

## **ENTREPRENEURIAL FINANCE: *Strategy, Valuation, and Deal Structure***

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### **Chapter 11. The Entrepreneur's Perspective on Value**

#### **Questions and Problems**

1. A venture that requires an investment of \$5 million is expected to return a total of \$20 million in four years. Assume that the venture has a standard deviation of (four-year) holding-period returns of 120 percent and that its correlation with the market is 0.3. Suppose the risk-free rate is 4 percent per year and the market risk premium is 7 percent per year. The one-year standard deviation of market returns is estimated to be 14 percent.
  - a. What is the beta of the venture?
  - b. What is its required holding period rate of return to a well-diversified investor?
  - c. What is its required holding period rate of return to an entrepreneur who will invest all of her wealth in the venture?
  - d. How much is the venture worth to the diversified investor?
  - e. How much is it worth to the entrepreneur?
2. Suppose a two-year venture will cost \$1.5 million and yield an expected cash flow of \$3.2 million. The standard deviation of the expected cash flow is \$2 million. Suppose further that the expected market is 13.5 percent per year, the risk-free rate is 7 percent per year, the market variance is 4 percent per year, and the correlation between the venture and the market is 0.2.
  - a. Use the CEQ form of the CAPM to find the NPV of the venture to a diversified investor.
  - b. Use your answer in part (a) to find the equilibrium standard deviation of holding period returns and then use the RADR form of the CAPM to find the NPV to a diversified investor.
  - c. Use the CEQ form of the CAPM-based model (Eq. 10.6) to find the NPV of the venture as a full commitment.
  - d. Use your answer in part (c) to find the equilibrium standard deviation of holding period returns and then use the RADR form of the CAPM-based model to find the NPV of the venture as a full commitment.
3. SIM Consider the simulation model in Table 11.2. Suppose sales revenue in year 1 is the greater of zero or a normal distribution with a mean of \$400,000 and a standard deviation of \$250,000. If the forecast of year-1 sales is positive, then the expected growth rate of sales from year 1 to year 2 is 50 percent. After year-2, sales growth rate assumptions are the same as in Figure 10-4, except that if sales in the prior year are zero, then the forecast is for sales of zero. Expected profitability is 55 percent of sales, less a fixed cost of \$1000 per year. However, if the venture fails to generate positive sales in year-1, there will be no fixed cost in the subsequent years. Other assumptions in the model are unchanged.
  - a. Simulate performance of the venture over the six-year period. What is the expected cash amount that will go to the investor/entrepreneur in year 6, and what is the

standard deviation of that cash receipt? How often does the venture fail to generate sales in year 1? how often does it run out of cash by year 6

- b. Using the same model and assumptions, what are the expected sales and standard deviations of year 6 sales and profit? What would expected sales have been if the venture did not run out of cash?
  - c. Assuming the required investment is \$2 million, the risk-free rate is 4 percent, the market rate is 9 percent, and the standard deviation of market returns is 30 percent per year, try using Eq. (11.4) with the realized holding period return to find the NPV of the investment as a full commitment. What do you find, and what do you conclude?
  - d. Now, try using the valuation template from Table 11.3 to estimate the value of the venture as a full commitment (where all of the entrepreneur's wealth is invested in the venture). What do you find for the CAPM-based result? Is your answer the same as in part c? Why or why not?
4. The market standard deviation is 20 percent; and the standard deviation of returns for a new venture is 80 percent. The correlation of returns is 0.4. The risk-free rate is 4 percent, and the market return is 10.5 percent. Find the portfolio standard deviation, portfolio required rate of return, and new venture required rate of return for each of the following.
- a. The entrepreneur invests 40 percent of wealth in the venture and 60 percent in the market.
  - b. The entrepreneur invests 20 percent of wealth in the venture and 80 percent in the market.

Now suppose the correlation is 0.1. Find the portfolio standard deviation, portfolio required rate of return, and new venture required rate of return for each of the following.

- c. The entrepreneur invests 40 percent of wealth in the venture and 60 percent in the market.
  - d. The entrepreneur invests 20 percent of wealth in the venture and 80 percent in the market.
5. Return to the simulation results from problem 3. Use the valuation template from Table 11.3 to evaluate a partial commitment in the venture under each of the following assumptions. (Expected venture cash flows and their standard deviation are from problem 3.) Assume the risk-free rate is 4 percent per year, the market return is 9 percent per year, and the market standard deviation is 30 percent per year.
- a. Correlation between the venture and the market is 0.3; the entrepreneur has total wealth of \$8 million and invests \$2 million in the venture, with the balance in the market.
  - b. Correlation between the venture and the market is 0.3; the entrepreneur has total wealth of \$16 million and invests \$2 million in the venture, with the balance in the market.
  - c. Correlation between the venture and the market is 0.1; the entrepreneur has total wealth of \$8 million and invests \$2 million in the venture, with the balance in the market.

- d. Correlation between the venture and the market is 0.1; the entrepreneur has total wealth of \$16 million, and invests \$2 million in the venture, with the balance in the market.
  - e. How do you explain the differences?
6. An individual who currently earns \$120,000 per year is considering a new venture. To proceed, she must resign and commit three years to the venture. For that, she expects to receive a salary of \$50,000 per year. If the venture fails, she can return to her current line of work but expects that her starting salary will drop to \$100,000. In either case, her earnings in alternative employment are expected to grow at a rate of 6 percent per year. Her remaining work life is 20 years. She believes it is appropriate to value future earnings using a discount rate of 14 percent. She also has \$90,000 of equity in a house and will use the equity to secure a loan of that amount to invest in the venture. Finally, she has retirement savings invested in a market index of \$800,000 that she is unable to use in the venture.
  - a. What is the present value of the entrepreneur's human capital?
  - b. What is the present value of human capital (net of expected compensation) she would need to commit to the venture?
  - c. What fraction of her total wealth would she be committing?
7. A public corporation is considering developing a new software application that would enable GPS navigation systems in automobiles to "learn." With the application, the system would be able to update maps when it determined that its initial map file had become obsolete. It also would integrate a clock and calendar, so that over time, it would develop a database of true expected driving times based on day of week and time of day. This would enable the system to improve its route selections and give more accurate estimates of expected driving time. Company engineers project that it would take four years to develop and commercialize the software. With luck, the corporation would be first to market and would preempt others from entering. If so, the financial planning group estimates that "harvest-date" value of the product would be \$60 million. Alternatively, the company's product might not preempt rivals. In a market where several products are competing, the product price would have to be lower. Under that scenario, the financial planning group estimates that harvest-date value would be \$35 million. Finally, another entrant could preempt the company's efforts, even after most of the development costs had been incurred. In that scenario, the company would realize nothing on its investment. The annual current risk-free rate is 3 percent. The financial planning group estimates that the market risk premium is 5 percent, the standard deviation of market returns is 14 percent and the venture's correlation with the market is 0.25.
  - a. Assuming that the probability of the success scenario is 15 percent, and the probability of the failure scenario is 40 percent, what is the present value of the opportunity to the corporation?
  - b. Under the same assumptions, what is the present value of the venture to an entrepreneur who would be willing to invest 30 percent of her \$9 million total wealth in the venture, with the remainder being placed in a market index portfolio?
  - c. Comment on the relative values to the corporation and the entrepreneur and on who should undertake the venture.

8. For the project described in problem 7, suppose that the corporate project approval and oversight processes are the main reasons the project is likely to take four years to complete, and that an entrepreneur acting independently could complete the project in three years. Faster completion would increase the likelihood that the innovator would succeed in preempting rivals and would reduce the probability of failure. Assuming that the probability of the intermediate outcome would remain at 45 percent, and the scenario-contingent cash flows would not change despite the faster completion, how much would the probability of success need to increase and the probability of failure decrease to make the project as valuable for an independent entrepreneur as it is to the corporate investor in problem 7?
9. A public company has a retirement plan where employees can invest a portion of their retirement savings in company stock. Whatever the employee does not invest in company stock can be invested in a diversified portfolio. Whatever is invested in company stock must remain in company stock until the employee retires. To encourage investment in company stock, and in recognition of the resulting underdiversification, the company will match whatever the employee invests in company stock with an additional 15 percent investment on the employee's behalf. Suppose the annual risk-free rate is 4 percent, the market risk premium is 6 percent, and the standard deviation of market returns is 14 percent. Company stock has beta risk of 1.2, and a correlation with the market of 0.4. The annualized standard deviation of returns is 42 percent, based on the beginning investment amount including the employer's matching contribution.
  - a. Suppose an employee invests \$10,000 in company stock. Considering the employer's matching contribution, what is the expected value of the investment in one year? In two years?
  - b. What is the standard deviation of cash flows for an employee's one-year investment of \$10,000 by an employee? What is it for a two-year investment? Be sure to incorporate the employer's contribution.
  - c. Suppose an employee has no other wealth. How soon would the employee need to retire to make investing \$10,000 (plus the company match) in company stock equal in present value to investing \$10,000 in the market (with no matching contribution)?
  - d. How would the answer in part (c) be different if the employee had \$90,000 of other wealth, all invested in a market index?
  - e. For an employee who already has \$90,000 in the market and five years until retirement, what allocation of a current \$10,000 investment between company stock (that cannot be harvested until retirement) and the market index would maximize the present value of the employee's wealth?
10. The annual risk-free rate is 5 percent, the expected return on the market for one year is 11 percent, and the standard deviation of market returns is 14 percent. A prospective venture that would be harvested in one year has an expected cash flow of \$2.0 million, with cash flow standard deviation of \$1.2 million. The correlation between the venture and the market is 0.25. The venture would require an investment of 1.5 million, which would leave the entrepreneur with \$3.5 million invested in the market. Use Equations 11.6 through 11.9 to find the present value of the venture. How would the present value change if the holding period were two years instead of one, with all other assumptions unchanged? Should the entrepreneur invest if the holding period is one year? Two years? Explain.

11. Suppose an entrepreneur is considering a new computer service venture. The entrepreneur believes the venture has risk characteristics similar to early-stage public computer service companies and has asked you how to value the opportunity. The first step in your analysis is to estimate the entrepreneur's opportunity cost of capital. Based on a sample of firms you found on Yahoo.com, you have concluded that computer service firms tend to have beta risk of around 1.10 and that the average correlation of returns with market returns is 0.17. The entrepreneur would plan to invest about 10 percent of his total wealth in the venture. The expected holding period is 1.5 years, the annual risk-free rate is 3 percent, the market return is 9 percent, and the market standard deviation is 14 percent. Use the template in Table 11.4 to estimate the entrepreneur's cost of capital.