

ENTREPRENEURIAL FINANCE: *Strategy Valuation and Deal Structure*

Chapter 5. Developing Business Strategy Using Simulation

Questions and Problems

Note: You should be familiar with using Venture.SIM™ or another Excel simulation add-in (@RISK or Crystal Ball) before attempting these problems.

1. SIM A new venture requires \$15,000 per month during their prototype development stage. Development time is represented by a triangular distribution with minimum, most likely, and maximum values of 2, 10, and 24 months. How much funding should the entrepreneur raise if he wants to have sufficient capital to meet 75% of the development outcomes?
2. SIM Cool Rinks builds and operates outdoor ice skating facilities. They are in the process of evaluating expansion opportunities.
 - a. The first option is a new location in Indiana. For the business to be profitable, the average daily temperature needs to be below 32° more than 75% of the time during the 90-day skating season. At the site being considered, the average daily temperature during the season is normally distributed with a mean of 25° and a standard deviation of 11°. Is Indiana a promising market for Cool Rinks?
 - b. Now assume Cool Rinks has a second location under consideration in Utah. It is colder, with the average daily temperature during the season normally distributed with a mean of 14° and a standard deviation of 10°. In addition to the 32° requirement, the company projects that a site will not be profitable if more than 40% of the days have an average temperature below 10°. How does the Utah site compare to Indiana as a potential location for a new rink?
3. SIM You are planning a new restaurant and have located a site which will accommodate seating and parking for 400 customers. Nightly demand is estimated by a triangular distribution with minimum, most likely, and maximum values of 75, 300, and 600. Estimate what percentage of the time this site will be sufficient to meet demand.
4. SIM You have spent the last six months developing a new product for treatment of arthritis. You believe a breakthrough could occur at any time during the next eight months and that the probability of success in any given month is about 10 percent. If you do not succeed within that period, you have decided to abandon the project.

In the event that your efforts are successful, the clinical testing required for FDA approval will take six to ten additional months from the time of development success. Based on prior experience, if development efforts are successful, there is an 80 percent probability that approval will be granted. Notice of approval or disapproval in any month is equally likely. During development, your venture has been consuming cash at an average rate of \$30,000 per month. You estimate that in any given month there is a 30 percent probability that the cost will be only \$20,000 and a 20 percent probability that it will be \$45,000. The cost of financing the venture will be much lower once FDA approval is obtained. The problem is that you need additional financing right now.

- a. Suppose you want to provide enough financing for the worst case outcome. How much money should you raise?

- b. Using a simulation model, determine how much you should raise now so that the probability of running out of money before the FDA acts is 25 percent.
 - c. Suppose the cost of financing would also be lower after development was completed. How could you use simulation to determine the best way to stage the financing of the venture? What factors would affect your choice of when and how much capital to raise?
5. SIM An entrepreneur who would like to open a restaurant has approached you. By coincidence, it is the same entrepreneur whose decisions we have been studying in this chapter. The entrepreneur is offering 1 percent of the equity of the venture for each \$10,000 you invest and will contribute \$400,000 to the project. Suppose you agree with the entrepreneur's assumptions, as set out in Table 5.1 for the large restaurant and elsewhere in the chapter for the small restaurant, including the PV assumptions. Use simulation to examine the opportunity from your perspective instead of the entrepreneur's.
 - a. What is the NPV of your investment in the large restaurant if there are no options and investment is immediate?
 - b. What is the NPV of your investment in the small restaurant if there are no options and investment is immediate?
 - c. How do the abandonment options with exercise values of \$600,000 for the large and \$300,000 for the small restaurant affect the NPVs of your prospective investments?
 - d. Suppose, in order to acquire an abandonment option for either restaurant, the expected cost is \$20,000 higher (which you would pay in exchange for an additional 2 percent of the equity). Would you want the entrepreneur to acquire the option?
 - e. Suppose the entrepreneur proposes to initially build the small restaurant and if expected demand turns out to be more than 300,000 meals, to expand capacity to the same as the large restaurant. The cost of expanding is \$300,000, and the entrepreneur proposes that you contribute this in exchange for an additional 15 percent of the equity. Based on the simulation, would you want to accept this proposal? Why or why not? Is there another alternative under which the entrepreneur could exercise the expansion option that you would find more attractive?
6. SIM The monthly standard deviation of the S&P 500 Index is 6.8 percent. The expected return for investing in the Index is 1.0 percent each month.
 - a. Suppose you invest \$100 in the Index today:
 - (i) Use simulation to estimate the expected value of the index investment at the end of three months and the standard deviation of the ending value (at that point).
 - (ii) What are the estimates of expected value and standard deviation at the end of nine months?
 - b. Suppose, instead of investing \$100 in the Index, you are interested in an option on an underlying \$100 claim on the Index (i.e., the underlying claim has a market value of \$100, the same as in part a.
 - (i) What is the expected value in three months of a three-month call option with an exercise price of \$100, and what is the corresponding standard deviation of possible values?
 - (ii) What is the expected value in nine months of a nine-month call option with an exercise price of \$100, and what is the standard deviation?

(iii) What is the expected value in three months of a three-month put option with an exercise price of \$100, and what is the corresponding standard deviation of possible values?

(iv) What is the expected value in nine months of a nine-month put option with an exercise price of \$100, and what is the standard deviation?

(v) What is the expected value in nine months of a nine-month call option with an exercise price of \$80, and what is the standard deviation?

7. SIM Think about an aspect of your current situation (possibly related to your career, education, or personal life).
 - a. What are the most important decisions you will have to make as you go forward?
 - b. Try describing the alternatives in terms of a decision tree.
 - c. What real options are reflected in the choices you will have to make?
 - d. The outcomes of the different branches of the tree should be describable in terms such as dollars, utility, and happiness. See if you can write a model, similar to the one in the chapter, which describes how the outcomes relate to your possible choices.
 - e. Now, supposing that you wanted to simulate the results of your decisions, how might you go about specifying the assumptions of your model?
 - f. If you feel ambitious, try setting up the model in an Excel spreadsheet and use simulation to evaluate the choices. (Feel free to take some liberties with the specific assumptions.)
8. Refer to the restaurant example in the chapter. "If the investor is astute, the terms of the deal will be different for the large restaurant than for the small one." Why and how do you think they might be different?
9. The origin of the term "real options" is traceable to Professor Stewart Myers ("Determinants of Capital Borrowing," *Journal of Financial Economics*, 1977), who noted that many corporate real assets can be viewed as call options. What do you think he means? Why might it be useful to think of corporate real assets as call options? Provide examples to illustrate your answer. Try to identify, at least conceptually, the underlying asset, the exercise price, and the expiration date.
10. SIM Reevaluate the storage space needed in the box example in Section 5.4. However, instead of 5,000 boxes per day, now assume you expect from 4,000 to 6,000 per day. The actual number will be drawn from a uniform distribution over this range.
 - a. What is the maximum size of warehouse you will need? Estimate the size that would be sufficient 95 percent of the days.
 - b. How does this compare to an estimate from the text example of the size that would be sufficient 95 percent of the days? What do you think accounts for the difference in size?
11. SIM The common stock of Unron is selling today for \$50 per share. The stock is expected to appreciate at a rate of 1.0 percent per month with a standard deviation of 15.0 percent per month. As an Unron employee, you have just been awarded executive stock options to acquire 1000 shares. The options have an exercise price of \$50 but cannot be sold or exercised for 5 years (60 months). The monthly risk-free rate is 0.3 percent.
 - a. Construct a spreadsheet to simulate the price of Unron stock at the end of the five years and the value of the call option at expiration. Run the simulation and plot the results for the stock price.

- b. How likely is the option to be in the money at expiration?
 - c. What is the expected stock price in five years? What is the expected value of the call option at that time?
 - d. As you cannot trade the options, you cannot use conventional option pricing models to determine their value. What is the present value of the options if you discount their expiration-date value by 1.0 percent per month? What is it if you discount by the risk-free rate?
12. SIM Download the Black-Scholes Option Value Template from the text website and use it to value the following options on Unron stock (see Question 11):
- a. One-year calls with exercise price of \$50.
 - b. One-year calls with exercise price of \$40.
 - c. One-year puts with the same exercise prices.
 - d. Six-month calls and puts with the same exercise prices.
 - e. For one-year puts and calls with exercise price of \$50, how does value change if the risk-free rate increases to 0.5 percent per month?
 - f. For one-year puts and calls with exercise price of \$50, how does value change if the monthly standard deviation decreases to 10 percent?
 - g. Discuss the consistency of your findings with the principles of option valuation.
13. SIM For the restaurant example in the chapter, evaluate the combined effects of the following assumption changes on the values of the large and small restaurants and the effects of the various options on value: (i) The standard deviation of meal prices is \$2. (ii) The preliminary market size estimate has a triangular distribution with (8, 2.6, and 0.5 million units). (iii) The preliminary estimate of market share has a standard deviation of 2 percent.
- a. How do these assumptions of increased risk affect the optimal strategy?
 - b. Why do you think the effects are as you find them to be?
14. SIM For the restaurant example in the chapter, evaluate the combined effects of the following assumption changes on the values of the large and small restaurants and the effects of the various options on value: (i) The expected variable cost per meal is \$4. (ii) Expected fixed cost of the large restaurant is \$750,000. (iii) Expected fixed cost of the small restaurant is \$600,000.
- a. How do these assumptions about the variable and fixed cost structures affect the optimal strategy?
 - b. Why do you think the effects are as you find them to be?