

Chapter 13

RISK ANALYSIS AND PROJECT EVALUATION

AGENDA

- Learning Objectives
- Principles Used in This Chapter
 - 1. Real Options in Capital Budgeting



LEARNING OBJECTIVES

1. Explain the types of real options.



PRINCIPLES USED IN THIS CHAPTER

- Principle #2: There Is a Risk-Return Tradeoff



13.4 REAL OPTIONS IN CAPITAL BUDGETING

REAL OPTIONS IN CAPITAL BUDGETING

- Opportunities to alter the project's cash flow stream after the project has begun are referred to as **real options**. The most common sources of flexibility or real options that can add value to an investment opportunity include:
 1. **Timing Option** – the option to delay a project until expected cash flows are more favorable.



REAL OPTIONS IN CAPITAL BUDGETING (CONT.)

2. **Expansion options** – the option to increase the scale and scope of an investment in response to realized demand; and
3. **Contract, Shut-down, and Abandonment option** – the option to slow down production, halt production temporarily, or stop production permanently (abandonment).



CHECKPOINT 13.5

Analyzing Real Options: Option to Expand

You are considering introducing a new drive-in restaurant called Smooth-Thru featuring high protein and vitamin-laced smoothies along with other organic foods. The initial outlay on this new restaurant is \$2.4 million and the present value of the free cash flows (excluding the initial outlay) is \$2 million, such that the project has a negative expected NPV of $-\$400,000$.

Looking closer, you find that there is a 50% chance that this new restaurant will be well received and will produce annual cash flows of \$320,000 per year forever (a perpetuity), while there is a 50% chance of it producing a cash flow of only \$80,000 per year forever (a perpetuity) if it isn't received well.

The required rate of return you use to discount the project cash flows is 10%.

However, if the new restaurant is successful, you will be able to build 4 more of them and they will have costs and cash flows similar to the successful restaurant's cash flows.

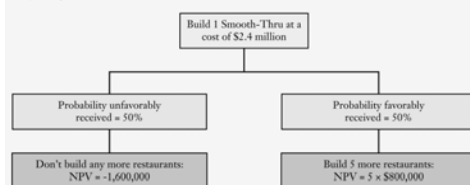
If your new restaurant is not received favorably, you will not expand. Ignoring the fact that there would be a time delay in building additional new restaurants if the project is favorably received, determine the project's NPV.



CHECKPOINT 13.5

STEP 1: Picture the problem

Graphically, this can be viewed as:



STEP 2: Decide on a solution strategy

Determine an NPV for this project assuming you will build 5 identical Smooth-Thru restaurants if the project is favorably received, and assuming you will not build any additional restaurants if it is not favorably received.



CHECKPOINT 13.5

STEP 3: Solve

In this problem we have an initial outlay of \$2,400,000, a discount rate of 10%, and there is a 50% chance the new restaurant concept will be favorably received and a 50% chance it will be unfavorably received. If it is favorably received it will produce a perpetuity of \$320,000 per year, while if it is unfavorably received it will produce a perpetuity of \$80,000 per year. Thus,

$$\text{NPV if favorably received} = (\$320,000 \div .10) - \$2,400,000 = \$800,000$$

$$\text{NPV if unfavorably received} = (\$80,000 \div .10) - \$2,400,000 = -\$1,600,000$$

Assuming we will open 5 Smooth-Thru restaurants if it is favorably received and only one if it is unfavorably received, and each of these outcomes has a 50% probability, the expected NPV is,

$$\text{Expected NPV} = (5 \times .50 \times \$800,000) + (1 \times .50 \times -\$1,600,000) = \$1,200,000$$

STEP 4: Analyze

Without the option to expand, this project would have a NPV of -\$400,000.

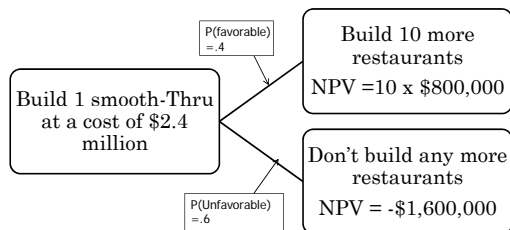
$$\text{NPV} = (\$800,000 \times .5) + (-\$1,600,000 \times .5) = -\$400,000$$

However, adding the option to expand allows the firm to take advantage of the increased certainty that the project will be received favorably and expand on it. This partially explains why many large restaurant chains introduce new theme restaurants in the hopes that they succeed. If they do, the chain can open additional new restaurants or franchise them.

CHECKPOINT 13.5 – CHECK YOURSELF

- o If you thought there was a 40% chance that this project would be favorably received and 60% chance that the project would be unfavorably received, what would be the NPV of the project if you were to introduce 10 additional restaurants if it is well received?

STEP 1: PICTURE THE PROBLEM



STEP 2: DECIDE ON A SOLUTION STRATEGY

- We need to determine the NPV of this project assuming we will build 10 restaurants if the project is favorably received and will not build any additional restaurants if it is not favorably received.



STEP 3: SOLVE

- We are given the following information (per Restaurant):
- Perpetual annual cash flow (if favorably received) = \$320,000
- Perpetual annual cash flow (if not favorably received) = \$80,000
- Probability of being favorably received = 40%
- Discount rate = 10%



STEP 3: SOLVE (CONT.)

- We use the PV of perpetuity equation (given by CF/i) to determine the present value of cash flows.
- NPV (if favorably received)
 - $= (\$320,000 \div 0.10) - \$2,400,000 = \mathbf{\$800,000}$
- NPV (if not favorably received)
 - $= (\$80,000 \div 0.10) - \$2,400,000 = \mathbf{-\$1,600,000}$



STEP 3: SOLVE (CONT.)

- Assuming we will open 10 restaurants if it is favorably received and only one if it is unfavorably received, we can determine the expected NPV as follows:
- Expected NPV
= $10 (.4)(\$800,000) + 1(.60)(-1,600,000)$
= **\$2,240,000**



STEP 4: ANALYZE

- Without the option to expand, this project would have had a NPV of -\$640,000.
- $NPV = \$800,000(.4) + (-\$1,600,000)(.6)$
= -\$640,000
- However, by considering the option to expand, the project has a positive NPV.