Chapter 11 - Capital Budgeting and Economics

This chapter is concerned with answering the question: Where do positive NPV projects come from? In a competitive world, positive NPV projects should be difficult to find. Therefore, you should carefully evaluate projects that purport to produce a positive NPV.

We focus on using our "economic intuition" in order to critically evaluate the assumptions used in calculating the project NPV. In particular we will:

1) Understand why (and when) we should trust market values.
2) Understand when it is likely we might earn "positive economic rents," and why, in general, they should not be expected.

In order to determine a project’s NPV, we need to determine the initial investment, expected future cash flows, and the discount rate(s).

Estimation errors are unavoidable. For example, consider “Project A” (from the Chapter 7 notes)

Time 0 cash flow (initial investment) = -$100

Project A time one expected cash flow calculation (from Chapter 7 notes):

Boom economy cash flow = $155, probability = 20%
Normal economy cash flow = $135, probability = 60%
Recession economy cash flow = $40, probability = 20%

Expected time one cash flow = $120
Beta = 1.80887
Discount rate = 20.1945%

NPV = -$100 + $120 / 1.201945 = -$0.1618

Based on the project NPV, the project is rejected.

The estimation error - assume that the economy for the next year ends up being a ‘booming’ economy. So the project’s time 1 cash flow would have been $155.

In retrospect, the project should have been accepted. However, based on the information available at time 0, the project was correctly rejected.

As in the previous example, the expected cash flows that you calculate for an individual project are likely to be an overestimate or an underestimate of actual project cash flows.

In the previous example, the actual cash flow would have been higher than the expected cash flow.

However, over time and over many projects, overestimates from some projects should cancel out underestimates with other projects. Therefore, these estimation errors are diversified away to a certain extent.

Even though you can’t estimate with 100% accuracy, the estimates of the expected future cash flows need to be unbiased, i.e., not above or below the expected cash flow. (In the same way, you need to make an unbiased estimate of the discount rate.)
If you make unbiased estimates of future cash flows, then these unbiased estimates should, on average, be equal to actual future cash flows (assuming you have enough observations across many projects and many years).

**Evidence of unbiased estimates of future cash flows** – refer back to Project A and ignore inflation. Over a 100-year period of time, you would expect to see (roughly):

- 20 booming years with a $155 cash flow
- 60 normal years with a $135 cash flow
- 20 recession years with a $40 cash flow

Total cash flows for 100 projects = $12,000  
Average per project = $120

**Example of biased estimates of future cash flows** – an overly optimistic manager makes the following estimates for the probabilities of the three different types of economies. (Another possible error for the optimistic manager would have been to overestimate the cash flows in the three economic states.)

- Boom economy probability = 25%
- Normal economy probability = 60%
- Recession economy probability = 15%

Effects on the NPV calculation for Project A:

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<th>Using the unbiased estimates of economy probabilities</th>
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<td>Expected cash flow</td>
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<td>Beta</td>
<td>1.80887</td>
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<td>Discount rate</td>
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<td>NPV</td>
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Only over time (and many projects) will we be able to determine that the manager is making biased estimates.

**Problems associated with making a biased estimate.**

No problem exists if there is no change in project selection due to the bias.

- A bias towards overestimating expected cash flows (or underestimating the discount rate) will make a good project look great. (Project is still accepted.)
- A bias towards underestimating expected cash flows (or overestimating the discount rate) will make a bad project look horrible. (Project is still rejected.)

Problems occur in the following two circumstances:

- A bias towards overestimating expected cash flows (or underestimating the discount rate) can make a bad project look good. (Negative NPV project accepted.)
  
  This problem is compounded if a manager has an incentive to overestimate cash flows (or underestimate the discount rate). When would a manager have the incentive to do this?

- A bias towards underestimating expected cash flows (or overestimating the discount rate) can make a good project look bad. (Positive NPV project rejected.)
  
  This problem is compounded if a manager has an incentive to underestimate cash flows (or overestimate the discount rate). When would a manager have the incentive to do this?
How do you prevent (or minimize) forecast errors?

1) Trust market values. In other words, use the information that is available from the current market value (as established by investors that buy and sell the asset in question) in your analysis of the project.

To use this approach, you need current market values from an asset that trades in an active and competitive market.

Why do we want to use market values? If you try to estimate expected future cash flows (and discount rates) for an asset that trades in an active and competitive market, you might let your optimistic (or pessimistic) estimates bias your NPV calculations. This could cause you to accept a bad project (or reject a good project).

We are assuming that the current market value established by numerous investors is a more reliable estimate of the asset’s true value that your own estimate.

Example – You plan to invest in ABC stock and sell in one year. ABC stock does not currently pay dividends (and will not for the next several years). Assume financial markets are perfect, efficient, and in equilibrium.

- Current stock price = $10 (last trade on the NYSE)
- Beta = ???
- Risk-free rate = 5%
- Market risk premium = 8.4%

What is the expected time 1 sale’s price? ________
What is the discount rate? ________

To answer the above two questions, first consider the solution to the next two questions.

What is the NPV of the investment? ________
Therefore, what is the present value of the time one stock price? ________

Why (in general) do we try to accurately calculate an unbiased estimate of the project’s expected future cash flows and discount rate?

Example – Joe is offering the sale of the mining rights for gold on his property for $20 million. The right to mine gold will be for 10 years and the purchaser must restore the property after the end of the 10-year period. The costs of extraction and restoration have already been estimated. Also, geologists have determined that 100,000 ounces of gold can be extracted from the land. (Assume that the gold market is perfect, efficient, and in equilibrium.)

You work for a potential purchaser. Your job is to estimate the cash revenues from the project.

- Production: 10,000 ounces of gold per year for 10 years.
- Present value of extraction costs = $4 million
- Present value of restoration costs = $2 million
- Current price of gold: ________

What is the present value of the expected cash revenues?

What is the NPV of the project?

Does the present value of the expected cash revenue increase or decrease if you extract the gold quicker (i.e, 20,000 ounces of gold per year for 5 years)?
What if the market is not active or competitive? Then the price is not necessary an “equilibrium” price.

Example – A house has been for sale for the last six months for $150,000. Should you buy the house for the purpose of reselling at a later date?

   What is the present value of the expected future selling price?
   What is the NPV of this project?

Example – A house just went on the market for $150,000. Should you buy the house for the purpose of reselling at a later date?

   Does it make a difference that the house hasn’t been exposed to the market yet?

2) Economic Rents - Summary of this section - Why hasn’t anyone else thought of this idea?

In a competitive industry that has been operating for a long period of time, projects that involve entering and exiting this industry have a zero NPV (i.e., the IRR equals the opportunity cost of capital).

Why? If entering the industry really had a positive NPV, then competitors will also enter the industry. The impact of this is:

   • Supply of items to be sold will _________.
   • This will cause a _________ in price
   • This will cause a _________ in the NPV of a project that involves entering this industry

The opposite would occur if entering (and staying in) the industry were a negative NPV project. In this case competitors will withdraw from the industry. The impact of this is:

   • Supply of items to be sold will _________.
   • This will cause a _________ in price
   • This will cause a _________ in the NPV of a project that involves entering this industry

The competitive equilibrium would therefore occur when there is no advantage to entering (or exiting) the industry (NPV = $0). In this case, economic rents equal zero.

Example - Based on current wheat prices and the costs of farming, land used for wheat farming should be priced such that the NPV of wheat farming is a zero-NPV project. Therefore, there is no incentive to purchase land to farm wheat.

   However, notice that you can expect to earn a fair rate of return (based on the beta risk of farming), therefore it would not necessarily be bad to enter farming.

Corollary: If wheat prices increase, what should happen to the price of land used for farming wheat?

Lesson - Be suspicious of projects that involve long-run competitive industries that purport to produce a positive (or negative) NPV.

A side issue – What if you have developed a new machine that allows you to plant and harvest wheat at a lower cost than your competitors?
Where are you likely to find positive NPV projects?

1) Positive economic rents can be expected during the start-up phase of an industry. However, these positive rents should only be temporary until enough competitors enter the new industry.

Before entering a "start-up" industry, you should carefully evaluate how long the excess profit period will last. The addition of competitors to the industry can be swift (and the more profitable the project, the faster competitors will enter).

2) Positive economic rents are also likely for entrants into an industry if they are able to enforce some type of monopoly. Monopolies can occur because of:

A) Legal constraints (patents, regulatory).

   Example: Lexington has recently imposed a restriction on the size of lots outside of the urban development area. The minimum lot size is now 40 acres.

   Questions: Assume that existing smaller lots can still be sold in their smaller lot sizes.

   • What should happen to the market value of these lots?
   • Should you purchase a small lot from an existing owner (for investment purposes) if one became available?
   • Should you sell a smaller lot if you owned one?

B) Market power (size of your company in relation to the total market). Example: Microsoft

C) Some other competitive advantage (superior management/personnel, location, etc.).

   Example: Project consists of expanding oil-refining capabilities. Location of an existing plant next to an oil pipeline would give your company a competitive advantage (in the expansion) over other refining companies. (To compete, other companies would need to construct a whole new plant in the same general area or build an extension to the pipeline.)

   Example: Project involves constructing a housing development beside a new golf course that is under construction. The land on the north side of the golf course is for sale, but the only access is through another person’s property. This other piece of property is not for sale.

Remember that a positive NPV project must produce positive economic rents!

Therefore, if your analysis shows that a project has a positive NPV, you must be able to explain to yourself why the project produces positive economic rents. In addition to analyzing the spreadsheet for computational errors, determine if there are any logical errors!

If the NPV from the spreadsheet is positive (or negative) ask if it is logical that the company should capture positive (or negative) economic rents with this project.

Chapter 11 Review Questions

1. What is estimation error? What is an unbiased estimate of future expected cash flows? What is a biased estimate of future expected cash flows? How would we know if a manager were making biased or unbiased estimates of future expected cash flows?

2. How could a manager's compensation package give the incentive for a manager to make biased estimates of a project’s future expected cash flows? What type of compensation scheme would give managers the incentive to overestimate future expected cash flows? What type of compensation scheme would give managers the incentive to
underestimate future expected cash flows? How can cash-flow estimation bias cause managers to make bad capital budgeting decisions (i.e., accept negative NPV projects or reject positive NPV projects)? Given a tendency for a particular manager to overestimate (or underestimate) future project cash flows, which of his (or her) projects should you review for accuracy of the NPV calculation - projects which he (she) calculates a positive NPV or a negative NPV?

3. What does it mean to "accept market values as given"? How does "accepting a market value as given" reduce the chance of making an error in calculating the NPV of a project?

4. What are "economic rents"? Understand and be able to explain why you should expect to earn zero economic rents from investing in a project in a long-run competitive industry. Given this assumption, what should happen to the price (value) of assets as the future expected cash flows associated with the use of those assets change? For example, other things equal, what should happen to the value of wheat farmland if wheat prices increase? (Note: For the same reason, changes in the discount rate should also have an impact on wheat farmland prices.)

5. Know the circumstances when positive economic rents should be expected.

Chapter 11 Practice Questions

1. Using the following information, what is the expected price of XYZ stock in 10 years? *Answer: Expected stock price in 10 years = $75.89.* What is the present value of this time 10 stock price? *Answer: $15.*
   - XYZ stock does not currently pay dividends (and will not for at least the next 10 years).
   - Current stock price = $15 (last trade on the NYSE)
   - Beta = 1.5
   - Risk-free rate = 5%
   - Market risk premium = 8.4%

2. Using the following information, what is the expected price of ABC stock in 10 years (immediately after payment of the time 10 dividend)? *Answer: Expected stock price in 10 years = $22.78.* What is the present value of this time 10 stock price and of the dividends received over these ten years? *Answer: $15.*
   - ABC stock pays an annual dividend equal to $2 per share (in one year). These dividends are expected to grow at a rate of 4.2666667% per year in perpetuity.
   - Current stock price = $15 (last trade on the NYSE)
   - Beta = 1.5
   - Risk-free rate = 5%
   - Market risk premium = 8.4%

3. Your uncle said that he will give you 100 ounces of gold when you turn 25 (five years from today). You want to calculate the present value of this gift. Using the concept of “trusting market values,” a discount rate of 3% per year, and a current gold price of $275.85 per ounce, what is the present value of this gift? 100 * $275.85 = $27,585

4. Refer back to the previous problem. Assume that the gift will be at age 30 instead of age 25. Keeping the rest of the information the same, how does this change in assumption affect the present value of the gift?
   - A. The present value of the gift is now higher than the correct answer to the previous problem.
   - B. The present value of the gift is now the same as the correct answer to the previous problem. (Correct)
   - C. The present value of the gift is now lower than the correct answer to the previous problem.