

Incidentally, it is to be noted that the smaller the slope of RR , the more rapid will be the decline of E_t in the pertinent phase of its history. In particular, in the limiting case where $R = 0$, E_t will fall directly to S once the downturn begins.

5. I am grateful to Mordecai Kurz for pointing out this curious feature of case 1 to me.

4

The Effects of Financing Opportunities and Bankruptcy on Entrepreneurial Risk Bearing

*Jerry R. Green and
John B. Shoven*

General Introduction

Initiating new ventures often requires outside financing. In this chapter, we discuss the form this financing can take. We show how the risk of bankruptcy shapes the financial contract, and how the contract can be used to regulate the subsequent choices of the entrepreneur.

Clearly, some entrepreneurial ideas have such a large profit potential that an informed financier can be attracted without difficulty. Other ideas are so poor that they cannot be financed even at the best of terms. We deal with the middle ground: projects whose profitability depends on the cost of capital.

To the extent that short-run policies such as tax rates, depreciation rules, and investment credits effect the net returns of the entrepreneur and the financier, they will have an impact upon the criteria for selecting projects. Perhaps a more important channel for stimulating entrepreneurship is by providing, in the longer run, a history of successful innovations. These can serve as a point of focus for individuals with entrepreneurial talent and encourage their efforts in that direction. In this way, the flow of potential projects can be increased.

In this chapter, the existence of the entrepreneurial ideas is taken as given. We might imagine that the prevailing business climate generates ideas of variable quality. An efficient economic system could select the socially valuable ones, finance them, and reject the others. In the real world, and in the simplified models of it we study here, this ideal is not achievable. A variety of market imperfections stands in the way. The interests of the entrepreneur and the financier are not coincident if the finance takes the

An earlier draft was presented at the Price Institute for Entrepreneurial Studies Conference, Toronto, Canada, September 22-24, 1980.

form of debt. If it is an equity interest, the incentives for managerial effort have been dulled by the presence of a silent partner. For these reasons, it is natural to expect that the system will err. Some projects will be financed when superior ones are rejected.

Some of the causes of project selection bias are natural byproducts of the financing process. Specifically, projects in small firms cannot offer a lender a risk-free return because of the size of the firm and the risks involved. Bankruptcy will loom as a possibility at the time the financing takes place. Moreover, bankruptcy entails real costs, that is, if it could be avoided, the real return to the project under those circumstances would be higher. The second key ingredient in our recipe is the simplicity of the financial contracts we allow, relative to the complexity of the relevant uncertainties. This is the primary cause of real bankruptcy possibilities. Conversely, potential bankruptcy costs are a primary determinant of the cost of finance.

The temporal resolution of uncertainties is as important as the size of the risk. The central issue is whether uncertainties are resolved before or after debt repayments are scheduled.

We show that the prospect of bankruptcy may make debt finance so expensive that it results in the premature termination of socially beneficial ventures. Moreover, such a situation cannot always be rescued by a friendly takeover.

The tendency for debt-financed ventures to overemphasize the upper tail of profit possibilities (as opposed to, say, expected returns), is well known. Although this is true when the venture is in place, the opposite bias exists when the finance still has to be attracted. Excessively safe ventures may be chosen by the entrepreneur because he can obtain financing for these on much better terms.

In most actual ventures, some discretionary choices are made after the finance has been arranged and the project actually initiated. We will assume that the entrepreneur retains control of the firm in these matters. Having locked-in his financial base, there may be a divergence between his interests and those of his creditors. Such problems can be perceived at the date the financing is arranged. We show that sometimes (but not always) the structure of the initial financing can be arranged so that the potential for conflicting interests is mitigated, or even avoided.

Our work is aimed at the interplay between the entrepreneur's decisions and the manner in which the venture is financed. The complexity of the situations we are attempting to describe requires that we take a highly stylized viewpoint. At this stage, we proceed through a set of examples designed to shed light on the timing of scheduled debt repayments, senior versus subordinated obligations, bankruptcies, takeovers, and the investment decision itself.

Description of Assumptions

It is easiest to begin by setting out some of the central assumptions. The detailed structure of our model is then described in the following sections.

The effects of uncertainty on the conduct of the new venture can be manifested in risk sharing and risk avoidance. We will concentrate entirely on the latter. Specifically, we will assume that all participants are risk neutral, thereby eliminating the issue of risk sharing. Furthermore, to simplify the examples, we assume a zero rate of real interest in discounting future cash flows.

Bankruptcy possibilities arise in our model because of the potential insolvency of the venture. Because bankruptcy entails a cost in real resources (for instance, lawyers' time in arranging a reorganization or receivership) there will be a collective benefit if this outcome can be avoided. We will see, however, that problems arise because of the limitations of financial instruments and the dynamics of decision making in the conduct of the new enterprise.

A principal assumption concerns the competitive structure of the model. Potential lenders are assumed to behave in a perfectly competitive fashion. One can imagine that the entrepreneur proposes a set of financing terms and that these are accepted whenever they offer the lenders, on average, their competitive return.

We further suppose that the entrepreneurs and financiers have the same information about the nature of the undertaking, the decisions that will be faced at later stages, the relevant risks, and the possible needs for further capitalization. If additional borrowing is undertaken, the claim of the new lenders on future cash flows is strictly junior to the commitments made to the initial financiers. Subject to this priority, however, additional financing is obtained on competitive terms, as was the initial financing.

Finally, we assume that the entrepreneur retains sole control of the venture once it has started. Any subsequent decisions, real or financial, will be made in his own best interest. Moreover, the other participants in the enterprise know, at the time their commitment is made, that its future conduct will be determined in this way.

Available Financial Instruments

In the world we have just described, there is a very simple optimal financing package: all capital is equity capital, sharing equally in all profits and losses. By avoiding any debt obligations, the potential for bankruptcy is eliminated. All owners will obviously agree on the decisions to be taken;

and, as risk sharing is irrelevant, full efficiency can be achieved. There are a variety of reasons why this does not happen in reality. First, the incentives for efficient management are blunted to the extent that the entrepreneur is not the only marginal beneficiary of improved performance. Institutional restrictions, risk averse behavior, and differential information (all assumed away in our model) are other possibilities. Substantial equity participation by outside investors is often observed, but as our focus will be on the conflicts between holders of different financial claims, the analysis will proceed by treating all outside finance as if it took the form of debt. The terms on which loans are made will be determined as part of the solution of the model.

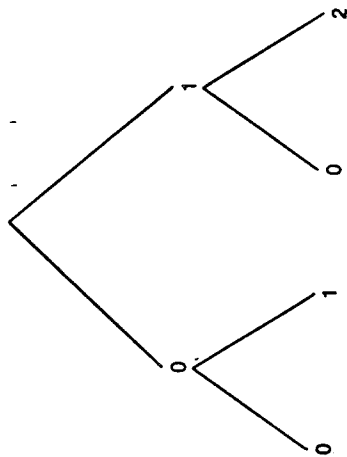
The nature of the debt contract is central to all of our results. Therefore, it is worthwhile to pause and consider the modeling of these obligations in detail. We assume that promised repayments cannot be made dependent upon any events that befall in the project, or upon any future decisions to be taken by the entrepreneur. This entails two consequences. First, debt repayment cannot be tailored to match the available cash flow. If it is insufficient, either the deficit must be financed by further borrowing on competitive terms, or the debt is in default and bankruptcy is declared. Second, if the cash flow exceeds the amount required for debt service, no restriction on dividends can be imposed. In our simple examples, any such excess will be garnered by the entrepreneur. Because all parties have complete information at the outset, this will be foreseen, and it will be reflected in the equilibrium financial arrangements.

In reality, of course, both of these restrictive assumptions are often circumvented. Complex debt contracts can be written. Convertible debt, mortgage bonds, and other instruments have equity characteristics that help protect the lenders while avoiding the real costs of bankruptcy. Direct restrictive covenants are used to avoid some of these problems as well. These facts only demonstrate the severity of the issue. In some cases, these more complex debt instruments effectively act as equity by eliminating the possibility of bankruptcy and removing the conflicting interests that distort investment decisions. However, no contract except real equity participation can always be flexible enough to entirely avoid the problem. Therefore, our use of rather extreme assumptions should be viewed as a stylized way of studying the consequences of incompleteness in the financial contracting process, rather than as an attempt to depict actual financial arrangements.

Structure of the Model

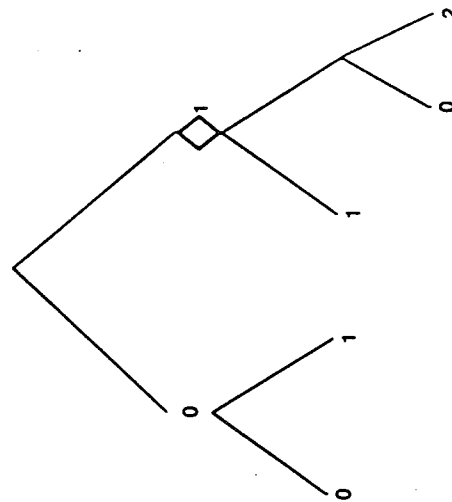
With these preliminaries out of the way, we can now describe our model. The project is assumed to require \$1 of additional debt capital that must be

raised at the outset. Once initiated, the net cash flows before subtracting debt repayments are described by a tree structure as they evolve over time. For example,



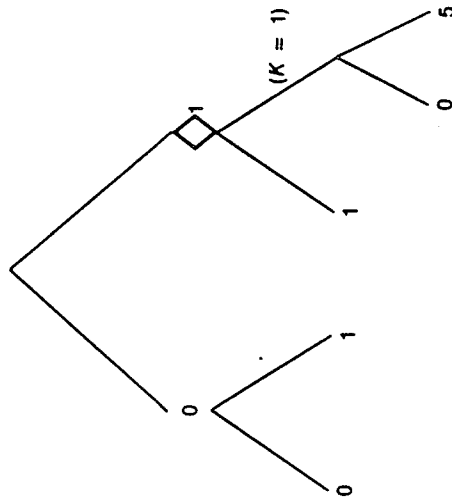
means that at the next date, a cash flow of either 0 or 1 will be realized, and at a subsequent date the possibilities are either 0 or 1, or 0 or 2. Unless otherwise specified, the probabilities of branches emanating from the same node of the tree will be assumed equal.

Some of our examples also involve decisions on the conduct of the project at subsequent dates. These form an important part of our analysis, and they will be indicated by the diamond symbol at the node where the decision is taken. For example,



means that if a cash flow of 1 is realized at the first date, the entrepreneurs can choose between a sure cash flow of 1 and a risky prospect with the same mean.

Finally, some subsequent decisions might require new capital beyond the initial \$1. If so, these will be indicated by the symbol "(K =)" next to the corresponding branch of the tree. For example,



means that to choose the risk option requires an additional unit of capital, but the safe option can be pursued without further costs.

Equilibrium

Because the entire tree structure describing the prospects of the venture is common knowledge to lenders at the start, the future conduct of the entrepreneur is perfectly predictable. An equilibrium is a complete dynamic description of the financial arrangements and real decisions, and has the following two properties:

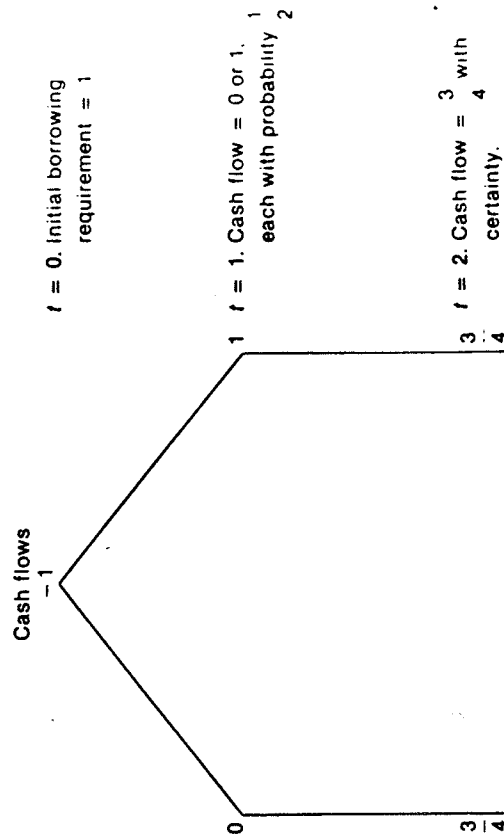
1. At any time, the entrepreneur will always behave in his own best interest. Furthermore, he has a rational perception of the consequences of any action he might take.
2. Lenders, knowing that this is true, use it to compute the anticipated return on their investments. It is this expectation that must meet the competitive standard.

This type of equilibrium is called perfect in the game-theoretic literature because it is internally consistent and the participants are completely rational.

Examples Using the Model

Example 1

We begin with the simplest example of financing when bankruptcy is possible.



By assumption, the entrepreneur cannot finance the \$1 initial cost with his own funds, and must seek external sources. Bonds are issued with required payments D_1 and D_2 in payment periods 1 and 2, respectively. The cash flow structure is as pictured. Our zero interest rate and risk neutrality assumptions imply that the project has a total economic value of $1\frac{1}{4}$ and a surplus of $1/4$.

Our assumptions about the occurrence of bankruptcy and its associated real costs are as follows: If the contractual obligation to debt holders is positive at time 1, and if the worse event is realized, there will not be any cash to pay them. We assume that this state of affairs leads to a bankruptcy. The remaining cash flow prospect (which in this case is a sure $3/4$ at date 2) is sold to another firm or individual, but at an unavoidable cost of C . Thus the debt holders can recover only $3/4 - C$.

One may ask why the debt holders should press for a forced sale of the firm, rather than letting the original entrepreneur continue operation, which will give them $3/4$ with certainty. Rationality should lead them to this benign course of action. Forced bankruptcies, however, do exist in the world, and it is the real costs of bankruptcy that drive all the examples in

this paper. Many bankruptcies are avoided (or at least postponed) because debt holders are lenient in pressing their claims, extend credit, or carry accounts receivable. This only attests to the magnitude of the real costs they are attempting to avoid. Nevertheless, we must assume that there is some divergence of interests between debt and equity, lest we implicitly convert the former into the latter and obviate the need for this entire analysis. The simplicity of these examples should not belie the difficulty of realizing such coordination in practice.

Suppose first that the entrepreneur tries to avoid a bankruptcy at time 1 by setting $D_1 = 0$. We assume that the equity holder (entrepreneur) cannot be contractually prevented from paying dividends in a period in which cash flows permit such after all current debt obligations have been paid. Thus, if the cash flow in period 1 turns out to be unity, and if D_1 has been set at zero, the equity holders will declare the \$1 as a dividend. The total return to the debtholders will be $3/4$ (the certain return in period 2) but this is insufficient to compensate them for their initial outlay. The problem is that while $D_1 = 0$ is compatible with the avoidance of bankruptcy costs, it is not compatible with offering lenders competitive terms.

Because of the above arguments, D_1 must be positive in any equilibrium. This implies that bankruptcy will occur with probability $1/2$. In the event that the cash flow of the company in period 1 is zero, the firm's value is just $3/4 - C$, since bankruptcy costs must be paid. All of this goes to the bondholders. To offer the lenders a competitive rate of return, the better branch must have an expected present value of $1/4 + C$. Debt repayments cannot be set at levels above the maximum cash flow (that is, $D_1 \leq 1$, $D_2 \leq 3/4$), so the condition for competitive lending terms is

$$\min(1, D_1) + \min\left(\frac{3}{4}, D_2\right) = 1\frac{1}{4} + C \quad (4.1)$$

Possible solutions are shown in figure 4-1.

If C , the bankruptcy costs, is less than $1/2$, any financial terms on segment AB are feasible. The project can be undertaken, and the residual value or profit to the entrepreneur is

$$\frac{1}{2}((1 - D_1) + (\frac{3}{4} - D_2)) = \frac{1}{4} - \frac{C}{2} \quad (4.2)$$

An all-equity venture, on any financial structure that prevents the possibility of bankruptcy, will have a value of $1/4$. However, as we have seen, if the project is financed with debt, it can only proceed if bankruptcy costs are less than $1/2$. Furthermore, there is a 50 percent probability that the bankruptcy costs will be paid.

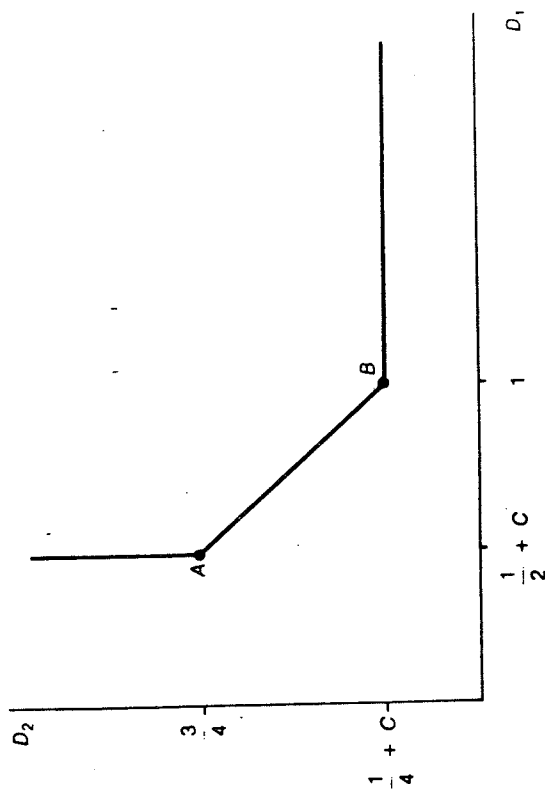
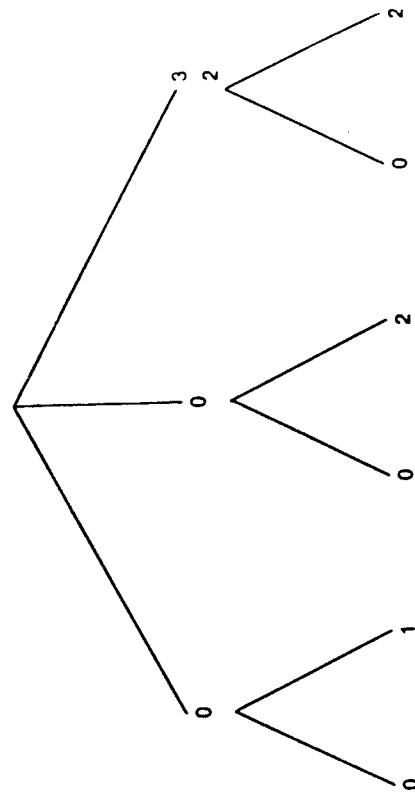


Figure 4-1. Required Promised Repayments to Finance Venture in Example 1

Example 2



In the second example of our model, there are three possible outcomes at $t = 1$, with all branches equally likely at each t . What this example

illustrates is that bankruptcy can spread or spill over from one branch to another because of the constraints on financial structure. To obtain a competitive return, debt holders must increase their terms to offset the bankruptcy that occurs in one branch. However, this increase in terms may doom other probability branches (that is, lead them to bankruptcy).

In this example, assume that only the left branch leads to bankruptcy. In that case, the debt must be structured so that

$$\frac{1}{3}\left(\frac{1}{2} - C\right) + \frac{2}{3}D_1 + \frac{1}{3}D_2 = 1$$

or

$$\frac{2}{3}D_1 + \frac{1}{3}D_2 = \frac{5}{6} + \frac{1}{3}C \quad (4.3)$$

Since $D_2 \leq 2$, this requires $D_1 > 0$. Thus the firm is insolvent along the middle branch. Any attempt to save the project along the middle branch by refinancing with junior debt will fail. If such an attempt is to succeed,

$$\frac{1}{2}(2 - D_2) \geq D_1 \quad (4.4)$$

since the probability of the \$2 payoff in period 2 is $1/2$. Condition (4.3), in conjunction with $D_1 \leq 3/2$, $D_2 \leq 2$, requires that the debt terms be on the line segment AB in figure 4-2. Condition (4.4), however, requires that the terms be on or below CD . Therefore, even though the middle branch has an expected present value of one, it will lead to bankruptcy.

Given that both the left and center branches involve default, the condition to offer debtholders a competitive return can be written as

$$\frac{1}{3}\left(\frac{1}{2} - C\right) + \frac{1}{3}(1 - C) + \frac{1}{3}D_1 + \frac{1}{6}D_2 = 1$$

$$D_1 \leq \frac{3}{2}, \quad D_2 \leq 2 \quad (4.5)$$

This has feasible solutions along line segment $\overline{EF}$ in figure 4-3 as long as $C \leq 1/2$. It should be noted that $\overline{EF}$ is strictly northeast of $\overline{AB}$ in figure 4-2. That is, the competitive lending terms have been increased to offset the now $2/3$ chance of incurring bankruptcy costs.

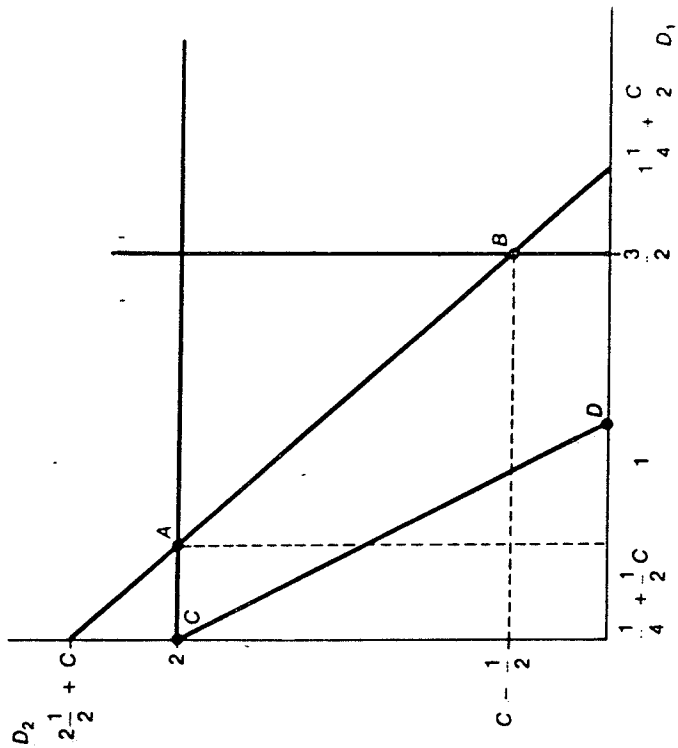


Figure 4-2. Required Promised Repayments to Finance Venture in Example 2: Only Left Branch in Default

Example 3

It is often observed that bankruptcy provisions can bias equity holders toward riskier prospects, since limited liability effectively insures them against extremely low or negative cash-flow outcomes [see, for example, Bulow and Shoven (1978)]. The extreme example of this occurs in a firm with (temporarily) adequate cash flow, but a negative net worth. If the equity holders are prohibited from paying dividends in such a situation, their best alternative strategy is to invest in extremely risky projects, in the hope of giving the firm some chance to survive.

While the above argument is relevant for an ongoing concern, the focus in our model is rather on the financial arrangements of a new venture. We show in this example how the incentives for risktaking can be reversed when we look at the problem of *ex ante* financing. The choice among projects can be influenced by the cost of capital. As lenders have complete information

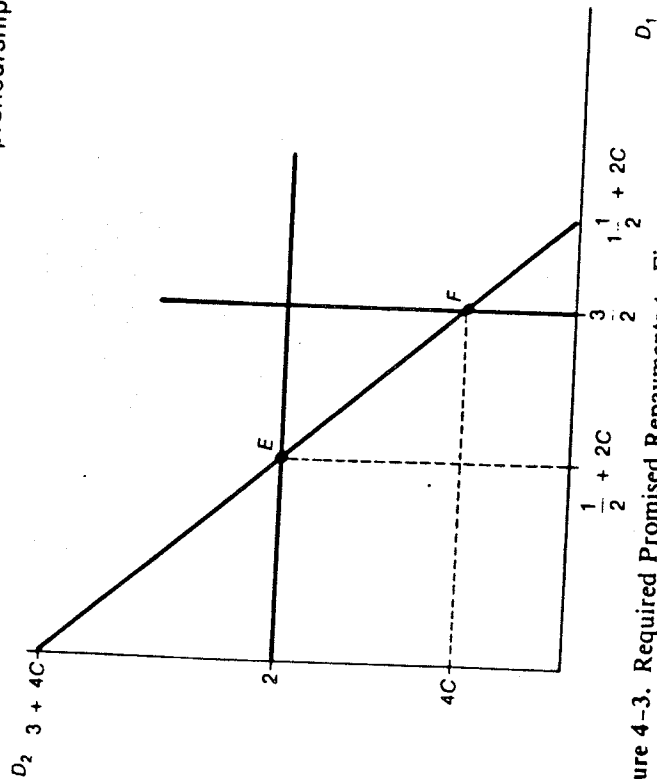
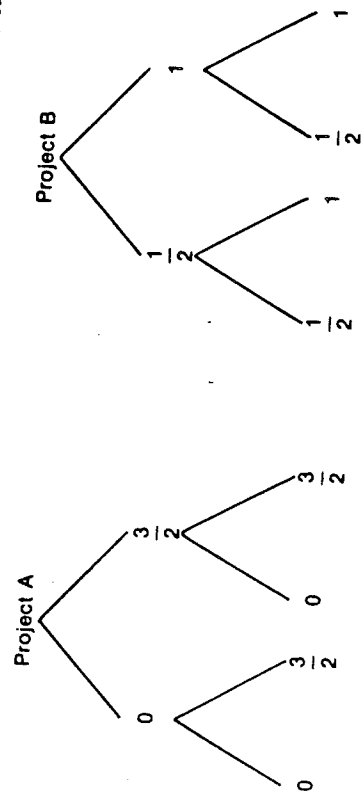


Figure 4-3. Required Promised Repayments to Finance Venture in Example 2: Left and Middle Branches in Default

about future prospects, they can offer better terms to entrepreneurs who can demonstrate that their debt is less risky. In order to avoid bankruptcy costs, the safer of two projects may be preferred, even if the expected present value of its cash flows (excluding bankruptcy costs) is somewhat less than that of a risky project.

We compare two projects with the same expected present value of cash flow.



Effects of Financing Opportunities

61

The competitive return constraint for the lender for project A is

$$D_1 + \frac{1}{2}D_2 = 1\frac{1}{4} + C$$

$$D_1 \leq \frac{3}{2} \quad D_2 \leq \frac{3}{2} \quad (4.6)$$

This can be financed as long as $C \leq 1$ along the line segment AB in Figure 4-4. The return to the equity is

$$\frac{1}{2}\left(\frac{3}{2} - D_1\right) + \frac{1}{4}\left(\frac{3}{2} - D_2\right) = \frac{1}{2}(1 - C) \quad (4.7)$$

Project B, the safer project with the same expected present value, can be financed with debt by setting $D_1 = D_2 = 1/2$. There is no possibility of

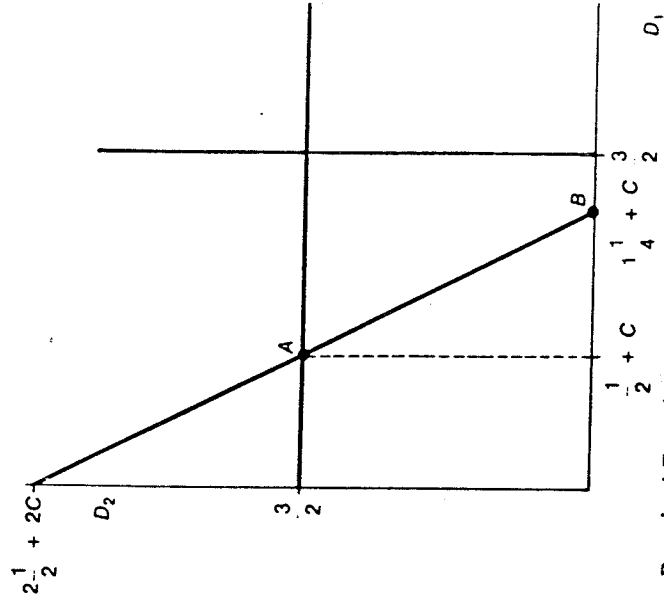


Figure 4-4. Required Promised Repayments to Finance Venture in Example 3

bankruptcy, and therefore, no premium need be included in the terms of the loan. The entrepreneur can realize a higher expected present value given by

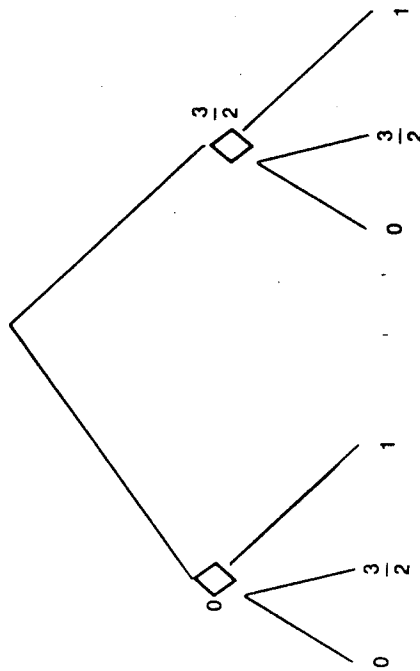
$$\frac{1}{2}\left(\frac{1}{2}\right) + \frac{1}{2}\left(\frac{1}{2}\right) = \frac{1}{2} > \frac{1}{2}(1 - C) \quad \text{for } C > 0 \quad (4.8)$$

Therefore, project *B* will be preferred. The lesson is that bankruptcy costs impose a kind of nonconvexity in the evaluation of projects, favoring those whose cash flows do not threaten default.

Examples 4 and 5 should be viewed in parallel. They address the issue of whether the entrepreneur can effectively commit himself to the socially superior course of action through his prior financial arrangements, even though the actual decision will be taken at a later date when he retains control and when he might have the incentive to act against the bondholders' interests. This type of financial strategy is possible, as in example 4; but it is not always the case, as example 5 will demonstrate.

Example 4

Example 4 involves a choice at time $t = 1$ of a safe or a risky investment, as shown below. The entrepreneur can choose between a project that pays a certain \$1 and one with a 50-50 chance of 0 or $3/2$.



The safer project clearly has a higher expected present value. However, with the initial financing set at $t = 0$, the question we now ask is whether the entrepreneur will choose the safe or risky profit at $t = 1$. Can the entrepreneur

neur, by suitably structuring the initial financing package, make it credible that *ex post* he will not opt for the risky (inferior) alternative despite its better upper tail?

Suppose the entrepreneur announces at time $t = 0$ that he will choose the risky investment at $t = 1$. The cash-flow pattern is thus identical to project *A* in example 3. If the worse event happens at $t = 1$, the firm will go bankrupt and its value will be $1 - C$, rather than $3/4 - C$. The possible financing is thus given by

$$\frac{1}{2}D_1 + \frac{1}{4}D_2 + \frac{1}{2}(1 - C) = 1$$

or

$$D_1 + \frac{1}{2}D_2 = 1 + C \quad (4.9)$$

If we set D_1 to $3/2$, then $D_2 = 2C - 1$. The value to the entrepreneur is

$$\frac{1}{4}\left(\frac{3}{2} - 2C + 1\right) = \frac{1}{4}\left(\frac{5}{2} - 2C\right) = \frac{5}{8} - \frac{C}{2} \quad (4.10)$$

If, after obtaining this financing, the entrepreneur considers switching to the safe choice, the value of his choices at the decision juncture are

$$\text{Risky: } \frac{1}{2}\left(\frac{3}{2} - D_2\right)$$

$$\text{Safe: } 1 - D_2 \quad (4.11)$$

Therefore, he will have an incentive to contradict his promise of choosing the risky option if

$$1 - D_2 > \frac{3}{4} - \frac{D_2}{2}$$

or

$$D_2 < \frac{1}{2}$$

The lowest D_2 can be is $2C - 1$. Therefore, if $C \geq 3/4$, there will never be an incentive for switching, and we will have a perfect equilibrium in the sense that precommitments will be kept. If $C < 3/4$, the announced choice may not be followed, depending on whether $D_2 < 1/2$.

Now, let us examine the case where the entrepreneur commits himself in advance to the safe strategy along the right branch. In this case, the debt requires that

$$\frac{1}{2}(D_1 + D_2) + \frac{1}{2}(1 - C) = 1$$

or

$$D_1 + D_2 = 1 + C \quad (4.12)$$

A natural question, of course, is why not set the financing at $D_1 = 0$ and $D_2 = 1$, thereby eliminating the risk of bankruptcy. This financing, however, is obviously not compatible with equilibrium. With this financial structure, it would be in the interest of the entrepreneur to choose the risky investment. Note that the entrepreneur's profit with a precommitment to the safe strategy is

$$\begin{aligned} \frac{1}{2}\left(\frac{5}{2} - D_1 - D_2\right) &= \frac{1}{2}\left(\frac{3}{2} - C\right) \\ &= \frac{3}{4} - \frac{C}{2} \end{aligned} \quad (4.13)$$

which dominates the $5/8 - C/2$ yielded by the precommitment to the risky move. The question we want to examine is whether the commitment can be made credible. At $r = 1$, the prospects are valued at

$$\text{Safe: } 1 - D_2$$

$$\text{Risky: } \frac{1}{2}\left(\frac{3}{2} - D_2\right) \quad (4.14)$$

For small D_2 , the safe strategy dominates, for larger D_2 , the risky strategy gives the larger return. Since $D_1 \leq 3/2$, $D_2 \geq C - 1/2$. Safe is at least as good as risky as long as

$$1 - D_2 \geq \frac{1}{2}\left(\frac{3}{2} - D_2\right)$$

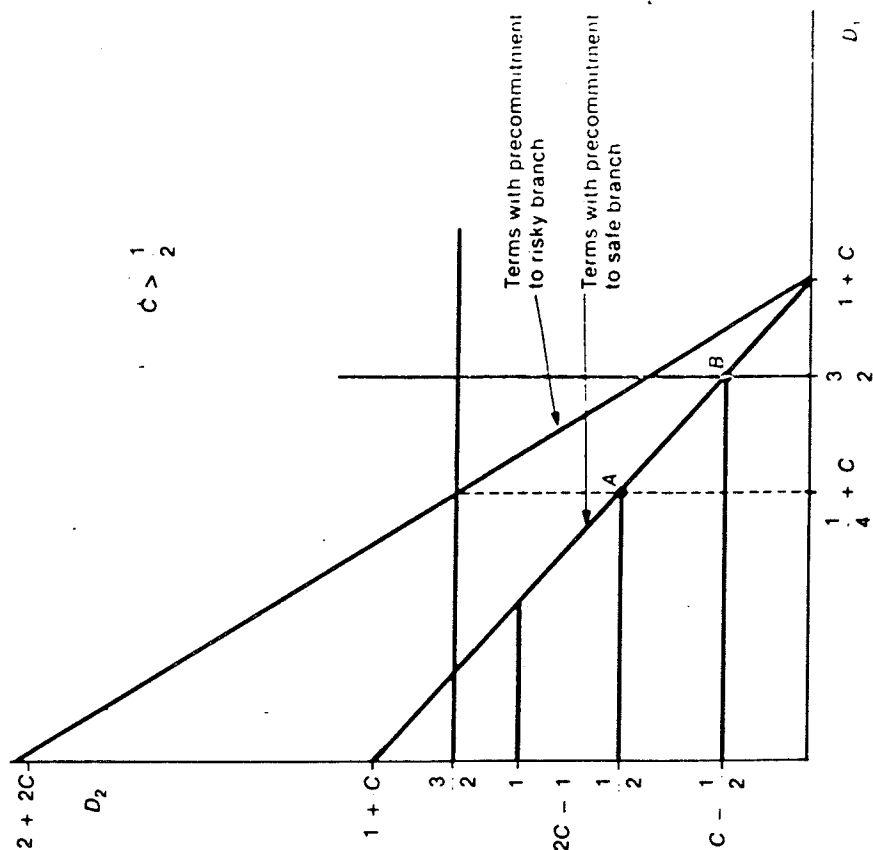


Figure 4-5. Two Self-Enforcing Promised-Repayment Plans to Finance Venture in Example 4

or

$$D_2 \leq \frac{1}{2}$$

Collecting our results, we see that a credible precommitment to the safe investment can be made as long as $C - 1/2 \leq D_2 \leq 1/2$. Clearly C must be less than unity. The financial terms are illustrated in figure 4-5.

It shows that the financial terms are better for the entrepreneur if he can make the safe commitment. This can be done only along the segment

valuable to the entrepreneur and has a higher return; however, it cannot be sustained as an equilibrium.

Consider a safe precommitment. At the decision node, the choice facing the entrepreneur is

Safe: $1 - D_2$

$$\text{Risky: } \frac{1}{2}(2 - \epsilon - D_2) = 1 - \frac{D_2 - \epsilon}{2} \quad (4.19)$$

Risky will be chosen if

$$1 - \frac{D_2 - \epsilon}{2} > 1 - D_2$$

or

$$D_2 > \epsilon$$

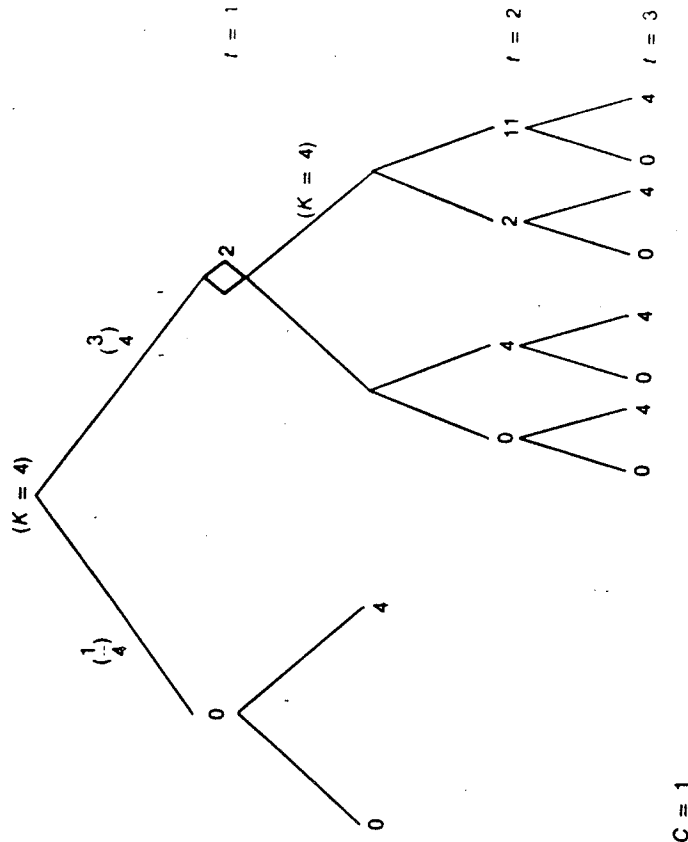
To make D_2 as small as possible with the safe precommitment, D_1 is set to $3/2$ and D_2 to $C - 1/2$. However, if $C - 1/2 > \epsilon$, there is no way to make the safe precommitment valid, and the risky option must be chosen even though it is socially less valuable.

Example 6

One phenomenon of great practical importance in many new ventures is the possibility of a takeover by a large corporation. Reasons for takeovers are quite varied. We will consider only one in this example. The need for more capital to finance a good investment project can be better met by a large outside investor than by the original entrepreneur, who must issue additional risky debt.

As in the examples above, the point to be emphasized is that the foresight of all concerned will influence the initial financing and, hence, the subsequent behavior of the entrepreneur. Debt must be so contracted that the takeover will be beneficial both to the outside firm and to the entrepreneur. Only in this case can it be rationally predicted. The cash-flow structure is as follows:

Effects of Financing Opportunities



To find the financing plan that gives the entrepreneur the highest expected profit, we must consider cases that depend on whether or not the original lenders perceive that a takeover will occur at $t = 1$. Within each case, we will compute the relevant values to the entrepreneur and the outside firm as they depend on the subsequent actions chosen.

1. **No Takeover, Entrepreneur Declines New Project.** Let us first assume that no takeover is perceived, and that the new investment will not be undertaken by the entrepreneur using a new debt issue. Lenders then perceive the expected value of the promised repayment sequence (D_1, D_2, D_3) , with $D_1 \leq 2$, $D_2 \leq 4$, and $D_3 \leq 4$, to be

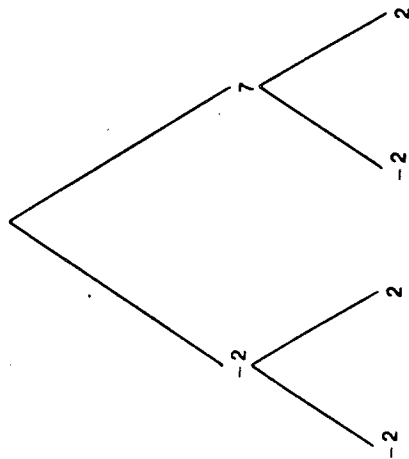
$$\frac{1}{4}(2 - C) + \frac{3}{4}D_1 + \frac{3}{8}(2 - C) + \frac{3}{8}D_2 + \frac{3}{16}D_3 \quad (4.20)$$

For this to be feasible, its value must at least be 4, or

$$\frac{3}{4}D_1 + \frac{3}{8}D_2 + \frac{3}{16}D_3 = \frac{27}{8}$$

If the entrepreneur behaved as predicted and did not finance the additional investment, his initial expectation could be computed by taking $D_1 = 2$, $D_2 = 4$, $D_3 = 2$, which gives a value of $3/8$. Other financing plans satisfying (4-20) would have the same value.

2. No Takeover, Entrepreneur Accepts Project. Will the failure to invest be verified? From the viewpoint of a new lender, the cash flow remaining in the new investment after D_2 and D_3 have been repaid will be



The left-hand branch yields nothing to new debt holders. The original lenders would insist on a bankruptcy to get back 3 out of the 4 they are owed. [They would receive the cash flow (2) and the net bankruptcy value of the remaining firm ($1/2 \cdot 4 - 1 = 1$)]. Note that bankruptcy could not be avoided by issuing debt at this point to cover the cash-flow deficit.

On the right-hand branch, the residual cash flow is worth 8 ($7 + 1/2 \cdot 2$) to new lenders. Back at the decision point ($t = 1$) their expectation is just 4; therefore, the financial package is just barely feasible.

Will the entrepreneur borrow on these terms and thereby invalidate the beliefs of lenders who financed the original investment? No. The new loan repayments would wipe out all of the profit, even in the most favorable of circumstances. Therefore, if investors believed that the entrepreneur will not finance his future investment, they would demand terms under which this belief could be verified *ex post*.

3. No Takeover Anticipated, Entrepreneur Seeks Takeover Offer at $t = 1$. Now we introduce the possibility that even though a takeover was not anticipated by lenders, *ex post* the entrepreneur seeks a takeover by a large firm at $t = 1$. In such a situation, the outstanding debt obligations must be honored. The parent firm cannot repurchase the debt at market values

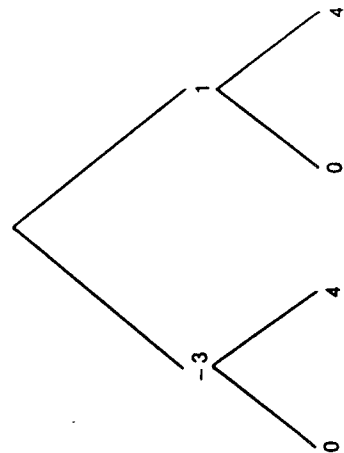
reflecting default risk and then proceed with the takeover, because the expectation of this will cause the market price to reflect the full default-free value. With the debt structure (2,4,2) shown above, the parent firm would have a gross expected return of $1/2(2) + 1/4(4) + 1/2(1) + 1/4(0) = 8/8 = 1$. The debt obligations are worth 6 and the additional capital requirements are worth 4, making it impossible to compensate the entrepreneur at all. Therefore, a takeover is not financially possible with this debt structure.

4. Takeover Anticipated, Terms Defined by Opportunity Cost of the Entrepreneur. On the other hand, suppose that we assume that the original lenders believe from the beginning that there will be a takeover. Can this be verified *ex post*? The lender in this case thinks that in the worse event they will recover 1, because the firm will be worth 2 and the bankruptcy costs absorb 1 (by assumption) in this example. In the better event, the debt is made riskless because of the takeover. Therefore, the breakeven value for lenders is given by

$$\frac{1}{4} + \frac{3}{4}(D_1 + D_2 + D_3) = 4 \quad (4.21)$$

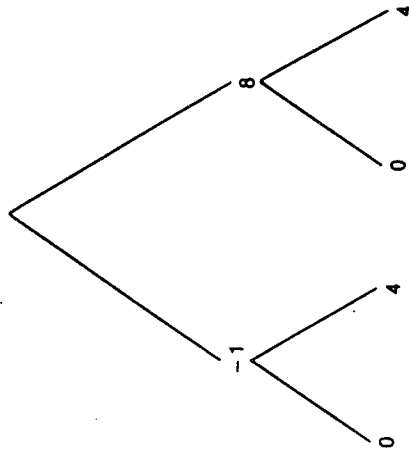
Consider, for example, the solution $D_1 = 2$, $D_2 = 3$, $D_3 = 0$. Note that these terms are strictly better than those considered above, where a takeover was not feasible.

To see whether takeover will occur here, we have to find out the maximum value realizable by equity if (contrary to lenders' beliefs) the entrepreneur does not submit to the takeover. This maximum must be computed for both the case in which the entrepreneur tries to undertake the additional investment and that in which he does not. First, assume that the entrepreneur chooses not to make the additional investment when it is possible. Their net prospects at $t = 1$ after debt repayments are,



Clearly the left-hand branch results in bankruptcy, so we are left with an overall expected value of $3/2$. If they do invest, they must raise 4 units of

capital to be repaid out of the net proceeds remaining after senior debt obligations are met:



Let these junior obligations be denoted d_2 , d_3 . If there is to be no default on this junior debt, we must have $d_2 \leq 1$ on the left-hand branch. Were $d_2 > 1$, the obligations would exceed the remaining expected value of the firm on the left-hand branch. However, $d_2 = 1$ implies that $d_3 \geq 6$ is required to satisfy the breakeven condition for junior lenders. This is clearly unfeasible, so junior debt must be risky if it is viable at all. Risky junior debt will get no payoff on the left-hand branch because the senior debt will force a bankruptcy that will leave zero value remaining. The breakeven condition for junior debt is, thus,

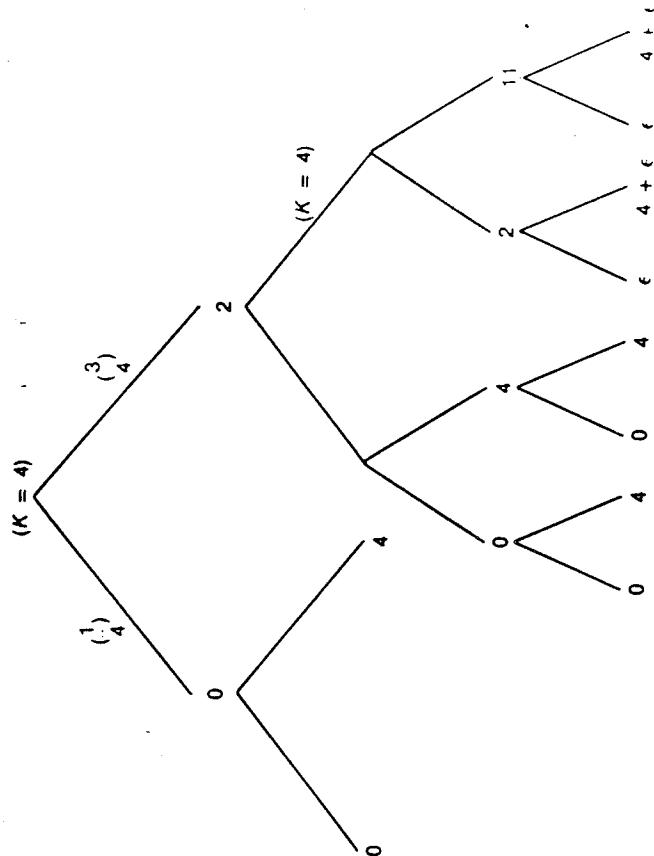
$$\frac{1}{2}d_2 + \frac{1}{4}d_3 = 4 \quad (4.22)$$

Take, for example, $d_2 = 8$, $d_3 = 0$. Under this option, the value to equity is entirely due to the payoff of 4 they receive on the rightmost branch at $t = 3$. The value viewed from $t = 1$ is just 1, which compares unfavorably to the "don't invest" option of $3/2$. To summarize, given that the debt is structured according to the belief that a takeover will occur, the best policy the entrepreneur can follow in resisting a takeover is not to make the new investment, yielding an expected value of $3/2$ from the potential takeover point onward. The takeover firm must give him at least $3/2$ if he will yield control.

5. Takeover Anticipated, Is It Profitable? Will there be a successful takeover? The debt is worth 3, the new investment is worth 4, and equity costs $3/2$, which is its opportunity cost as computed in sub-section 4 above. Total

outlay will be 8 1/2 (exactly equal to the gross value of the project) so the takeover is a borderline case.

It is easy to modify the example slightly to make takeover strictly superior. For example,



for $1/2 > \epsilon > 0$. It is still better (given no takeover) for the entrepreneur not to invest and get $3/2$ than to undertake the investment and get $1 + \epsilon$. His reservation value is not increased at all; thus, the cost of the takeover is still the same. The value is, of course, higher, and so it is strictly preferred and can be confidently predicted by the initial lenders.

Conclusion

Through a series of highly stylized examples, we have illustrated that the interaction of the entrepreneur and his financiers can lead to socially inferior outcomes, even though both parties have complete information and identical attitudes toward risk. This result comes from the rigidity of the debt contract and the fact that once the initial financing is set, neither the entrepreneur nor the financier are interested in maximizing the total (social) return of the venture. Despite the fact that everyone rationally understands

the incentives faced by the other participants, costly bankruptcies might occur and less than optimal investments might be undertaken.

Our framework of analysis has been kept extremely simple to highlight the results. In fact, however, we believe that the type of outcomes we have derived are even more likely in a more realistic environment. For example, taxes have not entered our examples; but these clearly affect bankruptcies and takeovers in a monumental manner. First, for a firm with its primary financing set, a tax system with symmetrical loss offsets the variance of net cash flows, lowering the value of the entrepreneur's position and encouraging bankruptcy. At the same time, as tax-loss carry-forwards are forfeited in bankruptcy, but assumed in a takeover within the same industry, the tax system favors takeovers relative to bankruptcies. Similarly, differential risk aversion and asymmetric information can add to the likelihood of non-optimal outcomes.

We have not highlighted all of the results generated by models of the type presented. One that others have noted (White 1980) deals with the principle of investment diversification. Risk-averse investors place a premium on assets that have a negative covariance with the individual's existing portfolio. If one is risk neutral (as in this model) covariance is a matter of indifference. Here, however, once financing is set, the entrepreneur may strictly prefer additional investments that have a positive covariance with the cash flows of the existing firm. The reason is clear—namely, total variance increases the value of the claimant of the upper tail, that is to say the equity holders or the entrepreneur. As we saw in our examples 3 through 5, this result would likely be reversed if we considered the problem before the financing was fixed.

The class of problem examined here is very relevant for fledgling firms seeking either bank financing or venture capital. These enterprises almost always face a nonnegligible bankruptcy probability, and the idea of entrepreneurial talent is frequently embodied in one individual. The lenders may have information regarding the prospects of the firm, but must leave control in the hands of the entrepreneur. The question we have addressed is whether entrepreneurs and such informed, competitive lenders can cooperate in initiating and financing ventures in a socially efficient manner.

References

- Bulow, J., and Shoven, J. "The Bankruptcy Decision." *Bell Journal of Economics*, 9, 2 (Autumn 1978):437-456.
 White, M.J. "Public Policy Toward Bankruptcy: Me-First and Other Priority Rules." *Bell Journal of Economics*, 11, 2 (Autumn 1980): 550-564.

5

Entrepreneurial Concepts, Definitions, and Models: Formulations

Harold N. Shapiro

Introduction

This chapter concerns a variety of ideas that relate to the formulation and possible understanding of problems concerning entrepreneurial activities. It is intended as a rough map of the terrain, with some indication of roads that might be traveled. There is much conjecturing as to what might be seen on such a journey, but this is not the report of an actual trip.

Though economic theory as a science, and its application as an art form, are much advanced (with reference to our current social complex), the very basic role of the entrepreneur, its definition, its measurement, and the determination of its influence and implications, has not received a deserving share of investigative effort. Certainly, it would be presumptuous to assume that the efforts represented by this modest book could fulfill this need. Rather, it is the hope of this and the other chapters to renew and sharpen the focus on those problem areas that relate to the entrepreneur and his activities.

Quite independently of any formal definitions, the entrepreneur functions and performs within, and is motivated by, the economic, social, political, and cultural frameworks in which the entrepreneurial activity is imbedded. In a sense, all of economic theory is an effort at uncovering and understanding the relevant economic framework. Moreover, psychology, sociology, government, and history all contribute to the determination of the rules under which the entrepreneur operates and of the forces that operate on him.

Viewed from this perspective, the avowed objective of studying entrepreneurship is much easier stated than achieved. Indeed, it appears to imply an almost prohibitive awareness and command of both the facets and dynamics of modern society. Prohibitive not only from the point of view of the intellectual capacity of the investigator, but also simply because much of the required factual information does not exist. How then does one cope with the difficulty of organizing the analysis of this complex situation in the face of such intellectual and informational handicaps. We begin our answer to this by setting as our goal the establishment of a general framework for