Capital Budgeting

For 9.220, Term 1, 2002/03
02_Lecture8.ppt

Outline

☐ Introduction
☐ Discounted Cash Flow (DCF) Techniques
  ■ Net Present Value (NPV)
  ■ Internal Rate of Return (IRR)
  ■ Profitability Index (PI)
☐ Summary and Conclusions
Recall the Flows of funds and decisions important to the financial manager

Introduction
- Capital Budgeting is the process of determining which real investment projects should be accepted and given an allocation of funds from the firm.
- To evaluate capital budgeting processes, their consistency with the goal of shareholder wealth maximization is of utmost importance.
**Discounted Cash Flow (DCF) Techniques**

- The main DCF techniques for capital budgeting include: Net Present Value (NPV), Internal Rate of Return (IRR), and Profitability Index (PI)
  - Each requires estimates of expected cash flows (and their timing) for the project.
  - Including cash outflows (costs) and inflows (revenues or savings) – normally tax effects are also considered.
  - Each requires an estimate of the project’s risk so that an appropriate discount rate (opportunity cost of capital) can be determined.
  - The discussion of risk will be deferred until later. For now, we will assume we know the relevant opportunity cost of capital or discount rate.
- Sometimes the above data is difficult to obtain – this is the main weakness of all DCF techniques.

**Net Present Value (NPV)**

- Method: \( NPV = PV_{\text{inflows}} - PV_{\text{outflows}} \)
- If \( NPV \geq 0 \), then accept the project; otherwise reject the project.
Example Project

- Initial investment required: $100,000
- Opportunity cost of capital: 15%
- The NPV is ...

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Revenues less Expenses after tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$20,000</td>
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<tr>
<td>2-9</td>
<td>$40,000</td>
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<td>10</td>
<td>$10,000</td>
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</tbody>
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NPV using the Calculator

- Use CF\_j key to enter the cash flows.
- Use N\_j key to enter the number of times a cash flow repeats.
- Enter the opportunity cost of capital in the I/YR key.
- Use the NPV function to compute NPV
- Note: before starting the evaluation of a new project, clear previous data and ensure the calculator is set to 1 P/Yr.
NPV: Strengths and Weaknesses

- **Strengths**
  - Resulting number is easy to interpret: shows how wealth will change if the project is accepted.
  - Acceptance criteria is consistent with shareholder wealth maximization.
  - Relatively straightforward to calculate

- **Weaknesses**
  - Requires knowledge of finance to use.
  - An improper NPV analysis may lead to the wrong choices of projects when the firm has capital rationing – this will be discussed later.

Internal Rate of Return (IRR)

- IRR is the rate of return that a project generates. Algebraically, IRR can be determined by setting up an NPV equation and solving for a discount rate that makes the NPV = 0.
- Equivalently, IRR is solved by determining the rate that equates the PV of cash inflows to the PV of cash outflows.
- Method: Use your financial calculator or a spreadsheet; IRR usually cannot be solved manually.
- If IRR ≥ opportunity cost of capital (or hurdle rate), then accept the project; otherwise reject it.
Example Project

- Initial investment required: $100,000
- Opportunity cost of capital: 15%
- The IRR is ...

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IRR using the Calculator

- Use CFj key to enter the cash flows.
- Use N, key to enter the number of times a cash flow repeats.
- Use the IRR function to compute IRR.
- Note 1: before starting the evaluation of a new project, clear previous data and ensure the calculator is set to 1 P/Yr; however, if you have already entered the cash flows for an NPV analysis, you do not need to reenter them – they are in your calculator already and can be used for the IRR calculation.
- Note 2: You do not need to input the opportunity cost of capital to calculate the IRR, however, you need the opportunity cost to make your accept/reject decision.
IRR: Strengths and Weaknesses

**Strengths**
- IRR number is easy to interpret: shows the return the project generates.
- Acceptance criteria is generally consistent with shareholder wealth maximization.

**Weaknesses**
- Requires knowledge of finance to use.
- Difficult to calculate – need financial calculator.
- It is possible that there exists no IRR or multiple IRRs for a project and there are several special cases when the IRR analysis needs to be adjusted in order to make a correct decision (these problems will be addressed later).
Profitability Index (PI)

- Method: \[ PI = \frac{PV_{\text{Cash flows after the initial investment}}}{\text{Initial Investment}} \]
  - Note: PI should always be expressed as a positive number.
  - If PI ≥ 1, then accept the real investment project; otherwise, reject it.

Example Project

- Initial investment required: $100,000
- Opportunity cost of capital: 15%
- The PI is ...

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PI using the Calculator

- If you also need to calculate NPV and IRR, then follow the steps below:
  - Use CF<sub>j</sub> key to enter ALL of the cash flows.
  - Use N<sub>j</sub> key to enter the number of times a cash flow repeats.
  - Enter the opportunity cost of capital in the I/YR key.
  - Use the NPV function to compute NPV.
  - Take the NPV result, add back the initial investment and then divide the new result by the initial investment to get the PI.
  - Note: before starting the evaluation of a new project, clear previous data and ensure the calculator is set to 1 P/Yr; however, if you have already entered the cash flows for an NPV analysis, you do not need to reenter them – they are in your calculator already and can be used for the IRR calculation.

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PI using the Calculator

- If you just need to calculate PI, then follow the steps below:
  - Enter 0 for CF<sub>0</sub>.
  - Use CF<sub>j</sub> key to enter the cash flows that follow the initial investment.
  - Use N<sub>j</sub> key to enter the number of times a cash flow repeats.
  - Enter the opportunity cost of capital in the I/YR key.
  - Use the NPV function to compute NPV – gives the PV of the cash flows after the initial investment.
  - Take the NPV result and divide by the initial investment to get the PI.
PI: Strengths and Weaknesses

Strengths

- PI number is easy to interpret: shows how many $ (in PV terms) you get back per $ invested.
- Acceptance criteria is generally consistent with shareholder wealth maximization.
- Relatively straightforward to calculate.
- Useful when there is capital rationing (to be discussed later).

Weaknesses

- Requires knowledge of finance to use.
- It is possible that PI cannot be used if the initial cash flow is an inflow.
- Method needs to be adjusted when there are mutually exclusive projects (to be discussed later).

Summary and Conclusion

- The DCF techniques, NPV, IRR, and PI, are all good techniques for capital budgeting and allow us to accept or reject investment projects consistent with the goal of shareholder wealth maximization.

- Beware, however, there are times when one technique’s output is better for some decisions or when a technique has to be modified given certain circumstances – these cases will be discussed in the next lecture.
Midterm Exam 1 – Coverage and Grading

- Covers: All material from lectures including self-study parts plus chapters 1, 3, 4, 5 (not 5.5-5.8), 5 Appendix, and the following sections of Chapter 6: 6.1, 6.5, 6.7, 6.8. The rest of Chapter 6 will be covered after the midterm.
- Format: 40-60% multiple choice (15-25 questions); remainder is problems (4-8 questions).
- No credit will be given for indicating which calculator buttons you pushed.
- Full credit will be given for correct answers. Incorrect answers with no work will receive no credit. Work to be shown for partial credit should be the numbers in the equations.
- Do not round intermediate results; store them in your calculator. Final $ answers may be rounded to the cent (i.e., 2 decimal places; e.g., $1,253.56); other answers such as %, years, etc., may be rounded to 6 decimal places (e.g., 34.123456%).

Midterm Exam 1 – Advice

- If in doubt of a question’s wording, ask for clarification!
- Some questions will be similar to lecture examples, assignments, and text questions, BUT, beware some questions will be quite different from those you have seen previously – to test whether you really understand the concepts and can apply them to new situations.
- Time management is important; don’t waste time on questions – do easier ones first if think you are going too slowly.
- Don’t forget your formula sheet – double sided 8.5 by 11 inches; no word-processed or photocopied info is allowed; any hand-written content can be included.
9.220 Midterm Exam 1 – Locations

☐ If you are registered in Stangeland’s class, L01 Tu/Th 10 a.m., you will write in Room 105.

☐ If you are registered in Zheng’s class, L02, Tu/Th 1 p.m., you will write in Room 107.

☐ If you are registered in Eisenberg’s class, L03, Tu/Th 2:30 p.m., you will write in Room 122.

☐ Remember, the exam is **Monday**, Oct. 7, from **7 p.m. to 9 p.m.**