Capital Budgeting continued:
Overview: (1) Estimating cash flows
          (2) CB examples
          (3) Dealing with uncertainty of cash flows

Chapter 7:  1,5,7,8,27,32
Chapter 8:  1,3,5,8,13
(clarification for problem 13b: assume an equal probability that cash flows are
revised up to $1.5 million or down to zero)

(1) Estimating cash flows

Cash flow ingredients:
  • Initial investment
  • Operating cash flows
  • Salvage value

Principles of cash flow estimation:

a) Cash flows should be after taxes

marginal vs. average tax rates

Dealing with losses: Can the firm take tax savings in year of loss?
(depends on profit/loss in both the level of the project and the firm)

Depreciation methods
(b) *Cash flows should be incremental*

Sunk costs

Working capital

Opportunity costs

Product cannibalization

c) *Cash flows should be estimated consistently*

Use nominal cash flows and nominal discount rate, or, real cash flows and real discount rate

\[
1 + \text{nominal interest rate} = (1 + \text{Real discount rate}) \times (1 + \text{expected inflation rate})
\]
(2) Capital Budgeting Examples:

A company is considering the purchase of a new machine, costing $250,000. As a result of this project, the company’s inventory will increase $50,000 and accounts payable will rise $27,000. The company has already spent $30,000 on research costs. This machine will increase revenues $400,000 per year. It will cost the company $200,000 per year to operate the new machine (excluding depreciation).

The project will terminate at the end of four years. At this time, the net working capital will be recovered and the machine will be sold for $50,000. For tax purposes, the machine will be depreciated (to zero) straight line over four years. Given a tax rate of 40% and a cost of capital of 15%,

a) find the NPV of this project
b) find the payback period of this project
Examples: Calculating Equivalent Annual Cost.

Two types of batteries are being considered for use in electric golf carts at BraeBurn Country Club. Burnout brand batteries cost $36, have a useful life of 3 years, will cost $100 per year to keep charged, and have a scrap value of $5. Longlasting brand batteries cost $60 each, have a life of 5 years, will cost $88 per year to keep charged, and have a scrap value of $5.

For Burnout, calculate OCF:

Sales
- costs
- depreci
EBIT
- tax
+ depreci
OCF

Calculate total FCFF:

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For Longlasting, OCF = -$54

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Using a 15% required return, calculate a cost per year for the two batteries.

Calculate PV of cash flows.

PV of total cash flows for Burnout = $175.40,
PV of total cash flows for Longlasting = $239.40.

What 3 year annuity has the same PV as Burnout?

The annuity factor for 3 years at 15% is 2.283.
$175.40 = EAC x 2.283
EAC = $175.40/2.283 = $76.83

What 5 year annuity has the same PV as Longlasting?

The annuity factor for 5 years at 15% is 3.352.
$239.40 = EAC x 3.352
EAC = $239.40/3.352 = $71.42
Examples: Incremental cash flows.

You run a mail-order firm, selling upscale clothing. You are considering replacing your manual ordering system with a computerized system, to make your operations more efficient and to increase sales.

The computerized system will cost $10 million to install and $500,000 to operate each year. It will replace a manual order system that costs $1,500,000 to operate each year.

The system is expected to last ten years, and have no salvage value at the end of the period. The system is expected to increase annual revenues from $5 million to $8 million for the next ten years. The cost of goods sold is expected to remain at 50% of revenues. The tax rate is 40%.

As a result of the system, the firm will be able to cut its inventory from 50% of revenues to 25% of revenues immediately. There is no change expected in the other working capital components. The discount rate is 8%.

What is the NPV of the project?
(3) Dealing with Uncertainty of Cash Flows

Decision Trees
Presents the decisions and possible outcomes, with probabilities, at each stage of a multistage project. Decision trees operate as follows:
Step 1: break the project into clearly defined stages.
Step 2: list all possible outcomes at each stage.
Step 3: specify the probability of each outcome of each stage.
Step 4: specify the effect of each outcome on expected project cash flows.
Step 5: evaluate the optimal decision to take at each stage in the decision tree, based on the outcome at the previous stage and its effect on cash flows and discount rate, beginning with final stage and working backward.
Step 6: estimate the optimal action to take at the very first stage, based on the expected cash flows over the entire project, and all of the likely outcomes, weighted by their relative probabilities.

Adding Options:

Option to Abandon A Project
Value of abandonment option = NPV of Decision with abandonment - NPV of Decision without abandonment

Option to delay investment
Decision tree example: Drilling Company owns land, but is not sure if there is oil. An exploratory well can be drilled today for a cost of $20 million. There is an 80% chance the exploratory well will come up dry; if so, there is still a chance that there is oil to be found. Whether the exploratory well is successful or not, production capacity can be installed in one year for $100 million. The discount rate for both phases of the project is 10%.

Once production capacity is installed, the same amount of after-tax cash flow is expected to be generated in perpetuity. The actual amount will not be known until after production capacity is installed. If the exploratory well is successful, annual cash flow is expected to be $30M. If the exploratory well is unsuccessful, annual cash flow is expected to be $7.5M. Should Drilling Co. invest in the exploratory well?
Example of Decision Tree

- **Success (20%)**
  - Invest $100m
    - NPV (t=2) $181.82M
  - Don’t invest
    - $0

- **Failure (80%)**
  - Don’t drill
    - $0
  - Drill well for $20m
    - t-1
      - Invest $100m
        - $0
      - Don’t invest
        - $0
    - t=1
      - Invest $100m
        - -$22.73M
      - Don’t invest
        - $0
Cash Flow Analysis

Sensitivity Analysis
Sensitivity analysis examines the sensitivity of the decision rule (NPV, IRR, etc.) to changes in the assumptions underlying a project. Sensitivity analysis is conducted as follows:
Step 1: conduct a base case analysis based on expectations for the future cash flows and find NPV, IRR, PI.
Step 2: identify key assumptions made in the base analysis.
Step 3: change one assumption one time and find the NPV, IRR, or PI after the change.
Step 4: the findings are presented in the form of either graphs or tables.
Step 5: the information is used in conjunction with the base analysis to decide whether or not to take the project.

Scenario Analysis
Scenario analysis is an analysis of the NPV or IRR of a project under a series of specific scenarios, based on macroeconomics, industry, and firm-specific factors. There are four steps to take in a typical scenario analysis:
Step 1: the biggest source of uncertainty for the future success of the project is selected as the factor around which scenarios will be built.
Step 2: the values each of the variables in the investment analysis (revenues, growth, operating margin, etc.) will take on under each scenario are estimated.
Step 3: the NPV and IRR under each scenario are estimated.
Step 4: A decision is made on the project, based on the NPV under all the scenarios, rather than just the base case.

Simulations
In a simulation, the outcomes for important variables are drawn from distributions for these variables, and the NPV or IRR are computed based on these outcomes. This is a common technique used in engineering. The approach requires the following steps:
Step 1: choosing those important variables whose expected values will be replaced by distributions.
Step 2: choosing correct distribution for each of the variables.
Step 3: estimating the parameters for the distributions.
Step 4: drawing one outcome from each distribution based on the parameters estimated in step 3.
Step 5: computing the investment statistic (NPV, IRR, etc.) for the set of outcomes drawn in step 4.
Step 6: repeating step 4 and 5 for a sufficient number of times.
Step 7: computing the summary statistics (average, variance, coefficient of variation, etc.) for the investment statistics across all simulation runs. A final decision is made based on the summary statistics.

**Breakeven Analysis**

*Accounting Versus Financial Breakeven*

Estimate the revenues that will be needed in order for a project or company to break even in accounting terms.

\[ NI = \left[ (\text{price} - \text{variable cost per unit}) \times \text{quantity} - \text{fixed costs} - \text{depreciation} \right] (1-t) \]

If \( NI = 0 \); quantity = \( \frac{\text{fixed costs} + \text{depreciation}}{\text{price} - \text{variable cost}} \)

Note: if interest expense is zero, this is the same as \( \text{EBIT} = 0 \).

Present Value Breakeven (Financial breakeven)
- the number of units a firm has to sell to arrive at a NPV of zero.

If all variables (sales price, variable costs, fixed costs) are constant through the project, then:

\[ \text{PV Breakeven quantity} = \frac{[\text{EAC} + (\text{fixed costs})(1-t) - (\text{depreciation})(t)]}{(\text{price} - \text{variable cost})(1-t)} \]
where $EAC = \frac{\text{initial investment}}{\text{annuity factor}}$
Example: Problems 8.6 & 8.7

You are considering investing in a company that cultivates abalone for sale to local restaurants. The proprietor says he'll return all profits to you after covering operating costs and his salary.

Price per abalone = $2.00
Variable costs = $0.72
Fixed costs = $300,000
Salaries = $40,000
Tax rate = 35%

(8.6) How many abalone must be harvested and sold in the first year of operations for you to get any payback (assume no depreciation)?

(8.7) What is the present value break-even point if the discount rate is 15%, the initial investment is $140,000, and the life of the project is seven years? Assume straight-line depreciation method with a zero salvage value.