

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

Chapter 12. Deal Structure: Addressing Information and Incentive Problems

Questions and Problems

1. A venture that will cost \$1 million, including \$200,000 worth of the entrepreneur's time, is expected to be harvested in three years and to yield \$6.5 million at that time. Based on a simulation study, the standard deviation of harvest cash flows is \$3.5 million. Assume that the annual risk-free rate is 3 percent and that the expected market rate of return is 9 percent per year. The standard deviation of market returns is 14 percent per year. The correlation between the venture and the market is estimated to be 0.4. Estimate the NPV of the venture to the following individuals, assuming that each makes the entire investment:
 - a. An entrepreneur whose total wealth, including human capital, is \$1 million.
 - b. A well-diversified investor.
 - c. An entrepreneur whose total wealth is \$2 million, where the balance of total wealth is maintained in a market index.
 - d. An entrepreneur whose total wealth is \$10 million, where the balance is maintained in a market index.
 - e. An entrepreneur whose total wealth is \$10 million, where \$1 million is in the venture, \$3 million is retained in a riskless asset, and the balance is maintained in a market index.

Discuss your results. In particular, discuss how the values of intangibles like self-employment and total control might affect the relative values of the different scenarios, and how the entrepreneur's risk aversion might affect the relative values of the scenarios in parts (d) and (e).

2. Consider the venture described in problem 1, and assume that the entrepreneur has total wealth of \$2 million. Evaluate the following financing alternatives in terms of the entrepreneur's NPV.
 - a. An investor will contribute \$400,000 of the total cost in exchange for a 40 percent share of the equity of the venture.
 - b. A creditor will lend the entrepreneur \$400,000 in exchange for expected repayment of principal and interest of \$700,000 in year 3. The loan is somewhat risky, and reduces the standard deviation of the entrepreneur's cash flow at harvest to \$3 million. Assume the correlation of the entrepreneur's risk with the market remains at 0.4.
 - c. An investor will contribute \$400,000 in exchange for enough equity to generate an expected return equal to the CAPM required return.
 - d. An investor will contribute \$700,000 in exchange for enough equity to generate an expected return equal to the CAPM required return plus \$100,000 of present value.

Discuss your results, considering also how the entrepreneur's interest in control or private risk aversion might affect the relative values and choice. Also, compare your results to the result in Problem 11-1, part (c).

3. Suppose a venture is subject to constant returns to scale over a range of investment levels from \$500,000 to \$2.5 million. Above or below those levels, venture rates of return are lower. How should the entrepreneur or a prospective investor use financial considerations to decide on the scale of the venture:

- a. Assume that the entrepreneur would be the only investor in the venture?
- b. Assume that the entrepreneur would share risk and return proportionally with an outside investor?
- c. Assume that an investor would be willing to purchase all of the equity and hire the entrepreneur?

How would you expect the sizes of the ventures to be different under these three scenarios?

4. Suppose the risk-free rate of interest is 4 percent per year, the market risk premium is 5.5 percent per year, and the market standard deviation is 14 percent. A venture has an approximate beta of 2.0 based on its cost, and a correlation of 0.25 with the market and an expected return on invested capital of 22 percent per year. Total cost is \$3 million at time zero. Expected harvest is at year 3.
 - a. How much of the equity would a well-diversified investor require in exchange for investing \$1.5 million in the venture? What is the true beta of the investor's investment, based on equilibrium holding period returns?
 - b. Suppose the entrepreneur needed to raise \$800,000 in capital to be used by the venture and was willing to sell 30 percent of the equity. How much more than \$800,000 would a diversified investor pay to acquire the equity?
 - c. How would your answer change if the entrepreneur were willing to sell 49 percent of the equity? How much would the entrepreneur need to invest, and for what share of the equity?
 - d. Assuming the entrepreneur will base his decision to pursue the venture on opportunity cost of capital, how much other wealth would the entrepreneur need to have available for investing in the market to make the investment in part (c) economically viable?
5. Consider a venture with expected cash flow in year 6 of \$10 million and standard deviation of cash flow of \$5.5 million. Assume that an entrepreneur plans to invest \$1 million in the venture and the remaining \$500,000 of her total wealth in a market index. The annual risk-free rate is 4 percent, the annual market rate is 11 percent, and the one-year standard deviation of market returns is 14 percent. The correlation between the venture and the market is 0.3. Use Valuation Template 6 to assess the effects of the following changes on the value of an entrepreneur's interest in a venture. Find the base value and treat each change as incremental to the preceding one.
 - a. Time to harvest can be shortened to five years. Doing so would reduce expected cash flow to \$8.5 million, and standard deviation of cash flow to \$5 million.
 - b. The same change would reduce the total required investment to \$900,000. The entrepreneur can shift the savings to investment in the market index.
 - c. The entrepreneur can bring in an outside investor who offers to contribute \$500,000 in exchange for 30 percent of the equity. The entrepreneur would invest the savings in the market index.
 - d. The entrepreneur believes the investor would accept a share of equity, in exchange for the \$500,000 investment, which would result in a NPV to the investor of \$150,000 based on the CAPM required return. Any additional savings would be invested in the market index by the entrepreneur
 - e. The entrepreneur also believes that the investor would be willing to purchase 80 percent of the equity on terms that would give the investor a NPV of \$250,000 based on the CAPM

required return. Any cash generated for the entrepreneur would be invested in the market index.

- f. Finally, the entrepreneur could sell the 80 percent interest to an active investor who would require an annual expected return of 15 percent. The entrepreneur believes that active investor involvement would enable the venture to be harvested one year sooner (in four years instead of five), would yield the same expected cash flow, but would reduce the standard deviation of cash flows to \$4 million.

Discuss your results. Do you think financial structure and the choice of investor are important to the entrepreneur? Assuming the effects of these contract changes cannot be estimated with much precision, what lessons can you still draw?

- 6. Consider a venture that requires \$2 million in capital, including \$1.7 million in cash and \$300,000 of human capital. Suppose an investor proposes to provide all \$1.7 million of the needed cash in exchange for convertible preferred stock with a liquidation preference. The preference would pay the investor 3 times ("3X") her initial investment at harvest, so for each dollar she invested, she would be entitled to receive three dollars before any returns would go to the entrepreneur. The preferred stock is convertible to 20 percent of common equity. At the time of harvest, the investor can choose to receive either three times her initial investment (in cash) or 20 percent of equity (which she sells for cash), whichever is greater. However, if the venture does not do well, she cannot receive more than 100 percent of the total harvest value of the venture. To evaluate the proposed contract, you have constructed the following table, which sets out the likely scenarios of total harvest value, and their probabilities of occurring.

Scenarios	Probability	Harvest Value
Scenario 1: Best case	10%	\$40,000,000
Scenario 2	15%	\$20,000,000
Scenario 3	20%	\$10,000,000
Scenario 4	25%	\$4,000,000
Scenario 5: Worst case	30%	\$0
	100%	

The risk-free rate is 4 percent per year, the market rate is 9 percent, the annualized standard deviation of the market is 14 percent. Assume that the correlation between market returns and any financial claims on the venture is 0.3.

- a. Use the scenario data and contract terms to compute the expected cash flow and cash flow standard deviation of the financial claims of the investor and the entrepreneur. Then use the results along with Valuation Template 5 to value the financial claims.
- b. Suppose, instead, that the preferred shares have a 1X preference and are convertible to 35 percent of common equity. Redo the analysis and valuations.
- c. Alternatively, suppose the investor receives 40 percent of common equity, with no liquidation preference. Redo the analysis and valuations.
- d. Finally, suppose the investor receive 36 percent of common equity with no liquidation preference, but with enough warrants to raise the investor's fractional ownership interest by an additional 30 percent. The warrants can be exercised only if the venture achieves the best case scenario harvest value. Otherwise the investor's interest is 36 percent.

Discuss how the different contracts affect the values of the investor's and entrepreneur's interests. Explain why the values change in the way they do. Given your results, why do you think many new venture financing contracts include liquidation preferences investors and why do you think entrepreneurs often receive warrants they can exercise if the venture does well?

7. SIM Consider the following three contracts between an entrepreneur and a very wealthy business angel (who would be well-diversified, even after investing in the venture):
- Contract 1: The investor would invest \$1 million in exchange for preferred stock with a liquidation preference of two times ("2X") the initial investment. The stock would be convertible at time of harvest to 40 percent of the common equity. The angel would convert if doing so resulted in receiving a higher share of harvest cash flows. The entrepreneur would invest \$800 thousand in the venture, including \$360 thousand as the value of human capital in alternative use. (You can think of the entrepreneur as drawing no salary, although it would be equivalent for the entrepreneur to fund a salary from his portion of investment in the venture).
 - Contract 2: The investor would invest an additional \$240 thousand, which would be sufficient to enable the entrepreneur to receive a salary with a present value of \$240 thousand. This would enable the entrepreneur to reduce investment in the venture and invest more in the market. The investor still would have a 2X liquidation preference (on a higher total investment) and convertibility to 40 percent of common equity.
 - Contract 3: The investor would make the same \$1.24 million investment. The liquidation preference would be reduced to 1X. The shares would be convertible to 30% of common equity at harvest. In addition, if total harvest value is more than \$10 million, 392 • Chapter 11: Financial Contracting with Symmetric Information the investor could exercise warrants that would raise his ownership stake to 50 percent. The exercise price of the warrants would be negligible.

Suppose that both parties expect the venture to be harvested in three years, and expect total harvest date cash flows to be exponentially distributed with a mean of \$5 million (You can use *Venture.SIM*TM to model this). The risk-free rate is 3 percent per year, the market rate is 9 percent, and annualized market standard deviation is 14 percent. The venture, which is involved in biotechnology, is believed to have a correlation of only 0.1 with the market. Under each alternative contract, the angel investor expects to invest an additional \$500,000 of human capital, which is not reflected in the direct investment or the contract terms. To compensate, the investor needs a return on financial capital that has a net present value of at least \$500,000. The entrepreneur has total wealth of \$3.5 million.

- a. Simulate the cash flows of the various claims.
 - b. Chart the simulation results (sorted by total harvest cash flow) and discuss how the different contracts affect the cash flows and risk of the parties.
 - c. Value the alternative contracts. Which one would you select, and why?
8. Compare the following three investment alternatives in terms of the percent of equity each investor would need in order to provide a normal (breakeven) return on capital and cover costs related to due diligence, making the initial investment, and ongoing involvement with the venture.
- Alternative 1: A passive investor would provide \$1.5 million of the \$2.0 million total investment, and would require a return high enough to compensate for \$150,000 of due diligence and other costs of evaluating and making the investment. In this case, the expected harvest value would be \$14 million, with a standard deviation of \$10 million.
 - Alternative 2: An angel investor group would provide \$1.5 million and contribute significant effort to improving the venture. The investor would need a return high enough to cover the \$500,000 present valued cost of these efforts. The involvement would increase the expected return at harvest to \$15 million and reduce the risk to a standard deviation of \$8 million. Members of the angel group would all be well-diversified after their investments.

- Alternative 3: A venture capital fund would invest \$1.5 million. The general partner assesses an annual management fee of 2.5 percent of capital under management (which is revalued annually so you can estimate the total management fee as the first-year fee times the years to harvest). The general partner also retains a carried interest of 20 percent of any capital appreciation at harvest.

Note, in comparing these alternatives rather than simulating the exact contracts you should, develop a rough estimate of value to the entrepreneur by assuming that the risk of the investment is prorated; 20 percent of the risk to the general partner and 80 percent of it to the limited partners. With a venture capital investor, expected cash flow would remain at \$15 million, but risk would be reduced to a standard deviation of \$7 million. The entrepreneur has total wealth of \$1.5 million, \$500,000 of which must be invested in the venture. The risk-free rate is 5 percent, the market rate is 11 percent, and market standard deviation is 14 percent. The venture's correlation with the market is 0.2, and it is expected to be harvested in 5 years.

- Given the impacts of the choices on expected and return and risk, how do they affect value to the entrepreneur? Determine the percent of equity each investor would require and the value of the entrepreneur's claim in each case.
 - Which alternative would you select and why?
 - Do you think simulation could produce better estimates of value? If so, explain for each alternative how simulation could help and identify any biases due to focusing on expected cash flows and risk for the entire venture rather than for each financial claim.
- Discuss how you would expect the contracting process and contract provisions between an entrepreneur and a prospective investor to be different in the following situations:
 - There are only a few specific possible outcomes that might result from the venture. The parties know what the possibilities are and agree about the probability of each outcome.
 - Same as (a), except that the parties disagree about the probabilities of the various outcomes.
 - The future for the venture is highly uncertain, but the parties agree about the risk and expected return of the project, and know that they agree.
 - Same as (c), except that the parties do not know that they agree about risk and expected return.
 - The future for the venture is highly uncertain, and the parties disagree about the risk and expected return, but do not know whether they agree or not.
 - Explain what is meant by "bounded rationality." How would you expect bounded rationality to affect the contracting process between an entrepreneur and an investor? How would you expect the contract terms between the two to be different from a situation where "rationality" was not "bounded"?
 - Explain what is meant by "opportunism." What is the difference between *ex ante* and *ex post* opportunism? How would you expect either one to affect the contracting process and contract terms between an entrepreneur and an investor?
 - How can investments in reputation, explicit contract provisions, and investments in project-specific assets be used to create "hostages" that facilitate the contracting process? How would you expect

the provisions of contract between entrepreneurs and investors to be different in the presence of non-salvageable sunk investments by the entrepreneur, the investor, or both?

13. Suppose a venture has existing assets that are worth \$160,000 if it is successful, but only \$60,000 if it is not. The entrepreneur is seeking outside capital of \$100,000 to pursue expansion. If the venture is successful, the expansion will have a NPV of \$70,000, but only \$20,000 if the venture is not successful.
 - a) Suppose the outside investor would receive enough equity to return a zero NPV, and that the entrepreneur would retain the rest. Suppose the entrepreneur knows only that the probability of success is 50 percent. What should the entrepreneur do? To answer, analyze the values of the entrepreneur's claims, with and without investment, based on what the entrepreneur knows at the time to the decision to raise the capital and undertake the expansion.
 - b) Suppose the entrepreneur knows whether the venture will be successful or not. What should the entrepreneur do? How should the investor respond to the entrepreneur if the investor believes that the entrepreneur knows whether the venture will be successful or not? What will be the ultimate result?
 - c) Suppose the expansion opportunity has the same NPVs as above, but that the entrepreneur's existing assets are worth \$110,000, no matter whether the investment in expansion is successful or not. How does this affect your analysis and conclusions?
 - d) What do you conclude about the role that existing assets play in the investment and capital raising decision?
14. If an entrepreneur devotes all of her effort to a venture, it will be worth \$1.25 million. If she devotes no effort to it, she can consume \$1.25 million worth of other goods and activities. Suppose that as the sole owner, she prefers to devote enough effort to the venture to achieve a value of \$1.0 million.
 - a) Now suppose that she desires to sell 40 percent of the equity to an outside investor, and that the investor purchases the equity based on its existing value of \$1.0 million. However, with the entrepreneur's reduced ownership, she would decide to devote less effort to the venture, so that its new value would be only \$700,000. Analyze the wealth transfer between the investor and the entrepreneur.
 - b) Suppose the investor correctly anticipates that the entrepreneur will reduce effort once some of the equity is sold, and that with correct anticipation, the entrepreneur would devote enough effort to make the venture worth \$800,000. How much should the investor pay? What does the entrepreneur end up with instead of the original \$1.0 million of value in the venture and \$250,000 of other consumption?
 - c) Suppose the entrepreneur is a workaholic, but that the investor does not know that she is. The investor believes she would reduce effort to the point where the venture is only worth \$600,000. How might the parties use monitoring and bonding arrangements to change the deal? What can you say about how much they would be willing to spend on monitoring and bonding?
15. Alan is a printer and Steve is a publisher. Steve proposes to buy publishing services from Alan for a price of \$8,000 per day. To accept the offer, Alan must install a printing press near Steve's location. If he does, the fixed costs, amortized over the life of the press, will be \$4,500 per day. If the

contract were terminated, Alan would own the press and be able to move it to a new location to realize some salvage value. The salvage value, if moved, is \$2,000 per day. Daily operating cost of the press is \$2,500 and will be incurred by Bill for operating the press.

- a) What is the break-even price for which it would make sense for Alan to enter into a contract with Steve?
 - b) Of that total, how much would be a quasi-rent on the fixed investment and how much would be payment for the variable cost of production?
 - c) How much of the quasi-rent is appropriable by Steve once the press is in place? Why?
 - d) Suppose a third party, Ed, is willing to buy printing services from Alan at the same location as Steve, and will pay \$3,500 per day for the service. How much of the quasi-rent is appropriable?
 - e) Using this example, discuss the relationship between opportunism and the small numbers bargaining problem.
16. Suppose, in problem 13, that instead of the probability of the good state being 50 percent, it is 70 percent. Answer parts (a) and (b) of the problem with this change.
17. Suppose, in problem 13, that instead of the cost of expansion being \$300,000, it is \$100,000. Answer parts (a) and (b) of the problem with this change.
18. An entrepreneur who is seeking \$1.5 million in outside capital believes her venture can be harvested in about three years. She expects the harvest value to be \$8.0 million at that time, and believes the riskiness of the harvest-date cash flow can be represented as a standard deviation of \$5.0 million and a correlation with the market of 0.2. From this point forward, she plans to commit \$500,000 of her own human and financial capital to the venture. Assume the risk-free rate is 4 percent per year, the market rate is 10 percent, and the market standard deviation is 14 percent per year. The entrepreneur has \$1.0 million of other assets she can invest in the market.
- a. Suppose she raises the \$1.5 million from a well-diversified investor who wants to earn at least \$500,000 present value over breakeven to cover the costs of effort the investor expects to devote to monitoring the investment. If the investor agrees with the entrepreneur's cash flow projections, what fraction of common equity will the investor need to justify making the investment? What will be the value of the entrepreneur's claim (Valuation Template 5 is a convenient way to approach this problem)?
 - b. Suppose, that the investor is not as optimistic as the entrepreneur, and, instead, believes the expected harvest cash flow is only \$6.0 million. All else the same, how does this change affect the percent of equity the investor requires? How does the change affect the value of the entrepreneur's interest?
19. An investor has been approached by an entrepreneur who is seeking \$1.25 million for a venture, claiming that he expects to have the venture ready for harvesting in two years. The entrepreneur claims that harvest value is expected to be \$4.0 million at that time, and that the riskiness of the harvest-date cash flow can be represented as a standard deviation of \$4.0 million and a correlation with the market of 0.25. From this point forward, he plans to commit \$250,000 of his own human and financial capital to the venture. Assume the risk-free rate is 4 percent per year, the market rate is 10 percent, and the market standard deviation is 14 percent per year. The entrepreneur has \$1.0 million of other assets he can invest in the market. The investor is concerned that the entrepreneur, like many others, may be claiming he can get to a point where harvesting is feasible faster than he

really can. The investor would like to test the entrepreneur's commitment to complete the project in two years instead of three.

- c. Suppose the investor wants to earn \$250,000 in present value to cover her costs of monitoring the investment. Assuming two years until harvest, what fraction of equity does the investor require, and what are the present value and NPV of the entrepreneur's interest (Valuation Template 5 is a convenient way to approach this problem)?
- d. Suppose the true expected harvest date is three years. How would the investor and the entrepreneur fare if the percentage allocations of ownership from part (a) are used? Everything else is the same. Does the financing plan reveal to the investor whether the entrepreneur really believes harvest will be possible in two years?
- e. Can the investor test the entrepreneur's harvest date claim by modifying the proposed contract so that the entrepreneur is required to commit \$500,000 in financial and human capital, and the investor's commitment is reduced to offset? If the entrepreneur really believes it will take three years to get to harvest, and all else is the same, would the investor expect the entrepreneur to accept the modified proposal? Explain.