most impressive and controversial entrepreneurs of our time

SPACEX

TESLA

PayPal™

SolarCity®

Mini Case Study: Do residential solar panels make economic sense?

- Average installation cost in Georgia, including state, regional, and local subsidies:
  - $15,489
- Average savings per year in Georgia in 2014
  - $1,068 (How is this a cash flow?)
- Current annual long-term borrowing rate:
  - Find the 30-year fixed mortgage rate (e.g., on wsj.com)
  - Assume that you will be able to use your solar panels for 30 years
- From a purely financial perspective, does it make sense to install solar panels?

Data from Clean Power Research, WSJ

Objectives

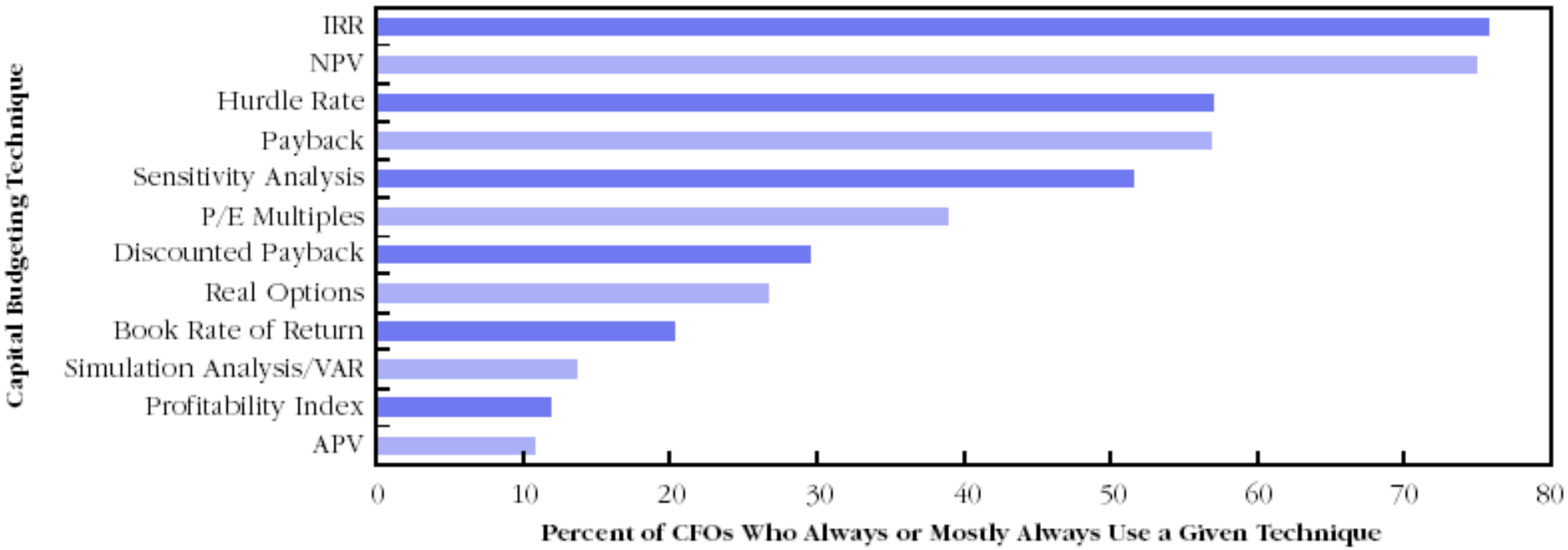
- Calculate the following values for a project
  - Net Present Value
  - Internal Rate of Return
  - Profitability index
  - Payback period
- Describe the benefits and drawbacks of each approach
- Recommended exercises:
  - 10th edition: Chapter 5, problems 1-2, 5-6, 10, 11a, 16abc
  - 11th edition: Chapter 5, problems 1-2, 5-6, 10, 11a, 16abc
  - 12th edition: Chapter 5, problems 1-2, 5-6, 10, 11a, 16abc

Capital budgeting

- Corporate financial decision making involves the following decisions
  - How to allocate capital budgets?
  - How to deem a project to be worthwhile?
  - What capital investments to undertake from multiple alternatives?
- Focus of this chapter: What are the different criteria to “judge projects”
  - Net Present Value
  - Payback period
  - Profitability Index
  - IRR
- Each of these approaches compares the cost of a project to the potential gains in some fashion

What's used in practice?

FIGURE 1 ■ SURVEY EVIDENCE ON THE POPULARITY OF DIFFERENT CAPITAL BUDGETING METHODS*



*We report the percentage of CFOs who always or almost always use a particular technique. IRR represents Internal Rate of Return, NPV is Net Present Value, P/E is the Price to Earnings ratio,VAR is Value At Risk, and APV is Adjusted Present Value. The survey is based on the responses of 392 CFOs, as are the rest of the figures in this paper.

What makes a good decision criterion?

- Good investment criteria should meet these requirements:
  - Don’t arbitrarily exclude any costs or benefits from the analysis.
  - Account for time value of money and for the risk involved.
  - If forced to choose among proposals, select the one that does shareholders the most good.

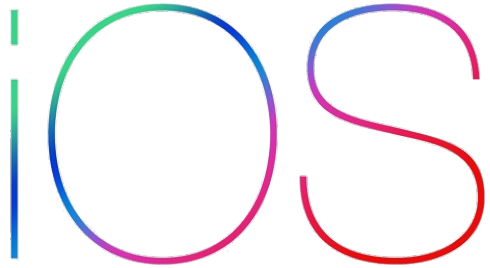
Project types

We generally encounter two types of projects in Finance:

- **Mutually exclusive projects**
  - There are several potential projects
  - Only one project has to be chosen
    - Either don't need more than one
    - Not enough money
  - Decision approach: Rank all alternatives, select the best one
- **Independent projects**
  - Projects are not competing with each other
  - Free to choose multiple projects
  - Accepting or rejecting one project doesn't affect the other projects
  - Project is accepted if it exceeds some minimum acceptance criteria

Example for mutually exclusive projects

- You have a great idea for a new smartphone app!
- Which operating system should you choose?
- Assume you only have time to learn one OS



Example for independent projects

- Consider the Netflix show The Chair
- Assume the financing of other Netflix shows is independent of financing of The Chair
- Should Netflix invest in the development of a new season?

Net Present Value

- The difference between market value of a project and its cost

NPV = Total PV of future cash flows – Initial investment

- How much value is created from undertaking an investment?
  - Estimate the expected future cash flows.
  - Estimate the discount rate for projects of this risk level.
  - Estimate initial costs

NPV – Decision Rule

- Independent projects
  - If the NPV is positive, accept the project: Accept if NPV > 0
- If mutually exclusive projects:
  - Shortlist projects with NPV > 0
  - Choose highest NPV project
- A positive NPV means:
  - Project is expected to add value to the firm
  - Increases shareholder value
- NPV is direct measure of how well project will meet our goal

Example

- Fuji software has the following projects (r = 15%)

Year	0	1	2	3
Project A	-7500	4000	3500	1500
Project B	-5000	2500	1200	3000

- Which project should be selected?

Evaluation of NPV

- Uses all cash flows
- Accounts for time value of money
  - Discounts all cash flow properly
- No major disadvantages
  - Best decision-making approach
- It can be time consuming to estimate, however

Payback Period

- Advantages
  - Easy to understand
- Disadvantages
  - Ignores the time value of money
  - Ignores cash flows beyond the cutoff date
  - Biased against long-term projects, such as research and development, and new projects
  - Could recommend a project with negative NPV

Profitability Index: Total PV of future CFs / Initial Investment

- **Advantages**
- Easy to understand and to communicate
- Gives same advice as NPV when evaluating **independent projects**
- Same advice as NPV method if investment projects have the same size (i.e., same initial cost), even for **mutually exclusive projects**
- May be useful when investment funds are limited

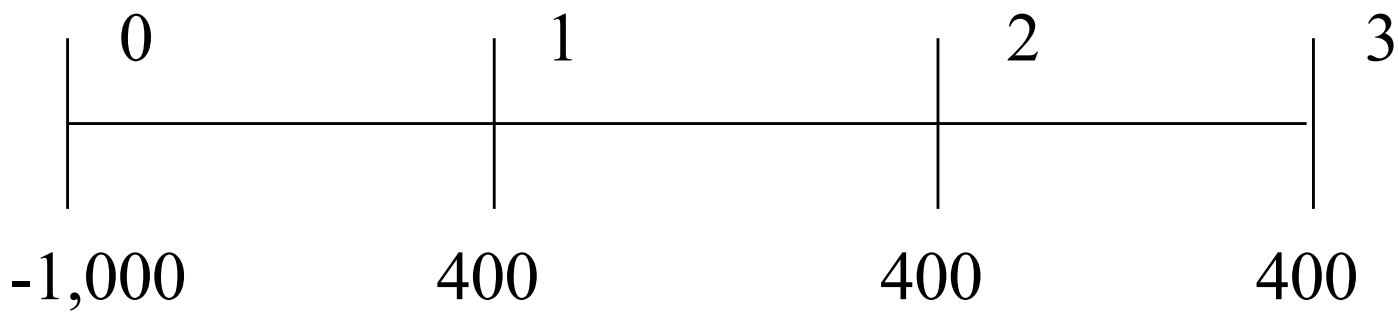
- **Disadvantages**
- Can give bad recommendations for mutually exclusive projects with different sizes

The Internal Rate of Return (IRR) Method

- **The IRR is defined as the discount rate that causes the project's computed NPV to equal zero.**
- IRR is a useful complement to NPV.
- Note that the IRR computation starts with the same set of cash flow projections as the NPV analysis.
- The only way to compute an IRR is by *trial and error.*

Internal Rate of Return (IRR) Example

- Consider the following stream of cash flows:

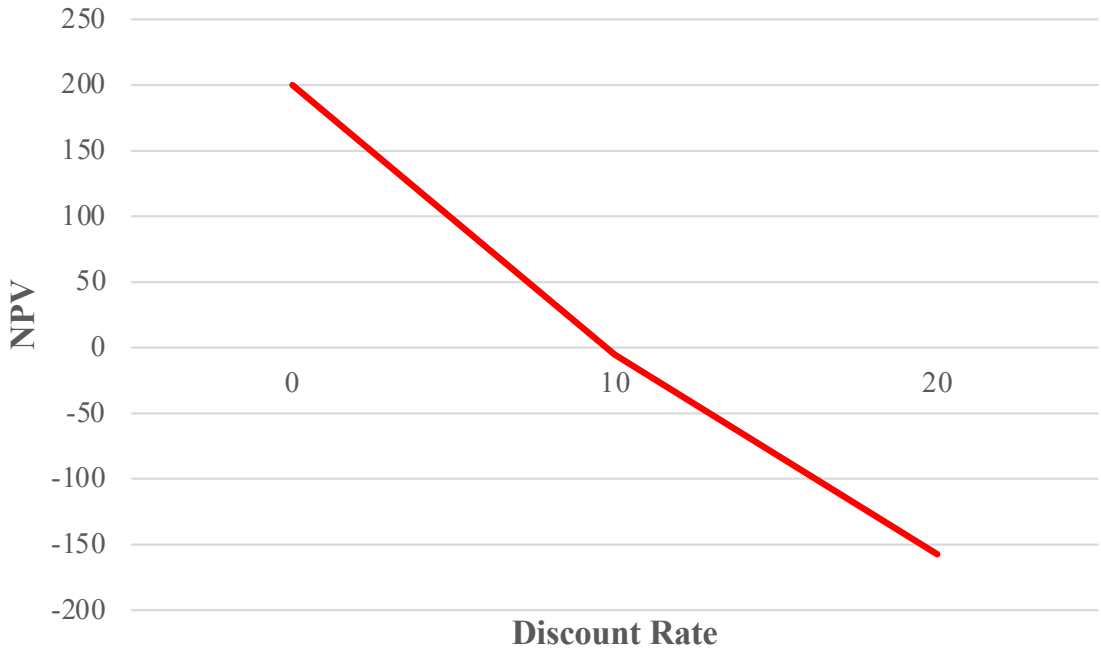


We calculate the NPV at different discount rates until we find the discount rate where NPV equals zero.

Internal Rate of Return (IRR) Example

- Evaluate the NPV at various discount rates:

Rate	NPV
0	$200
10	-$5.3
20	-$157.4



- At r=9.7%, NPV=0

IRR Interpretation

- The IRR can be interpreted as the answer to the following questions:
  - *If the capital were placed in a bank account instead of the proposed project, what interest rate would that account have to pay, in order to generate the same final wealth as this project?*
  - *Or, what rate of return can our shareholders expect to earn on the capital invested in this project?*
- Decision rule:
  - Accept the project if IRR is greater than the discount rate
  - Reject the project if IRR is less than the discount rate

Example

- Vital Silence, Inc., has a project with the following cash flows:

Year	Cash Flow
0	-$24,000
1	$9,700
2	$13,700
3	$6,400

- The company evaluates all projects by applying the IRR rule. If the appropriate interest rate is 9 percent, should the company accept the project?

The IRR approach has merit

- Its greatest advantage is the intuitive appeal of being able to answer the question, “what return do we expect to earn on the capital invested”?
- The IRR does not ignore any cash flows, and (by comparison to the discount rate, r) allows for time value of money and risk.
- In short, the IRR approach is very useful!

Summary: Evaluation of IRR method

- Appealing interpretation as return on investment
- Works well with independent projects
- Sometimes problem with multiple IRRs
- Doesn’t always work well with mutually exclusive projects

Summary of Evaluation Methods

- Payback period and profitability index are flawed
  - Can however provide some useful information
  - Might be considered as supplement to other approaches
- IRR analysis is similar in spirit to NPV and quite intuitive
  - But IRR analysis can be misleading if you don’t fully understand its limitations
- Net Present Value (NPV) leads to correct decisions if correctly implemented, is our recommended approach

Musk: One of the most impressive and controversial entrepreneurs of our time

SPACEX

TESLA

PayPal™

SolarCity®

Mini Case Study: Do residential solar panels make economic sense?

- Average installation cost in Georgia, including state, regional, and local subsidies:
  - $15,489
- Average savings per year in Georgia in 2014
  - $1,068 (How is this a cash flow?)
- Current annual long-term borrowing rate:
  - Find the 30-year fixed mortgage rate (e.g., on wsj.com)
  - Assume you are able to use solar panels for 30 years
- From a purely financial perspective, does it make sense to install solar panels?

Data from Clean Power Research, WSJ

Mini Case Study: Do residential solar panels make economic sense?

- NPV =
- IRR =
- Payback period (in years) =
- Profitability index =