PART IV

Security Design: The Control Right View

10

Control Rights and Corporate Governance

10.1 Introduction

Covenants can only go so far in determining a firm's future course of action. New information accrues and circumstances that were not clearly conceptualized at the onset arise after the initial funding has been secured. The firm therefore needs a governance structure that will elicit the parties' information and act on it to select a range of short-term and long-term decisions over which parties may have dissonant preferences: day-to-day management, choice of personnel, refinancing and dividend distribution, investments, mergers and acquisitions, and so forth.

This chapter takes a look at the design of decision processes and in particular at a special class of decision processes, namely, "decision rights" or "control rights." By "control right," I mean the right for a party (or group of parties) to affect the course of action in certain circumstances once the firm has gotten started.[1,2] Despite their simplicity, control

rights come in many guises: they can be contingent ("debtholders receive control if covenant X is violated"; "the venture capitalist surrenders control rights to the entrepreneur if certain financial or nonfinancial performance criteria are met"). They cover certain decisions, but not others. And they may be induced by another control right: control over decision A (the primary control right) may implicitly grant some control over decision B (i.e., an induced control right) even if, formally, one has no control over the latter decision. That is, one can use one's control right over decision A as a bargaining chip to obtain concessions along dimension B. For example, when a class of investors has gatekeeping power over the issuing of senior claims and therefore may control financing (the primary right stems from covenants such as "investor Y cannot be diluted without his assent" or "the holders of short-term debt can force liquidation if the payments are not made on time"), the need to secure the assent of the holders of such rights gives the latter a control over future decisions that is sometimes as strong as that provided by an explicit control right.[3] These examples as well as the fact that some types of shares carry special voting rights also demonstrate that charters, contracts, and the law may disconnect cash-flow rights and control rights.

In a sense, we already touched on the issue of control rights when we discussed active monitoring in Chapter 9. We assumed that the active monitor could reduce the extent of moral hazard by ruling out some egregious forms of managerial misbehavior. Conditional on the active monitor being informed,

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1. In general, decision processes are much more complex than just giving someone the right to decide. For example, in politics, a complex web of sequential rights (gatekeeping power by committees, bicameral enacting process, presidential or judicial review, etc.) is often used to produce new legislation.

2. I will not dwell here on the issues of whether control rights are best formalized in a complete or an incomplete contract setting or what an incomplete contract is exactly (see Maskin and Tirole (1999a,b) and Tirole (1999) for discussions of these issues). The distinction is irrelevant for what follows.

It is worth reminding the reader, though, that complete contracting does not mean that the future course of action is described in the initial contract (otherwise, the notion of control right would be meaningless). For one thing, the parties' preferences over known alternative actions may not be known *ex ante*; furthermore, future actions may not be describable when designing the contract. A control right allocated to one of the two parties is a simple way to elicit this information. Complete contracting simply means that the parties write an optimal contract given their limited knowledge of their future preferences and of the set of future alternatives.

The impact of the allocation of control rights received its first formal analysis in Grossman and Hart's (1986) and Hart and Moore's (1990) models of incomplete contracts (see also Williamson's (1985) less formal approach).

3. To give another example, it is often said that an independent regulatory agency is never really independent if Congress controls its budget. The argument is that Congress can threaten to substantially reduce the agency's budget in order to influence decisions that it is otherwise formally unable to control.

there was no issue as to whom the control right should go to, though: interference by the monitor increased *both* the NPV and the pledgeable income. It was trivially optimal to let the monitor interfere, and there was therefore no interesting allocation of the control right. This chapter studies the more interesting situation in which there is a real tradeoff.

Section 10.2 analyzes the allocation of (formal) control rights between insiders and outsiders. Its main theme is that when a firm is constrained in its ability to secure financing, the allocation of control between insiders and outsiders does not just reflect who desires control most; that is, control is not necessarily allocated to the party who will use it in the collectively most efficient way. In the presence of financing constraints, the allocation of control serves another purpose because it affects the extent to which the insiders can "commit" to return the funds to the investors. The design of a corporate governance structure should not only aim at efficiency, but should also keep an eye on its impact on pledgeable income. This logic implies that firms with severe financing problems are not able to avoid granting rights to their investors, including rights that decrease overall value.

Section 10.2 first makes this key point in the context of a single decision right. It then extends the analysis to multiple and contingent rights. Like collateral pledging, the allocation of control should be contingent on measures of performance. Indeed, contingent control boosts managerial incentives and raises pledgeable income. It is further shown that the allocation of multiple control rights follows a rule of relative willingness to pay for these rights, and that firms with stronger balance sheets can afford to relinquish fewer rights to investors. The theoretical predictions in the matters of contingent rights and multiple rights are supported by existing empirical evidence. Finally, Section 10.2 analyzes the relationship between control rights and specific investments, a relationship that was a key focus in the first formal papers on control rights (see, in particular, Grossman and Hart 1986; Hart and Moore 1990). It is shown that investor control reduces entrepreneurial initiative and may even reduce pledgeable income.

Section 10.3 argues that corporate behavior cannot be fully understood by looking solely at the formal allocation of control rights, and that it often requires examining who is actually in control. In all organizations, players who have no formal control often have an important impact on decision making. In the corporate governance context, management controls many decisions that are in principle bestowed upon the board of directors or the general assembly of shareholders; and large minority shareholders often influence the final outcome even though they do not hold enough voting shares to formally control it. The issue of real control is central to a discussion of corporate governance; in particular, the extent of control by management hinges on the alignment of its incentives with investors' goals and on the existence of informed investors and their ability to interfere with decision making. Section 10.3 argues that private information is an important source of real control. Namely, managers (or large minority blockholders) are able to influence decision making because they are better informed than shareholders and directors.

We should abstain from assuming that managers (or large minority blockholders) actually decide on corporate policies. An important theme in Section 10.3 is that the ability of informed parties to manipulate decisions depends on how trustworthy they appear to uninformed parties; trustworthiness in turn depends on the informed party's incentives and their alignment with the uninformed parties' interests. For example, the extent of managerial control can be shown to increase with the strength of the balance sheet. Another important theme of that section is that managerial control depends on corporate governance; for example, the presence of monitors (see Chapter 9) affects the extent of managerial control. Finally, the degree of informational asymmetry is endogenous, which further stresses the need for a clear distinction between formal and real control.

Section 10.4 returns to the allocation of formal control, now among outsiders. For example, how should control be allocated between equityholders and debtholders? To answer this question, one must first ask, what is the point of creating multiple classes of securities? After all, the creation of several classes of securities is bound to generate conflicts of interest. For example, equityholders, if given the right to decide, may engage in asset

substitution, that is, may expropriate debtholders by taking excessive risk. And, as we have seen in Chapter 2, debt covenants can only go so far in limiting excessively risky behavior by shareholders. This apparently simple question will lead us to a general discussion of security design, and to several hypotheses as to why, contrary to the Modigliani–Miller theory, it may matter.

10.2   Pledgeable Income and the Allocation of Control Rights between Insiders and Outsiders

10.2.1   The Aghion–Bolton Model

The importance of control rights in corporate finance was first noted by Aghion and Bolton (1992), and substantially developed by Hart (1995a) and Hart and Moore (1989);[4] for the purpose of this chapter, we can rephrase their finding in the following way: *the transfer of control rights to investors increases the pledgeable income and facilitates financing*. Or, to put it differently, control rights may substitute for necessarily limited cash-flow rights.

To illustrate this in the simplest possible way, let us return to the basic (fixed-size) model of Chapter 3: to finance her project, the entrepreneur must borrow the difference between the investment cost I and her net worth A. The project succeeds (and then yields R) with probability p, where $p = p_H$ if she behaves and p_L if she misbehaves (and then takes private benefit B); otherwise the project fails and yields nothing. Let us further introduce the possibility of taking an interim action that

(i) raises the probability of success uniformly by $\tau > 0$ (so the probability of success becomes $p_H + \tau$ or $p_L + \tau$, depending on the entrepreneur's behavior, if the action is taken, and remains p_H or p_L if the status quo action is selected);[5] and

(ii) engenders private cost $\gamma > 0$ for the entrepreneur (or, more generally, the firm's insiders[6]).

For example, the interim action could consist in switching to a more routine but also more profitable strategy,[7] severing a long-time relationship with a collaborator, firing workers, or divesting a division that management is eager to run. There is then a tradeoff between profitability and insiders' welfare. We assume that this interim action cannot be contracted upon at the initial (financing) stage. By contrast, the parties can contract on who is entitled to decide.[8] The choices of p (the moral-hazard dimension) and of the interim action both exhibit a potential conflict of interest between entrepreneur and investors. Unlike for the moral-hazard dimension, though, the choice of the interim action need not be delegated to the entrepreneur.

We look at whether the choice between this action and the status quo action is to be allocated either to investors or to insiders. The modified timing is described in Figure 10.1, where we indicate with bold letters the modification to the basic fixed-investment model of Chapter 3.

The assumption that the profit-enhancing action is orthogonal to managerial moral hazard, i.e., raises the probability of success uniformly, simplifies the analysis since it does not affect the incentive compatibility condition: if the profit-enhancing action is to be taken, then the incentive constraint becomes

$$[(p_H + \tau) - (p_L + \tau)]R_b \geqslant B$$

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4. See also Hart (2001) for a clear exposition of the importance of control rights for financial contracting.

5. Needless to say, τ must not be "too large," i.e., $p_H + \tau \leqslant 1$.

6. The quid pro quo between management and employees may induce the former to internalize some of the latter's concerns. See, for example, Pagano and Volpin (2005) for some modeling and implications of this quid pro quo.

7. Think of an academically oriented software or biotech entrepreneur whose choice of research orientation affects her future job market opportunities or her intrinsic motivation on the job.

8. As discussed in footnote 2, if the interim action and the status quo are identified at the contract design stage, the contract can simply specify which course of action will be selected. In contrast, suppose that *either* the payoffs attached to the various actions known at the initial date are not yet known at this date *or* that the actions cannot even be described *ex ante*. In that case, the players' interim information about the actions and their payoffs must be elicited at the interim stage. It turns out that in this model a focus on control rights is not restrictive, although the optimal (complete) contract may involve a randomization over who will have the control right (which does not affect the qualitative implications derived below).

For other and more sophisticated examples of situations in which the optimal complete contract takes the form of a simple institution, see, for example, Aghion and Tirole (1997), Che and Hausch (1999), Hart and Moore (1999), Maskin and Tirole (1999b), Nöldeke and Schmidt (1998), Segal (1995, 1999), and Tirole (1999). A broad and very useful framework for the analysis of the limits on the effectiveness of complete contracts when these can be renegotiated was developed by Segal and Whinston (2002), building on Maskin and Moore (1999) and Green and Laffont (1992, 1994).

Financing stage	**Interim action**	Moral-hazard stage	Outcome stage
Project costs I. Entrepreneur has equity $A < I$; borrows $I - A$.	**Choice between status quo action (probability of success is p), and profit-enhancing action (probability of success is $p + \tau$).**	Entrepreneur's choice affects the probability of success: $p = p_H$ (no private benefit) or p_L (private benefit B).	Verifiable profit: R with probability p (or $p + \tau$), 0 with probability $1 - p$ (or $1 - p - \tau$).

Figure 10.1 Control rights.

or

$$(p_H - p_L)R_b \geqslant B,$$

where R_b is the borrower's reward in the case of success. Note that τ does not enter the incentive constraint. For this reason, it does not matter whether the action is selected before (as in Figure 10.1) or after the managerial moral-hazard stage.

Let us first focus on the interesting case in which the profit-enhancing action reduces aggregate welfare and is thus *first-best* suboptimal:

$$\tau R < \gamma.$$

Suppose that the control right is given to the investors. Because they share part of the profit and bear none of the cost, they indeed select the profit-enhancing action, resulting in pledgeable income:

$$(p_H + \tau)\left[R - \frac{B}{(p_H + \tau) - (p_L + \tau)}\right]$$
$$= (p_H + \tau)\left[R - \frac{B}{\Delta p}\right].$$

Because investors do not earn supranormal profits in a competitive capital market (they break even), the NPV is also the entrepreneur's welfare when raising funds. This NPV must account for both the increase τ in the probability of success and the entrepreneur's cost γ associated with the interim action:

$$U_b = \text{NPV} = (p_H + \tau)R - I - \gamma.$$

The reader may wonder whether the entrepreneur and the investors would not want to renegotiate from the profit-enhancing action to the total-surplus-maximizing, status quo action after the investment has been sunk and before the interim action is selected. That is, would the Coase Theorem not imply that the two parties should not anticipate the profit-enhancing action? There is, however, no renegotiation since the entrepreneur has no money

to compensate investors for the loss of value on their claims.[9]

Suppose in contrast that the entrepreneur does not relinquish control. Because $R_b \leqslant R$, $\tau R_b < \gamma$, and therefore the entrepreneur does not pick the profit-enhancing action. In words, the entrepreneur bears the entire cost and gets only part of the benefits of the profit-enhancing action. The pledgeable income is, as in Chapter 3,

$$p_H\left(R - \frac{B}{\Delta p}\right),$$

and the NPV (i.e., the entrepreneur's payoff) is

$$p_H R - I > (p_H + \tau)R - I - \gamma.$$

As expected, allocating control to investors reduces the NPV by $\gamma - \tau R > 0$. But it increases pledgeable income by $\tau[R - (B/\Delta p)]$.

Suppose now that

$$p_H\left(R - \frac{B}{\Delta p}\right) < I - A < (p_H + \tau)\left(R - \frac{B}{\Delta p}\right).$$

Then the entrepreneur has insufficient cash on hand and can raise funds only by relinquishing the control right to the investors.[10] This first-best suboptimal

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9. The entrepreneur might, of course, keep enough wealth (keep some of her cash on hand A or even receive money from investors at the financing stage) in order to be able to compensate investors for surrendering control over the interim action. But then, why would the entrepreneur not just keep the control right in the first place (which is what we study next)? Giving the control right to investors to then buy it back does not alter the basic constraint that the entrepreneur is facing: she must allow investors to break even on average! We leave it to the reader to make this loose reasoning more rigorous.

10. Note that we allow only a "0/1 allocation" of the control right. Optimally, the entrepreneur would want to relinquish control stochastically under the set of inequalities just stated: that is, to give control to investors with probability x, and to retain control with probability $1 - x$, such that $(p_H + x\tau)(R - B/\Delta p) = I - A$. A continuous allocation of control is far fetched in the situation considered here, but is less so once we consider the extensions developed later in the chapter. First, the existence of multiple control rights (Section 10.2.2) provides for a more continuous allocation of control (see Exercise 10.9 for a limit case of many control rights). Second, the entrepreneur's real authority

No financing | Financing with transfer of control to investors | Financing with entrepreneur control

$$I - (p_H + \tau)(R - B/\Delta p)$$ $$I - p_H(R - B/\Delta p)$$ Entrepreneur's cash on hand A
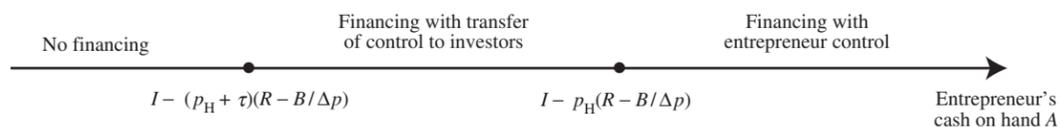
Figure 10.2

choice can thus be second-best optimal once imperfections in the credit market are accounted for.

Note the strong analogy with the strategy of costly collateral pledging under moral hazard. In Section 4.3 we noted that an entrepreneur who has insufficient pledgeable income may want to boost pledgeable income by pledging collateral that has more value to her than to the investors. Costly collateral pledging was thus first-best suboptimal (reduced the NPV), but was second-best optimal, as it allowed the entrepreneur to raise funds. Here, as in Section 4.3, the entrepreneur cannot commit to return the full value of the project to the investors and so there may not be enough pledgeable income to attract financing. Allocating control to investors enables the entrepreneur to commit, albeit in an inefficient way, to return money to investors.

This reasoning actually provides us with an *argument in favor of shareholder value* (see Section 1.8), or more precisely in favor of "investor value," since the model does not distinguish between different types of investor: a substantial initial investment by investors requires sufficient pledgeable income and therefore may force the entrepreneur to relinquish a right even when this reduces value in a first-best sense.[11]

Figure 10.2 summarizes the analysis so far.

Lastly, we note that the allocation of control is a trivial issue when investor control is first-best optimal, that is, when

$$\tau R > y.$$

In this case, investor control increases both the NPV from $p_H R - I$ to $(p_H + \tau)R - I - y$ and the pledgeable income from $p_H(R - B/\Delta p)$ to $(p_H + \tau)(R - B/\Delta p)$. In words, giving control to investors both facilitates financing and, when financing occurs, increases the utility of the entrepreneur, who gains more in reduced investors' stake than she loses through the loss in control.[12]

Reinterpretation (going public). As usual, the investment model can be reinterpreted as one in which the firm already operates, but must borrow in order to finance growth prospects. The prediction in this context is that the entrepreneur may have to surrender control in order to be able to finance growth. One important channel through which entrepreneurs relinquish control is the going-public process. Entrepreneurs often issue new shares with voting rights and thereby lose the control majority in their firm.[13] Conversely, entrepreneurs often prefer to sacrifice growth and keep control over operating, investment, and personnel decisions (for example, staying private may enable them to select their heirs as successors; not being able to select one's heir is akin to the cost y in the model).

(Section 10.3) varies more continuously, especially if one considers an environment that is uncertain at the date at which rights are allocated but less so at the date at which decisions are taken; in this context, the composition of the board (with more or less independent members) also provides for a more continuous allocation of control (as in Hermalin and Weisbach 1988).

11. Hart (1995b) makes a similar argument when discussing the possibility of a statutory rule requesting companies to have worker representatives on the board. He observes that such a rule may discourage a company from setting up in the first place, given that it may no longer lay off workers in the event of an adverse demand shock (p. 687).

12. Note, furthermore, that allocating control to the entrepreneur is not credible anyway: because entrepreneur control results in a first-best inefficient action, there are gains to transferring control to investors at the interim stage. Furthermore, investors have cash to compensate the entrepreneur for the loss of control. Hence, entrepreneur control is always renegotiated away. This is a key difference with the case of investor control when $y > \tau R$, for which investor control was inefficient but not renegotiated away as long as the entrepreneur invests her cash on hand in the project.

13. Share dilution is not the only way entrepreneurs lose control when they go public. As Boot et al. (2005) note, they also lose control in more insidious ways, due to the regulations they must abide by (restrictions on board composition, information disclosure, shareholder voting rights, and so forth).

In that paper, the cost y of going public is modeled in a different way relative to this chapter: Boot et al. assume that the entrepreneur and the investors have different priors (heterogeneous beliefs) about profitability, but that there is no adverse selection (each party knows the other party's beliefs, and they just "agree to disagree"). Thus, the investors' preferred action is viewed as suboptimal by the entrepreneur, who is willing to incur costs in order to retain control.

10.2.2 Multiple Control Rights

In practice, there are *multiple control rights* to be divided between insiders and outsiders: product design, day-to-day management, long-term strategic decisions, hiring decisions, mergers, alliance building, etc. The analysis above is straightforwardly generalized.[14] The intuition derived from the single-control-right analysis suggests, and this section confirms, that, in the presence of multiple control rights, it is always optimal for the entrepreneur to abandon *all* rights for which investor control is first-best optimal as well as, possibly, *some* rights for which it is not. Again, the optimal split of rights accounts not only for the value (NPV) impact of the allocation, but also for its impact on pledgeable income.

More formally, and generalizing the framework of Section 10.2.1 to multiple rights, suppose there are K dimensions of decision making and therefore K rights to allocate. Each right $k \in \{1, \ldots, K\}$ is characterized by the uniform increase $\tau_k > 0$ in the probability of success and the cost $y_k > 0$ borne by insiders if the course of action is altered in dimension k. The governance structure is now defined by the allocation $x \equiv \{x_1, \ldots, x_K\}$ of formal control rights, where $x_k = 1$ if investors obtain the control of decision k and $x_k = 0$ if the entrepreneur retains control.

Let us maximize the NPV (that is, the entrepreneur's utility) subject to being able to secure financing and to the entrepreneur's incentive compatibility constraint:

$$\max_{\{R_b, x\}} \left\{ \left[p_H + \sum_k \tau_k x_k \right] R - I - \sum_k y_k x_k \right\}$$

s.t.

$$\left[p_H + \sum_k \tau_k x_k \right] [R - R_b] \geqslant I - A,$$

$$R_b \geqslant \frac{B}{\Delta p}.$$

The solution to this program has the following features in the interesting case in which the financing constraint is binding:[15] there exists a threshold

$\theta < 1$ such that investors receive control over decision k if and only if their *relative willingness* to pay for that right exceeds the threshold, that is, if and only if[16]

$$\frac{\tau_k R}{y_k} \geqslant \theta.$$

As one would expect, it is optimal for the entrepreneur to abandon to investors those rights that matter most to them and for which investor control will not create large negative externalities on the entrepreneur.[17] Conversely, the entrepreneur should keep control over decisions that matter most to her and are unlikely to have a substantial negative

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constraint. Clearly, $x_k = 1$ only if

$$\frac{\tau_k R}{y_k} \geqslant \frac{1}{1 + \mu(1 - B/R\Delta p)}.$$

Note that $R \geqslant B/\Delta p$ (otherwise, the entrepreneur could not borrow) and so the threshold is smaller than 1.

The financing constraint is in general not satisfied with equality if the x_k are constrained to take values 0 or 1. In order not to leave a rent to investors, the entrepreneur must in general make the allocation of the marginal right (that is, the right k_0 with the lowest ratio $\tau_k R / y_k$ among the rights granted to the investors) random ($0 < x_{k_0} < 1$).

The less interesting case, in which the investor breakeven constraint is not binding ($\mu = 0$), admits solution

$$x_k = 1 \quad \text{if and only if } \tau_k R > y_k$$

(ignoring the nongeneric case in which $\tau_k R = y_k$ for some k). That is, the allocation of control is always efficient.

16. This condition is presented in its simpler form; we leave it to the reader to check that it is equivalent to ordering, for the various rights, the investors' benefit from control divided by the entrepreneur's benefit from control and setting a cutoff over which investors receive control.

17. As in the case of a single control right, we briefly discuss the possibility of renegotiation: might an allocation of rights that is not first-best efficient be renegotiated before the control rights are exercised? The only rights for which the allocation is not first-best efficient (i.e., those with $\theta \leqslant \tau_k R / y_k < 1$) are rights that are given to investors. Let us first assume that the entrepreneur has committed her cash on hand A and borrowed only what is needed to fund the investment cost, $I - A$ (it turns out to be optimal to do so). Then the entrepreneur no longer has any means of payment after securing financing, the entrepreneur has no way to compensate the investors for relinquishing these rights. In other words, there are potential gains from trade *ex post*, but these gains cannot be reaped in the absence of compensating transfer (technically, utility is "nontransferable").

As we noted in the single-control-right case, though, the entrepreneur could keep some cash so as to be able to renegotiate and "reacquire" some control rights that are initially allocated to investors, but for which investor control is first-best inefficient (control rights for which the initial allocation yields the first-best efficient exercise are not renegotiated since renegotiation cannot deliver *ex post* gains from trade). But then, such control rights could be directly allocated to the entrepreneur. The two constraints in the maximization of the NPV would still need to be satisfied (in net terms for R_b), and so the entrepreneur cannot do better by creating scope for renegotiation. We conclude that the optimal allocation of rights obtained above is not renegotiated.

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14. See Aghion and Tirole (1997) for the derivation in a different context.

15. Let μ denote the shadow price of the financing constraint. In the interesting case in which μ is strictly positive, then $R_b = B/\Delta p$, and the derivative of the Lagrangian with respect to x_k is equal to $[\tau_k R - y_k] + \mu \tau_k [R - B/\Delta p]$. The first term is just the (first-best) efficiency of taking the profitability-enhancing stance on decision k, while the second term reflects the benefits in terms of relaxing the financing

impact on profitability. To give a trivial illustration of this, consider the CEO's decision over what to eat for lunch at the headquarters' dining room. Shareholders may have a preference for a fish diet, because it reduces the CEO's probability of heart attack during her tenure very slightly relative to meat. Yet, one would expect $\tau_k R$ to be very small relative to y_k and so the choice would be left to the CEO. The same applies to most so-called "personal decisions."

The entrepreneur's incentive constraint is then binding ($R_b = B/\Delta p$). Intuitively, the entrepreneur prefers to pay investors in the "efficient" currency (cash, which is one-for-one) than in the "inefficient" one (control rights, whose transfer involves a deadweight loss). The conclusions are again analogous to those reached in Chapter 4 as to the allocation of costly collateral. There, we saw that the entrepreneur prefers to pledge collateral that investors value relatively most; and, of course, money is the best collateral.[18]

An important implication of this analysis is that, ceteris paribus, *firms with stronger balance sheets* (say, with a higher A; see Section 3.2.2 for a broader definition of balance-sheet strength) *abandon fewer rights*. This prediction fits with the evidence. Firms with strong balance sheets (high initial equity, strong collateral, safe income stream) obtain financing on markets, where they relinquish only a few control rights by including some covenants. Firms with intermediate balance sheets relinquish a few more control rights through more restrictive and extensive covenants when they deal with banks. Firms with weak balance sheets, such as high-tech start-ups which have little equity, collateral, and guaranteed income, relinquish most control rights to, say, venture capitalists.

Lerner et al. (2003) analyze the assignment of what industry practitioners perceive to be the five key control rights in alliances between small biotechnology (R&D) firms and pharmaceutical corporations in the United States: (1) "management of clinical trials" (the alliance may seek regulatory approval on a given bioengineered product for a variety of uses, some of which may compete with the pharmaceutical company's existing products); (2) "control of

the initial manufacturing process";[19] (3) "control of manufacturing after product approval" (the move of the production to the pharmaceutical company's facilities requires an extensive and time-consuming review by the Food and Drug Administration); (4) "retention of all sales categories for financing firm" (who gets the right to control marketing by disease or country); and (5) "ability to exclude the R&D firm from all aspects of the marketing process."[20]

Lerner et al. find that the R&D firm retains more control rights when it is in a stronger financial position; and that projects that are in their early stages and are thereby presumably subject to more significant agency costs are associated with more control rights transferred to the pharmaceutical company. Lastly, contracts signed at times when little external financing can be raised in public equity markets assign the most control rights to the pharmaceutical company. All three observations fit well with the theoretical prediction.

10.2.3 Contingent Rights

Control rights are often contingent on some observable event. For instance, a start-up entrepreneur loses some of her control rights when failing to meet some targets. Kaplan and Strömberg (2003, 2004) provide evidence that founders obtain or retain more control rights as performance improves and, relatedly, have more control rights in later-stage financings (which occur only if previous performance was satisfactory, because poor performance in early stages may interrupt refinancing).

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18. A second parallel with collateral pledging is that in both cases the inefficiency is not renegotiated away.

19. A drug is approved in the United States not as a matter of general principle, but rather only as manufactured in a particular facility. To get approval in another manufacturing facility requires an extensive review process. As a result, whichever party in an alliance in whose facility the drug is manufactured has an important advantage over his partner: even if the other party has the contractual right to terminate the alliance and to manufacture the drug in its own facility, it will be quite costly for that party to do so.

20. The smaller biotech company, seeking to develop its skills as a marketing organization (which many perceive as an essential step in becoming a fully integrated pharmaceutical firm), is often given the right to sell the drug alongside the pharmaceutical firm. In some cases, this means that the two firms' sales representatives sell the drug independently in the same territory; in others, that the biotech company's sales force plays a support role (e.g., they hire salesmen who provided technical backup to the pharmaceutical firm's "frontline" sales force); in yet others, the firms' sales forces take the lead in different market niches (e.g., the biotech firm's sales force might take the lead while selling to the military).

Financing stage	Moral-hazard stage	**Intermediate signal**	**Interim action**	Outcome stage
Project costs I. Entrepreneur has equity $A < I$; borrows $I - A$.	Choice of probability of success: $p = p_{\mathrm{H}}$ (no private benefit) or p_{L} (private benefit B).	**Signal accrues.**	**Choice between status quo action (probability of success is p), and profit-enhancing action (probability of success is $p + \tau$).**	Verifiable profit: R with probability p (or $p + \tau$), 0 with probability $1 - p$ (or $1 - p - \tau$).

Figure 10.3 Contingent control right.

The transfer of control rights is often made contingent on verifiable variables. For example, the venture capitalist obtains voting control if the firm's EBIT (earnings before interest and taxes) falls below some amount, or obtains board control if the firm's "net worth," here measured by the cumulative cash flow to date, falls below some threshold.[21] The transfer of control may also be contingent on nonfinancial performance variables: tests of product functionality, approval of the new drug by the Federal Drug Administration, or patent approval. One mechanism for the transfer of control is the automatic conversion provisions (see Black and Gilson 1998; Kaplan and Strömberg 2003); for example, the venture capitalist loses his superior control, voting, board, and liquidation rights when the firm completes a "successful" IPO (its stock sells at a price above some prespecified threshold) and his convertible preferred stock and debt are then converted into common stock.

Contingent control rights resemble multiple ones: the rights to control the same decision in multiple states of nature are de facto multiple rights (one right per state). An important insight is, however, specific to contingent rights: if the right is contingent on some measure of performance, it can act as a reward and relax the incentive constraint. The allocation of the control right then contributes directly and indirectly to securing financing, where the indirect effect refers to the motivational impact of the threat of losing control in case of bad performance. In general, *making control rights contingent enhances managerial incentives and boosts borrowing capacity.*

To illustrate this, consider the choice of a close collaborator for a software entrepreneur or a restaurant owner. Suppose that hiring a friend (or a family member) of the entrepreneur provides for a more pleasant work environment for the entrepreneur, while hiring a stranger with slightly better qualifications or a sharper profit focus would increase the probability of success. It may then make sense to let the entrepreneur pick her close collaborator, and if targets are not met (e.g., short-term losses are registered) to authorize the investors to replace the collaborator. Venture capital contracts discussed above provide another motivation.

Suppose that the control right is exercised after the entrepreneur's choice of effort and after a signal about entrepreneurial performance accrues (see Figure 10.3).

The signal can be high (H) or low (L). For effort i (high if the entrepreneur behaves or low if the entrepreneur misbehaves), the probability of signal j is σ_{ij}. As in Chapter 8, let us simplify the analysis by assuming that the signal is a sufficient statistic for learning about entrepreneurial effort; that is, the final outcome conveys no further information (beyond that contained in the signal) about the choice of effort. We know that the entrepreneur should be rewarded only as a function of the realization of the signal.[22] Let R_{b} denote the entrepreneur's reward in the case of a high signal (the reward is optimally set equal to 0 in the case of a low signal).

With *noncontingent* investor control, the entrepreneur's incentive compatibility constraint is

$$(\sigma_{\mathrm{HH}} - \sigma_{\mathrm{LH}})R_{\mathrm{b}} \geqslant B,$$

since she bears cost γ regardless of the realization of the signal. So, with a noncontingent control right

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21. Note that earnings and cumulative cash flows are verifiable accounting variables. Market values cannot be used as contingencies for unlisted companies.

22. We could, therefore, have omitted the signal and made the allocation of the control right contingent on the outcome; this requires, however, that the decision is taken after the outcome is realized, which is less natural unless the outcome itself stands for an intermediate performance.

allocated to the investors,[23] the pledgeable income is

$$(p_H + \tau)R - \sigma_{HH}\left[\frac{B}{\sigma_{HH} - \sigma_{LH}}\right].$$

With *contingent* control, the entrepreneur both is rewarded and retains control in the case of a high signal (i.e., she both receives R_b and avoids cost γ when the signal is high), and so the incentive constraint becomes

$$(\sigma_{HH} - \sigma_{LH})(R_b + \gamma) \geqslant B.$$

A contingent control right thus yields pledgeable income

$$(p_H + \sigma_{HL}\tau)R - \sigma_{HH}\left[\frac{B}{\sigma_{HH} - \sigma_{LH}} - \gamma\right].$$

Contingent control therefore increases the pledgeable income and facilitates financing relative to noncontingent control allocated to investors if and only if

$$\sigma_{HH}\gamma > (1 - \sigma_{HL})\tau R \quad \text{or} \quad \gamma > \tau R.$$

This is nothing but the condition under which investor control is first-best suboptimal. This is no "coincidence": starting from noncontingent control, allocating control to the entrepreneur in the case of a good signal increases, in that state, her payoff (in absolute terms but also relatively to the low signal case) by γ but reduces the expected revenue by τR. This explains why first-best suboptimality is also the condition under which contingent control increases pledgeable income in this simple model.

Finally, note the strong analogy with the treatment of contingent collateral in Section 4.3.4, where we show that collateral is optimally pledged in the case of failure. This analogy is not fortuitous. When investor control destroys value, allocating control to investors is like allocating collateral that is valued more highly by the borrower than by the investors. In both cases, a contingent allocation boosts borrower incentives and reduces the agency cost.

10.2.4 Control Rights and the Protection of Noncontractible Investments

The analysis so far has focused on the connection between the allocation of control and the entrepreneur's borrowing capacity. The literature on control

rights, in contrast, has often emphasized the relationship between the protection of specific investments, i.e., investments that are valuable only if they are used in the context of a specific relationship between two parties, and asset ownership, where asset ownership confers the right to determine the use of the asset (see, primarily, the work of Grossman and Hart (1986) and Hart and Moore (1990), as well as that by Klein et al. (1978) and Williamson (1985)).[24]

A typical environment in that literature involves a bilateral relationship between a "buyer" and a "seller" who sink noncontractible relationship-specific investments.[25] There are two key themes:

• Having control over assets that are used to create value within the relationship allows their owner to threaten to take the assets away and deal with a third party (another seller if the owner is a buyer, another buyer if the owner is a seller). The existence of such "outside options"[26] enables the owner to bargain for a larger share of the total surplus if the two parties need to renegotiate during the course of their relationship. That is, the allocation of control affects the sharing of the pie in the event of future renegotiation.

• The sharing of the surplus matters in particular if one or two parties to the relationship sink specific investments. The specific-investment-based theory of asset ownership has repeatedly stressed that asset ownership boosts the owner's incentive to invest.[27]

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23. A *noncontingent* control right allocated to the entrepreneur yields a lower pledgeable income.

24. Applications of the specific-investment theory of control rights to cash-constrained entrepreneurs and innovation include Aghion and Tirole (1994) and Lerner and Malmendier (2005).

25. In applications, who is the "buyer" and who is the "seller" is sometimes a matter of convention. The theory is, however, often motivated by examples of a supplier of an input (e.g., automobile parts) to a downstream producer (e.g., car manufacturer).

26. A corporate finance example of the exercise of an outside option is the replacement of the current CEO by a new CEO by the board of directors. (Who is the "buyer" and who is the "seller" are questions of semantics (see previous footnote). The board of directors acts on behalf of investors who are the suppliers of capital. The CEO is the supplier of managerial skills and effort.)

27. We have shown earlier in the chapter that lenders have more incentive to invest in the firm if they receive the control rights. A difference with the result mentioned here is that Section 10.2.1 assumed that the lenders' specific investment $(I - A)$ can be contracted upon. The holdup literature, in contrast, assumes that specific investments cannot be contracted upon, but in general does not rely on the existence of cash constraints.

Financing stage	**Managerial initiative**	Interim action	Moral-hazard stage	Outcome stage
Project costs I. Entrepreneur has equity $A < I$; borrows $I - A$.	**Manager incurs cost c and finds an alternative to status quo, or does not incur cost c and finds nothing.**	None if manager has not spent c. Status quo prevails. Choice of version of modification if manager has spent c.	Choice of probability of success: $p = p_H$ (no private benefit) or p_L (private benefit B).	Verifiable profit: R with probability p (or $p + \tau$), 0 with probability $1 - p$ (or $1 - p - \tau$).

Figure 10.4

This section, in contrast, ignores threats of trading with alternative parties;[28] rather, it analyzes the impact of the allocation of control on the borrower's incentive to come up with improvements to the original project. (Section 10.3 will further the analysis of managerial initiative by stressing the role of informational asymmetries rather than that of the allocation of control.)

Suppose that, in the model of Section 10.2.1, the idea leading to a potential modification of the initial project does not come out of the blue, but rather necessitates managerial initiative. As indicated in Figure 10.4, the borrower must sink some unobservable, private cost c in order to come up with an alternative to the status quo. For simplicity, only the borrower can find a relevant alternative.

In the absence of managerial initiative (the borrower does not spend c), the status quo prevails: the probability of success is $p = p_H$ or $p = p_L$ depending on the borrower's later behavior. Managerial initiative results in the possibility of modifying the initial project. This possibility becomes common knowledge as it arises.[29] The modification, however, comes in two versions.

Borrower-friendly version: relative to the status quo, the modification increases the probability of success by τ_b and creates a private benefit $-y_b > 0$ for the borrower;

Lender-friendly version: the modification increases the probability of success by τ_l and creates a

private benefit $-y_l$ for the borrower, with $\tau_l > \tau_b > 0$ and $(-y_b) > (-y_l) > 0$.

Note that the insiders' "cost" from the profit-enhancing action is now a benefit. This assumption guarantees that the entrepreneur is made better off when coming up with a possible modification, even though the latter becomes common knowledge (and thereby could hurt the entrepreneur in the absence of this assumption).

At the interim action stage, the choice of version may be the object of renegotiation if both parties can benefit from it. That is, if the privately optimal choice of version by the party in control is collectively inefficient (and so there are potential gains from renegotiation) and if the other party has the means to compensate the former for the change of version, then renegotiation occurs. Note that, since there are only two versions, it does not matter whether the interim action (the choice of version) becomes contractible at the interim stage or not: renegotiation can indifferently take the form of a transfer of control or of the specification of a particular version if feasible. We will assume that the entrepreneur then has the bargaining power (makes a take-it-or-leave-it offer to investors).[30]

Let us make the following three assumptions.

• In the relevant range of rewards R_b (i.e., rewards that are consistent with the investors' breakeven condition), the borrower ranks the borrower-friendly version over the lender-friendly version (from our previous assumptions, both are preferred to the status quo):

$$\tau_b R_b - y_b > \tau_l R_b - y_l > 0.$$

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28. While much of the literature has focused on the interaction between control and outside options, there have also been a number of contributions analyzing the allocation of control when control rights do not boost the value of these outside options; recent entries along the latter line include Aghion et al. (2004) and Hart and Moore (2004).

29. If only because the borrower has to exposit it if she wants investors to act upon it or to renegotiate.

30. This is indeed an assumption, since it is not implied by the fact that investors are competitive (and therefore have no bargaining power) *ex ante.*

We already know that lenders prefer the lender-friendly version to the borrower-friendly version, and the latter to the status quo:

$$\tau_l > \tau_b > 0$$

(and so the lenders benefit from managerial initiative even if the borrower-friendly version is implemented). Thus, both parties want to move away from the status quo, but they disagree on the version.

- Investor control is *ex post* (first best) optimal and initiative is desirable:

$$\tau_l R - \gamma_l > \tau_b R - \gamma_b > c.$$

- For expositional simplicity, we focus on contracts that specify an incentive-compatible stake $R_b \geqslant B/\Delta p$. As footnotes will indicate as we proceed through the analysis, this focus involves no loss of generality. (Furthermore, the reader may ignore *ex post* moral hazard by setting $B = 0$ if (s)he wants. This section is primarily focused on the agency cost associated with noncontractible managerial initiative.)

Even though investor control is ex post efficient, we will show that investor control may not be desirable, and that, for given stakes, investors may even be worse off from having control.

First, note that if the borrower comes up with a potential modification, the selected version is always the efficient, lender-friendly one:

Investor control. Investors, when having control, choose the lender-friendly version, which is not renegotiated because there are no gains to renegotiation. The borrower demonstrates initiative if and only if[31]

$$\tau_l R_b - \gamma_l \geqslant c.$$

As usual, the entrepreneur's utility is equal to the total value minus what is appropriated by the investors. So, we can rewrite this condition in terms of a comparison between the increase in NPV brought about by initiative, $(\tau_l R - \gamma_l) - c$, and the investors' "free-riding benefit," $\tau_l(R - R_b)$, namely, the extra rent that they automatically enjoy when the borrower spends c:

$$(\tau_l R - \gamma_l) - c \geqslant \tau_l(R - R_b).$$

Entrepreneur control. Without initiative, the entrepreneur obtains $p_H R_b$.

With initiative, the entrepreneur can use her control over versioning to offer to choose the lender-friendly version against a higher stake $R_b' > R_b$ in the case of success.[32] Knowing that the borrower chooses the borrower-friendly version if they refuse the offer, the lenders accept to renegotiate as long as[33]

$$(p_H + \tau_l)(R - R_b') \geqslant (p_H + \tau_b)(R - R_b).$$

The borrower thus chooses the highest value R_b' such that this inequality is satisfied. And so the borrower obtains utility

$$(p_H + \tau_l)R_b' - \gamma_l - c$$
$$= (p_H + \tau_l)R - \gamma_l - (p_H + \tau_b)(R - R_b) - c.$$

The borrower demonstrates initiative if and only if this utility exceeds $p_H R_b$, which can be written as[34]

$$(\tau_l R - \gamma_l) - c \geqslant \tau_b(R - R_b).$$

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31. How would this analysis be altered if $R_b < B/\Delta p$? In the absence of initiative, the contract might be renegotiated to be incentive compatible ($R_b' \geqslant B/\Delta p$) with $p_H(R - R_b') = p_L(R - R_b)$ (recall that the borrower has the bargaining power in renegotiation). Similarly, under borrower initiative, the contract might be renegotiated to R_b'' such that $(p_H + \tau_l)(R - R_b'') = (p_L + \tau_l)(R - R_b)$. Furthermore, renegotiation occurs in the absence of initiative if it occurs in its presence. Suppose, first, that there is renegotiation in both cases. The borrower then spends c if and only if

$$(p_H + \tau_l)R_b'' - \gamma_l - c \geqslant p_H R_b' \quad \text{or} \quad (\tau_l R - \gamma_l) - c \geqslant \tau_l(R - R_b),$$

which is the same condition as when $R_b \geqslant B/\Delta p$. If renegotiation fails in the presence of initiative, but occurs in its absence, then the incentive to demonstrate initiative is even smaller.

32. The entrepreneur could also ask for a lump-sum (not performance-based) payment over and above R_b. This does not alter the analysis when $R_b \geqslant B/\Delta p$ and is dominated if $R_b < B/\Delta p$.

33. The borrower would like to threaten to choose the status quo ($\tau = 0$) if the investors refuse to renegotiate, so as to force the latter to make even more concessions. This threat, however, is not credible, as it is indeed in the borrower's interest to choose the borrower-friendly version when the renegotiation has failed.

34. Again, let us check that this condition is unaltered if the initial contract specifies a stake that is not incentive compatible: $R_b < B/\Delta p$. In the absence of initiative, the contract may be renegotiated to an incentive-compatible level R_b' such that $p_H(R - R_b') = p_L(R - R_b)$, in which case the borrower's utility becomes $p_H R_b'$.

In the presence of initiative, the contract may be renegotiated to R_b'' such that $(p_H + \tau_l)(R - R_b'') = (p_L + \tau_b)(R - R_b)$. As in footnote 31, one can sequentially consider the situation in which renegotiation occurs in both cases, and that in which it occurs only in the absence of initiative. In the former case, for example, the borrower's utility is then $(p_H + \tau_l)R - \gamma_l - (p_L + \tau_b)(R - R_b) - c$. The borrower is willing to spend c provided that $(\tau_l R - \gamma_l) - c \geqslant \tau_b(R - R_b)$.

To sum up, total value in the absence or presence of initiative is unaffected by the allocation of control since under borrower control there is renegotiation to implement the version that yields the highest NPV.[35] What is altered by the allocation of control is the extent of investor free riding on the borrower's initiative: for all R_b,

$$\tau_b (R - R_b) < \tau_l (R - R_b).$$

Put differently, *the borrower appropriates more of the return on her noncontractible investment when she has control over the decision.*[36]

Finally, we show that entrepreneur control may *increase* pledgeable income and thereby facilitate financing.[37] Focusing on initiative-inducing contracts (which, as noted in footnote 36, also solve *ex post* moral hazard if B is small enough),[38] investor control is inconsistent with borrower initiative and funding if

$$(p_H + \tau_l)(R - R_b) < I - A \qquad (10.1)$$

for all R_b such that $\tau_l R_b - \gamma_l \geqslant c$.

By contrast, entrepreneur control is consistent with borrower initiative and funding provided that

$$(p_H + \tau_b)(R - R_b) \geqslant I - A \qquad (10.2)$$

for some R_b such that $(\tau_l R - \gamma_l) - c \geqslant \tau_b (R - R_b)$.

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35. This is actually a general result: renegotiation always leads to an *ex post* efficient outcome when the party under whose control the outcome is efficient has cash, that is, is not wealth constraint (and there is no asymmetry of information).

36. Note that if *ex post* moral hazard is small, i.e., B satisfies

$$\frac{c + \gamma_l}{\tau_l} > \frac{c - (\tau_l - \tau_b)R + \gamma_l}{\tau_b} > \frac{B}{\Delta p},$$

the stakes R_b that generate initiative are also *ex post* incentive compatible, i.e., satisfy $(\Delta p)R_b \geqslant B$.

37. Note the strong analogy with the basic moral-hazard model first developed in Section 3.2. There, we saw that an increase in the entrepreneur's stake directly hurts investors, but indirectly benefits them through enhanced managerial effort. Here, and similarly, entrepreneurial control directly hurts investors, but boosts entrepreneurial initiative. Like that of a higher managerial compensation, the net effect of entrepreneur control may be to boost pledgeable income, that is, to benefit investors.

38. With an *ex ante* competitive capital market, the lenders obtain no surplus, and so the entrepreneur receives the NPV. The issue is therefore how to induce initiative while generating enough pledgeable income to secure funding.

Finally, we could consider the case in which investors have (at least some) bargaining power at the renegotiation stage. Investors would still break even because the extra gains from renegotiation (which exist provided that the entrepreneur keeps enough motivation to demonstrate initiative) are competed away in the *ex ante* capital market.

Conditions (10.1) and (10.2) are consistent provided that

$$(p_H + \tau_l)\left(R - \frac{c + \gamma_l}{\tau_l} \right) < (p_H + \tau_b)\left(\frac{\tau_l R - \gamma_l - c}{\tau_b} \right)$$
$$\Longleftrightarrow \quad \tau_l R - \gamma_l > c,$$

which is the condition that initiative increases NPV.

Remark (ex post efficient investor control). We have assumed that investor control is *ex post* efficient. The analysis of the case in which entrepreneur control is *ex post* efficient is similar, with the following twist: when investors have control and therefore choose the inefficient version in the absence of renegotiation, renegotiation may not result in the efficient transfer of control to the entrepreneur (or, equivalently, an agreement on the efficient version). Indeed, the entrepreneur has no cash. She can offer a reduction of her stake from R_b to $R_b' \geqslant 0$, but this reduction (a) may not be sufficient to compensate investors or/and (b) may demotivate the entrepreneur (if $(\Delta p)R_b' < B$). Thus, renegotiation may be inefficient, unlike in the case considered here.

Remark (another perverse effect of investor control). Exercise 10.5 develops a different reason why investor control may make financing more difficult. In that exercise, the investors' exercise of control occurs simultaneously or after the entrepreneur's choice of effort and demotivates the entrepreneur by engaging in "damage control" (increasing the probability of success in the case of misbehavior at a private cost to the entrepreneur). The entrepreneur is then more tempted to misbehave; her stake must therefore be increased, which leads to a reduction in pledgeable income.

10.3 Corporate Governance and Real Control

Often players without formal control rights actually enjoy substantial control over their organizations.[39] To give two standard examples in the corporate finance area, it is well-known that boards of directors often rubber-stamp the top management's decisions, and that large minority shareholders often

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39. This section is influenced by my joint work with Philippe Aghion (Aghion and Tirole 1997) on formal versus real authority.

decide for the majority group of smaller ones. The allocation of formal control thus cannot be the full story: there is "separation between ownership and control."

Leading theories in corporate finance do not always make a clear distinction between formal and real control. Rather, they often assume that *management* has the formal right to select various decisions such as long-term investments, dividends and retained earnings, new debt and other securities issues, the CEO's successor, and takeover defenses. These assumptions are, for the most part, factually inaccurate: in practice, management needs to refer to higher authorities (board, general assembly) for permission concerning many of these decisions.[40] The assumptions are also partly nonintuitive. To the extent that the governance structure is in charge of controlling management, it would seem that management would face strong conflicts of interest, in particular when making decisions that affect the firms's corporate governance.

This is not to say that management does not have a substantial influence on such decisions in practice. It does. Managers enjoy much power, though, in part because they have proprietary information that often enables them to get their way. So, while shareholders have formal control over a number of decisions, managers often have real control.

If managers end up making the decisions in the end, would it not be appropriate to assume directly, in "reduced form," that they have formal control? The answer is, in general, "no." By presuming that management decides, one is unable to analyze two key aspects of the corporate governance debate:

• first, the allocation of formal control rights (why must management defer to shareholders for some decisions, but not others? how is the allocation of control rights influenced by the firm's balance sheet?); and

• second, the impact of corporate governance institutions on managerial effective/real control over

decisions (when formal control is given to investors, as is the case for many key decisions, the extent of actual control enjoyed by management is a function of the presence and incentives of active monitors, of the divergence of objectives among investors, and so forth).

It is preferable to start from first principles and then derive the conditions under which management gets its way either by procedural design or by lack of alternative for its principals.

10.3.1 Heuristics

To illustrate the benefits of starting from first principles, let us discuss the *extent* of real control by management. Assume that a number of actions are available, but that an action away from the status quo and chosen at random would have disastrous consequences. Only one action besides the status quo is "relevant" and it is *ex ante* unknown which action that is. Indeed, all actions *ex ante* look alike. Formal control belongs to investors (this can be justified, for example, by assuming that there is another action, which is preferred to all others by the entrepreneur and is disastrous for investors, i.e., it does not generate enough pledgeable income for the investors to break even).

Let us generalize the model of Section 10.2.1 slightly by assuming that

(a) the values of the increase, τ, in the probability of success and the cost, y, to the insiders are random and unknown at the date of contracting;

(b) these values can be positive or negative,

$$\tau \gtrless 0 \quad \text{and} \quad y \gtrless 0.$$

A negative τ means a profit-decreasing action, and a negative y refers to a private benefit for the entrepreneur (beyond B, that obtained by shirking). Assume that the initial contract, besides allocating formal control to investors, specifies a compensation R_b for the entrepreneur in the case of success.

Suppose in a first step that the entrepreneur learns which is the relevant action as well as its payoff characteristics $\{\tau, y\}$ at the interim stage, and that investors learn nothing. The entrepreneur can propose the action to investors (the description of the action, by itself, reveals no information about the values of τ and y as all actions are identical in the

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40. For example, corporate charter defenses (including staggered boards, supermajority rules, and so forth) require shareholder ratification. Poison pill plans may be adopted without shareholder approval, but they must still be approved by the board of directors (and can later be removed by shareholders through a vote). For an institutional background on takeovers, see Section 1.5, as well as Jarrell et al. (1988) and Shleifer and Vishny (1988).
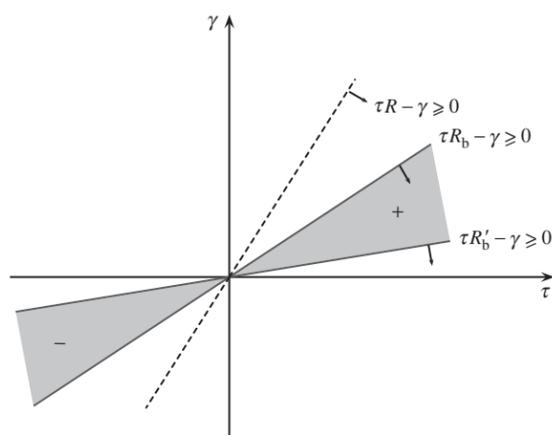
Figure 10.5

eyes of investors), and will do so if the action yields the entrepreneur a payoff superior to the status quo action, that is, if

$$\tau R_b - \gamma \geqslant 0.$$

Should investors then rubber-stamp the entrepreneur's proposal (without knowing τ and γ) or refuse to go along with it, resulting in a deadlock? Since they bear or receive none of the private cost or benefit γ, investors try to figure out whether the proposed action is on average profit enhancing. To this purpose their only piece of information is that it is in the interest of the entrepreneur to recommend the action, i.e., that the entrepreneur prefers the action to the status quo. Investors therefore rubber-stamp if and only if

$$E(\tau \mid \tau R_b - \gamma \geqslant 0) \geqslant 0. \qquad (10.3)$$

Condition (10.3) implies that the key to managerial real control is congruence. As we now show, *the higher the power of the managerial incentive scheme, the more likely it is that investors will go along with the entrepreneur's proposal:* for any joint distribution of $\{\tau, \gamma\}$, the left-hand side is positive when the entrepreneur's stake is R_b provided it is positive for some stake $R_b' < R_b$. To see this, it suffices to represent the set defined by $\tau R_b \geqslant \gamma$ in the $\{\tau, \gamma\}$-space. An increase in the entrepreneur's stake from R_b' to R_b adds to this set only points with $\tau > 0$ and subtracts only points with $\tau < 0$ in Figure 10.5.

We can now discuss the impact of the strength of the balance sheet on the separation of ownership and control. We measure this strength by the entrepreneur's cash on hand A. As discussed in Chapter 3, other measures of balance-sheet strength include the two measures of moral hazard—the private benefit B and the likelihood ratio $\Delta p / p_H$—and the market interest rate when it is not exogenously fixed.[41] These other indicators would lead to the same conclusions. A firm with a strong balance sheet (a high A) must pay back less to investors; thus R_b is large and so the entrepreneur enjoys much real control over decisions.[42] Conversely, a firm with a weak balance sheet (a low A) has a low R_b and therefore a low congruence between the entrepreneur and investors. This will result in frequent deadlocks, as one would expect.

This brings us to a discussion of active monitoring. When deadlocks are frequent, an active monitor who can bring further information to bear on the decision, may break deadlocks and therefore be particularly helpful, as argued by Burkart et al. (1997) (who, citing Franks et al. (1996), note that ownership concentration in the United Kingdom increases during periods of financial difficulty).

Suppose that an active monitor collects at a cost a signal σ_m about the quality of the entrepreneur's proposal, and that this active monitor has interests that are congruent with those of other investors, so that his recommendation to rubber-stamp or veto the entrepreneur's proposal is trusted by the latter. The signal σ_m contains information about the values of τ and γ (technically, it refines the investors' information partition). Thus, combined with the information conveyed by the fact that the entrepreneur recommends moving away from the status quo, it allows investors to make a better-informed decision.

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41. Collateral and income prospects are other indicators of the strength of a balance sheet.

42. In the model, there is a single decision and so the entrepreneur enjoys either full or no control over this decision. More generally, we could envision multiple decisions with different characteristics (different joint distributions over τ and γ), or equivalently a single decision to be taken in different states of nature (some information about the joint distribution over τ and γ could be learned by investors after the initial financing stage but before they choose whether to rubber-stamp the proposal). There would then be a broader range of degrees of real control.

The criterion for rubber-stamping the proposal is[43]

$$E(\tau \mid \tau R_b - \gamma \geqslant 0, \ \sigma_m) \geqslant 0.$$

In the next subsection, we will refer to the existence of such a monitor as "relationship lending" (see Chapter 9). By contrast, the absence of a monitor will be referred to as an "arm's-length relationship."

When the monitor does not have a majority of voting shares and has a conflict of interest with the other investors (for example, because the decision may affect one of his affiliated entities, or because the monitor certified the initial financing to the other investors in the first place and may want to try to cover up his mistake or else because the monitor may collude with the entrepreneur), the other investors should assess their relative congruence with the entrepreneur and the monitor for the type of decision at stake.

10.3.2 Strength of the Balance Sheet and Corporate Governance

This section provides a formal analysis of the question just posed: is a firm with a strong balance sheet more or less likely to resort to relationship lending?

10.3.2.1 Determinants of Trust and Monitoring

We first demonstrate two results:

(i) A stronger balance sheet leads to a less conflictual relationship with (more rubber-stamping by) arm's-length lenders.

(ii) Relationship lending is associated with a weak balance sheet.

To show this, suppose that the firm has enough pledgeable income under an arm's-length relationship provided that investors have control (otherwise an arm's-length relationship is not an option, making result (i) vacuous).

Arm's-length relationship. In the absence of active monitoring, the entrepreneur's net utility (also equal to the NPV) is

$$U_b = p_H R - I$$

if managerial proposals are turned down (deadlock), and

$$U_b^+(R_b) = p_H R - I + E(\tau R - \gamma \mid \tau R_b - \gamma \geqslant 0)$$
$$\times \Pr(\tau R_b - \gamma \geqslant 0)$$

if they are embraced (rubber-stamping). Because managerial proposals are accepted when

$$E(\tau(R - R_b) \mid \tau R_b - \gamma \geqslant 0) \geqslant 0,$$
$$U_b^+(R_b) > U_b, \quad \text{for all such } R_b.$$

Put differently, rubber-stamping cannot hurt investors who always have the option not to go along with the entrepreneur's recommendation; and it always benefits the entrepreneur, who makes a recommendation only if its acceptance benefits her. *Because rubber-stamping requires mutual consent, the action can only increase value in expectation*, if not necessarily in each of its realizations. Let $\bar{R}_b$ denote the minimum managerial stake such that investors trust managerial proposals; it is defined by

$$E(\tau \mid \tau \bar{R}_b - \gamma \geqslant 0) = 0;$$

we assume that $B/\Delta p < \bar{R}_b < R$.[44]

The investors' gross payoff (see Figure 10.6) as a function of R_b is

$$\mathcal{P}(R_b) = p_H(R - R_b)$$
$$+ \max\{0, E(\tau(R - R_b) \mid \tau R_b - \gamma \geqslant 0)$$
$$\times \Pr(\tau R_b - \gamma \geqslant 0)\}.$$

The first term on the right-hand side of this equation is the only term in the deadlock region; it decreases linearly with R_b. The second term's variation with R_b is complex, but it can easily be shown that this second term increases with R_b when investors have a weak preference for rubber-stamping, that is, in the left part of the no-deadlock region in Figure 10.6. Accordingly, the pledgeable income need not be a monotonic function of entrepreneurial compensation.

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43. While I am unaware of general results to this effect, it is straightforward to construct robust examples where, say, a small reduction in net worth calls for the presence of an active monitor. The next subsection studies one such environment. Here note simply that, for a continuous joint distribution over $\{\tau, \gamma\}$, the pledgeable income is continuous in R_b (with or without active monitoring). In contrast, in the absence of active monitoring, the NPV jumps down when $E(\tau \mid \tau R_b - \gamma \geqslant 0) = 0$ and R_b decreases slightly. So, under regularity conditions, if active monitoring is almost optimal before R_b decreases, then it becomes strictly optimal after the decrease.

44. If $\bar{R}_b < B/\Delta p$, then investors always go along with managerial proposals in the relevant range ($R_b \geqslant B/\Delta p$). The analysis is then straightforward.
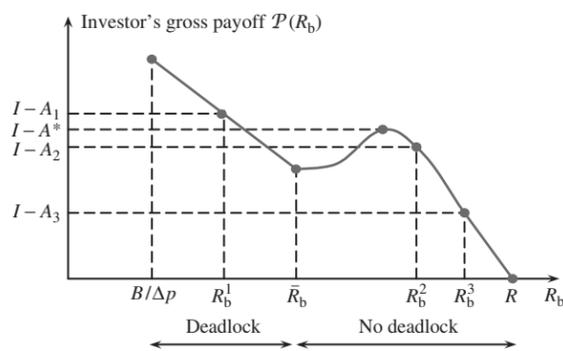
Figure 10.6

The borrower's stake R_b is the highest value $R_b^*(A)$ that enables investors to break even. If two stakes lead to the same expected investor income, the higher of the two makes the entrepreneur better off both because it directly yields her more income in the case of success and because it gives her more real authority. So, for example, for initial wealth A_2, the stake is R_b^2. The value $R_b^*(A)$ is an increasing function of A. As seen in Figure 10.6, managerial proposals are accepted only when $R_b \geq \bar{R}_b$.

The borrower's utility is $U_b^+ = U_b^+(R_b^*(A))$ for $A \geq A^*$, and is increasing in A. For $A < A^*$, the borrower's net utility, U_b, is independent of A. This proves result (i).

Relationship lending. Relationship lending may be beneficial for two reasons. The first, emphasized in Chapter 9, is that a tight relationship with a large investor reduces moral hazard and may be the only way for the firm to harness sufficient pledgeable income and thereby secure financing. The second, stressed here, is that relationship lending facilitates decision making in a situation in which investors are suspicious of the borrower's motivation.

To simplify the analysis, let us assume that an active monitor, by spending monitoring cost c, has access to the same information as the borrower concerning potential project modifications. More precisely, to prepare for his monitoring task, the monitor must spend the cost c upfront, that is, before being presented with a proposed modification; he can then assess the modification's profitability once the entrepreneur comes up with a suggestion. Provided that the monitor is given enough of a

stake in success to be incentivized to learn about such modifications, the initial project is amended when $\tau \geq 0$. The borrower's utility in the presence of an active monitor (and assuming there is no scarcity of monitoring capital and so the total cost of employing an active monitor is c)[45] is

$$U_b^a = p_H R - I + [E(\tau R - y \mid \tau \geq 0) \cdot \Pr(\tau \geq 0) - c].$$

This utility is independent of A. In contrast, we have seen that under an arm's-length relationship, U_b^+ is increasing in A. For A large (close to I), an arm's-length relationship is optimal. More generally there exists A^{**} such that an arm's-length relationship is optimal if and only if[46] $A \geq A^{**}$. This proves result (ii).

10.3.2.2 Application to Disclosure

The same logic implies that the entrepreneur will need to supply more information to investors as the balance sheet deteriorates and this deterioration is observed by investors (an unobserved degradation by definition does not raise concerns with investors).

Disclosure may be formalized in two ways: an overall "*ex ante*" disclosure policy and an "*ex post*" spontaneous disclosure, where "*ex post*" refers to a situation in which the entrepreneur already knows the proposal's characteristics (τ, y). For simplicity, let us restrict attention to the case of *ex ante* disclosure.[47] Suppose that setting up a disclosure mechanism costs c (transaction costs, involuntary

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45. Recall from Chapter 9 that monitors, even if they are competitive, may enjoy a rent. That is, their return may exceed that justified by their contribution to the initial investment and the monitoring cost. We have assumed that monitors have enough cash on hand that they do not enjoy such scarcity rents.

46. If $U_b^a < p_H R - I$, then $A^{**} = I - p_H(R - B/\Delta p)$; $A^{**} \in (A^*, I)$ if $U_b^a > U_b$.

47. *Ex post* disclosure could, for example, be modeled as in Dewatripont and Tirole (2005). In that paper, the agent with private information (the entrepreneur here) can at a cost disclose decision-relevant information that, also at a cost, can be assessed by the decision maker (here the investors); she can also disclose "cues" (information that has no direct bearing on the decision at hand, but is useful to assess the congruence between the two parties). In particular, the informed agent can either disclose information (provide information that helps the decision maker to assess his payoff from the proposed course of action), or put no effort into communication and rely on the decision maker to rubber-stamp the proposal. Communication does not increase monotonically with congruence. The agent with private information does not disclose information when congruence is high: she knows that the decision maker will rubber-stamp and therefore takes him for granted. By contrast, the agent discloses information when congruence is lower.

disclosure of strategic information to competitors and so forth), but supplies investors with useful information to evaluate the managerial proposals. Adopting a disclosure policy is then equivalent, in the previous analysis, to going for relationship lending, rather than keeping an arm's-length relationship. We can thus conclude that firms that need to raise funds or renegotiate existing loans will engage in more disclosure when having an (observably) weaker balance sheet. Put differently, firms will disclose more in bad times than in good times.

10.3.2.3   Managerial Initiative

Let us now assume that ideas for a new course of action do not arise exogenously; rather, they require entrepreneurial initiative. Initiative can be measured by the probability that the entrepreneur comes up with a proposed change in the course of action; this probability is now endogenous and smaller than 1, and can be expected to be influenced by the presence of a monitor who collects information about the investors' benefit from moving away from the status quo. In general, the monitor will collect more information if he has a higher stake in the firm. The following result (due to Burkart et al. 1997) can also be obtained.

(iii) Entrepreneurial initiative decreases with the ownership share of the monitor when the entrepreneur has real authority in the absence of monitoring.

The intuition for this result, developed in more detail in Section 10.6, is that an increase in the monitor's share enhances the latter's incentive to acquire information about the profitability of the entrepreneur's proposal. If the entrepreneur enjoys real authority in the absence of monitoring, the resulting increase in the intensity of monitoring results in a higher likelihood that the proposal be overturned or modified and thus in a lower payoff associated with coming up with proposals in the first place.[48]

Note that result (iii) relies on the interests of the entrepreneur and the investors being *ex post* dissonant with regards to the monitoring decision, that is, on the entrepreneur having real authority in the absence of monitoring and therefore losing control over the decision on when the active monitor becomes informed. By contrast, if the entrepreneur does not enjoy real authority in the absence of monitoring (her suggestions are rejected), then monitoring necessarily *enhances* initiative, because monitoring creates at least some probability that a suggestion be accepted.[49]

10.3.3   Private Benefits of Large Shareholders

Students of corporate finance are sometimes surprised by the frequent assertion that a holder of a large minority stake (10 or 20%, say) "controls" the firm. Relatedly, large blocks (which, incidentally, are seldom broken up) sell at a premium relative to the market price of individual shares, as was shown by Barclay and Holderness (1989) for blocks of at least 5% of common stocks listed on the New York Stock Exchange or the American Stock Exchange. Formal control is normally associated with a majority of voting rights, and the conventional wisdom regarding large minority blockholdings must be associated with a different channel of control.

There are several reasons why a block share may be valuable in firms without a majority shareholder. First, when shareholders' interests diverge, coalitions must be formed in order for the board to make a decision. A large blockholder may be uniquely placed to be part of this coalition and may derive

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some benefits, e.g., a cash transfer or an increase in ownership stake, in the formation of a majority coalition (Zwiebel 1995). Similarly, a large blockholder may be courted by the raider in a takeover attempt. Second, there may be a serious failure of corporate governance. For example, a large shareholder may collude with management to let the management pursue value-decreasing policies in exchange for, say, below-market transfer prices with a subsidiary of the large shareholder or an access to the firm's knowhow.[50] Third, the large shareholder may enjoy "control amenities" (prestige and perks attached to sitting on the board, etc.).

We are here interested in a fourth possible reason: even when corporate governance functions properly, the large blockholder may enjoy real authority, in the same way that the manager enjoys real authority. As one would expect, the large blockholder will have a higher impact on decision making if his interests are better aligned with those of majority shareholders. Conversely, high potential private benefits and low ownership share make it unlikely that the large shareholder will be able to convince other shareholders to go against managerial policy choices (see Exercise 10.3). Furthermore, they make the large shareholder unlikely to represent a useful counterpower to the manager if his interests are aligned with her own; for, the large blockholder will then tend to second managerial proposals to his own benefit.

10.4 Allocation of Control Rights among Securityholders

10.4.1 Potential Rationales for the Multiplicity of Securities

Part III distinguished between informed investors (active or passive monitors) and uninformed investors; because monitors are subject to moral hazard themselves, they may face income streams that differ from those of other investors. But there is a sense in which we have still been considering a single class of securities: we have introduced no reason why one should design different classes of securities with different control rights. In the case in which

control rights are relevant (active monitoring), it was optimal to achieve as much congruence among the active monitor and other investors as is consistent with incentives to monitor. That is, there was no gain attached to artificially creating conflicting goals and externalities from decision making among investors. In practice, though, we observe claims, such as outside equity and debt, with very conflicting interests and different control rights. The cost of such security designs is obvious: those investors in control may not internalize the welfare of other investors. The divergence of objectives creates externalities. For example, it is well known that shareholders may want to select negative-NPV actions that increase risk and "expropriate" debtholders, and that costly covenants and exit options protecting debtholders (short-term debt, convertible debt) must be put in place so as to limit the importance of this phenomenon (Jensen and Meckling 1976). The puzzle is thus to find the benefits, not the costs, of the coexistence of multiple securities. Explaining the coexistence of multiple securities with differentiated control rights is one of the main challenges currently facing corporate finance theory.

From a broad perspective, there are several possible explanations for the multiplicity of securities. Each probably has some relevance, but none is immune to criticism.

10.4.1.1 Investors' Demand for Specific Securities

Investors do not have identical preferences as to the characteristics of securities. They may for example face different tax treatments or marginal rates, or have different liquidity needs. Thus, they may demand differentiated securities. An important contribution along this line, reviewed in Chapter 12, is due to Gorton and Pennacchi (1990). Consider an economy with "short-term" and "long-term" investors. The difference between the two categories of investors is that short-term investors anticipate buying a house, facing possible unemployment, or being sick, say, and are therefore likely to be forced to sell their assets. Unlike long-term investors, short-term investors are concerned about losing money to better-informed traders in the market when they resell their assets (as in Kyle (1985) for example). They will thus be eager to buy "low-information-intensity

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50. The idea is that the large shareholder fails to perform the role of an active monitor in exchange for a favor from management (see Chapter 9 for a model of this type of collusion).

securities," that is, securities for which private information held by speculators is less likely to be an important factor. In a nutshell, AAA bonds (which by definition are unlikely to default, and on whose payoff there is therefore little asymmetric information) will probably be resold on the market at a fair value, while the stock of a firm will be subject to substantial adverse selection in the market and will therefore probably sold at a discount. Assuming that the speculative monitoring considerations discussed in Chapter 8 are minor for this firm, it pays the firm to tailor the securities to the needs of its clientele: issue stocks for long-term investors and bonds for those with more pressing liquidity needs.

While this explanation for the multiplicity of securities seems to make sense, more work is still required to make it tight. In particular, it is unclear whether security design and repackaging for the clientele's benefit should be performed at the firm's level or at that of an intermediary. Could one not obtain the benefits of congruence among investors at the firm's level and create the benefits from diversity for investors through unbundling at the intermediary's level?[51] A different issue related to the existence of intermediaries is whether they could not bundle high-information-intensity assets from different firms in order to create the low-information-intensity securities desired by short-term investors? This bundling is actually performed on a routine basis for example by closed-end funds offering market indices such as the S&P 500, which are less subject to asymmetric information than individual stocks (see Subrahmanyam 1991; Gorton and Pennacchi 1993).

10.4.1.2 Liquidity Management

Another important dimension of security design is the timing of the firm's liquidity needs. A high-tech start-up usually generates little or no income for a long time and must therefore be financed mainly through equity; as we saw in Chapter 5, short- and medium-term debt would create serious liquidity problems and would result in inefficiencies. In contrast, a firm in a mature industry with large cash flows and few investment needs should be subject to substantial leverage in order to ensure that the firm disgorges the excess cash.

More generally, because refinancing is subject to the same credit rationing problems as the initial financing, the firm's future liquidity must be carefully planned at the initial stage. Different securities have different impacts on the firm's available liquidity. Short-term debt drains liquidity whereas equity does not: while stockholdings are liquid at the level of the individual investor, they are illiquid for the collectivity of investors as a whole since an investor must resell his/her shares to another investor, without any flow of money out of the firm. Long-term debt in this respect is somewhat akin to equity, which explains why it is often proposed (in prudential regulation, for example) that part of long-term debt be counted as equity, even though long-term debt has very different cash-flow and control-rights characteristics compared with equity.

Liquidity management represents an important dimension of security design. But per se it does not explain the multiplicity of securities. The firm could equivalently replace this array of securities (short-term debt, equity, etc.) with different cash-draining characteristics by a single, composite one which would have the same timing and amount of liquidity demands on the firm. Thus, liquidity management can offer a clue as to the multiplicity of securities only if it is combined with one of the last two explanations, which we now describe.

10.4.1.3 Monitoring

Another, relatively unexplored, approach to explaining the multiplicity of claims would focus on the multidimensional nature of monitoring, together with a conflict of interest between the various monitoring tasks (otherwise the multiple monitoring tasks could be performed by the same monitor).[52] For instance, it may be optimal to separate the monitoring of moral hazard along the first- and second-order stochastic dominance dimensions. Monitoring

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51. Alternatively, the firm could issue multiple securities, but allocate control rights to a "neutral" group of investors, whose payoff would be representative of all other investor claims combined.

52. See Dewatripont and Tirole (1999) for a theoretical perspective on the rationale for advocacy in a situation in which an agent must perform conflicting tasks (which echoes on the output side Holmström and Milgrom's (1991) work on multitask effort substitution on the input side). These remarks borrow from discussions with Mathias Dewatripont.

of first-order stochastic dominance (profit enhancement) usually requires compensating the monitor with a claim on profit that puts heavy weight on the upside. Such claims, however, may discourage the monitor from paying attention to risk taking. Similarly, it may be odd to ask a monitor in charge of preventing distress to also monitor that the firm maintains the resale value of its collateral in the case of distress.

To sum up, multitask monitoring may give rise to the creation of conflicting claims for different active monitors; yet, per se, it will not explain the multiplicity of claims offered to *uninformed* investors (e.g., corporate bonds and equities held by small investors). In this respect, it would be interesting to analyze the coexistence of multidimensional speculative monitoring as well.

The structure of return flows associated with a security is not the only factor impacting the monitoring of the firm by the holders of this security. The liquidity/resellability of the claim also plays a major role, as already discussed in Section 9.5 in the case of active monitors. Chapter 11 will return to this aspect in the context of *potential* active monitors. This chapter will discuss takeovers and the concomitant incentive for potential acquirers to spot value-enhancing actions.

10.4.1.4 Control Rights: Multiple Securities as a Disciplining Device

The return structure of a claim determines its holder's monitoring focus on some aspects of management as well as the intensity of monitoring, as we just saw. But the return also determines the holder's choice of intervention if control rights are bundled with the return stream. Thus security design also matters from a control rights perspective. Now, as we already observed, decision making that is efficient from the investors' perspective would seem to call for a congruence between the rights holders and the other investors in order to prevent externalities. So, allocating control to claimholders who do not represent the collective interest of all investors in the firm would seem to make little sense unless this allocation serves to discipline management. We develop this theme in Section 10.4.2.

10.4.2 Security Design as a Disciplining Device

As we just discussed, designing securities with different return streams is bound to generate conflicts of interest among different securityholders. It is therefore *a priori* unclear why, provided one has reached the conclusion that investors should be given a specific control right (see Section 10.2), this control right should be allocated to a specific class of investors (e.g., shareholders or debtholders) whose interests are not representative of those of the community of investors as a whole. Put differently, the Aghion–Bolton model does not explain the coexistence of multiple claims (e.g., debt and equity) with different control rights.

Control, however, is often exerted by investors whose claim makes them unrepresentative of the community of investors as a whole. For example, during "normal times" equityholders have control, while in "bad times" debtholders acquire control, if only through their threat of liquidating the firm or through that of calling the entire principal due. Interestingly, control in normal (bad) times goes to securityholders who care more (less) about the upside than about the downside. Why do certain control rights go to certain cash flow claims? Somehow, such biases in policy preferences must serve one of several possible incentive purposes. This section investigates a specific one: security design disciplines management through a carrot-and-stick mechanism.

A carrot-and-stick view of security design is developed in Dewatripont and Tirole (1994) on the coexistence of debt and equity, and by Berglöf and von Thadden (1994) on the coexistence of short- and long-term debt. The basic idea of these papers is straightforward and builds on the contingent-control insight of Section 10.2.3. Managers' welfare in general depends on their firm's course of action as well as on their monetary compensation scheme. That is, interim decisions by investors should be treated as part of the managerial incentives package. But, while the carrot-and-stick theory of control in Section 10.2.3 emphasized the contingent allocation of control between insiders and outsiders, the carrot-and-stick view of security design emphasizes the contingent allocation of control among outsiders.
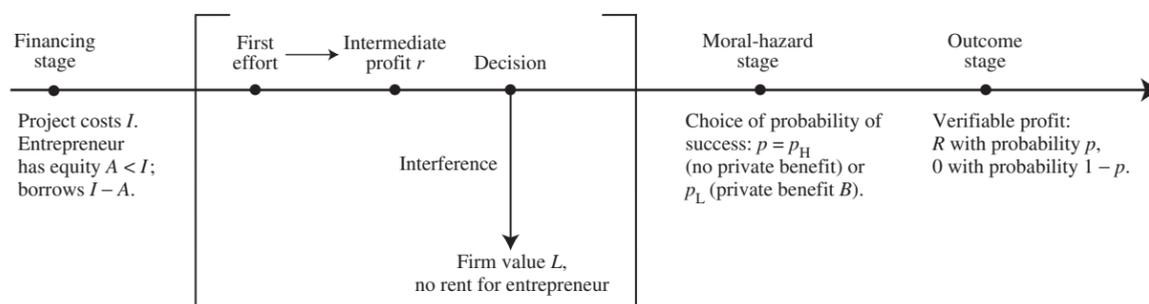
Figure 10.7 Multiple securities as a disciplining device.

The carrot and the stick are provided by allocations of control to investors who are more or less congruent with management. In particular, allocating control to "tough investors"—namely, investors whose preferences (as implied by their cash flow claim) have little congruence with those of managers—when interim managerial performance is weak and to "soft investors"—namely, investors whose preferences are less dissonant with those of management—when interim managerial performance is satisfactory creates good incentives for management.

Let us consider debtholders. The fact that they do not benefit from the upside makes them conservative, inclined to liquidate assets, downsize, encourage routine management, and more generally interfere to make the firm's return safer. Debtholder control is feared by managers and should arise when the firm's performance is poor. In contrast, equityholders, who are compensated on the upside, are somewhat less likely than debtholders to interfere with management[53] (although they still have substantial conflicts of interest with management) and should receive control in good times.

To illustrate the carrot-and-stick idea, let us enrich the basic model of Chapter 3 by adding an intermediate date and performance, and a decision over whether to "continue" or "interfere" in the firm's management after this intermediate performance is observed. The timing is summarized in Figure 10.7, where the new building block relative to the standard model is in bold characters.

After the financing stage ("date 0"), the entrepreneur exerts a first effort, that (possibly stochastically) determines a "date-1" or intermediate performance. This performance (short-term profit/EBIT, functionality test, drug approval, etc.) is verifiable. For concreteness, assume this is a short-term profit $r \in \{r_L, r_H\}$ with $r_L < r_H$; but as some of the examples suggest, the intermediate performance measurement may refer to a nonmonetary variable as well.

A decision must then be made as to whether to let the entrepreneur "continue" with her selected course of action or to "interfere." In the case of continuation, the "date-2" operations are as in the basic model. The entrepreneur is subject to moral hazard and must therefore be given a minimum share of the final cake R in the case of eventual success. In the case of interference, the investors can recoup a value L and the entrepreneur receives no rent or, more generally, a lower rent than under continuation.

To make things interesting, let us assume that what constitutes "continuation" and "interference" cannot be contracted upon at the financing stage.[54] This may be because "interference" can take many forms: reduction in the riskiness of the project or refusal to invest in new activities, downsizing, enhanced oversight by an active monitor, reduction in the entrepreneur's scope of authority, firing of the entrepreneur, reorganization, liquidation, and so

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53. Or they might interfere equally but not take actions that are as painful for management.

54. If the actions can be described, managerial incentives are not altered, but security design is irrelevant. Indeed, the initial contract can specify the course of action contingently on "date-1" performance. In a sense, and as we will see later, the design of securities with dissonant objectives serves to implement or approach the optimal state-contingent course of action.

forth. The inability to describe precisely the decision *ex ante* will, as in previous sections, lead to an allocation of control rights. Ruling out entrepreneur control, say because it would lead to a shortage of pledgeable income, we focus on the allocation of control to different classes of investors.

Abstracting from the details of this formulation, *the first key assumption is that different courses of action have different impacts on the entrepreneur's welfare.* This assumption implies that the entrepreneur is not indifferent as to who will receive control rights, and hence that a contingent allocation of control rights can be used to discipline the entrepreneur. This first assumption delivers a theory of security design in which contingent control rights covary with cash-flow rights.

The second key assumption, which underlies the specific security design, namely, the allocation of control to equityholders in normal times and to debtholders in bad times, is that the course of action least preferred by the entrepreneur (which we labeled "interference") produces a less risky cash flow.[55] As we will see, this assumption will imply that the entrepreneur can be punished by allocating control to a class of investors with a conservative slant.

Returning to our model, let us assume that

$$p_{\mathrm{H}}\left(R - \frac{B}{\Delta p}\right) > L.$$

That is, when the entrepreneur is held to her incompressible share, $R_{\mathrm{b}} = B/\Delta p$, interference reduces the income that can be pledged to the investors (it is "inefficient" even from the point of view of pledgeable income).

The reason why the decision in general is part of the incentives package is again the scarcity of pledgeable income. Paying the entrepreneur a bonus for a high intermediate profit r_{H} over and above her "quasi-rent" (her expected share in the final profit) under continuation reduces the pledgeable income. Offering the entrepreneur the prospect of this continuation quasi-rent, $p_{\mathrm{H}}R_{\mathrm{b}}$ (where, as earlier, $R_{\mathrm{b}} \geqslant B/\Delta p$ is the entrepreneur's reward in the case of final success), for a high first-period profit and of interference for a low first-period r_{L} profit may well

be a cheaper way to provide the same incentives, in the sense that it delivers a higher pledgeable income (note again, the analogy with the treatment of contingent control in Section 10.2.3). There is, of course, a cost of doing so. In this model, interference is costly for the investors as long as $p_{\mathrm{H}}(R - R_{\mathrm{b}}) > L$. Thus, the threat of interference reduces both the project's NPV (since $p_{\mathrm{H}}R > L$) and, for a given date-1 entrepreneurial behavior, pledgeable income. However, if the entrepreneur can control the first-period profit fairly well (there is little noise in first-period performance), the probability of interference conditional on a high first-period effort is low and so is the cost of basing the first-period incentives on the threat of interference.

To implement this contingent continuation decision, the entrepreneur can issue a level of short-term debt d exceeding the low first-period profit and smaller than or equal to the high first-period profit: $r_{\mathrm{L}} < d \leqslant r_{\mathrm{H}}$. If short-term debt is paid back from date-1 income, then equityholders, whose only potential income is an amount $R_{\mathrm{E}} > 0$ in the case of final success (if the firm continues), have control. They choose to continue because (a) debtholders have priority, and so total (short- plus long-term) debt $d + D$ must first be paid in full out of the payoff L under interference before shareholders can receive any income, and (b) debtholders are better off when being paid in full. Because by assumption the investors' total income (debt plus equity) is greater under continuation than under interference, the shareholders' income is *a fortiori* larger under continuation.

In contrast, in the case of distress (the short-term debt is not paid back entirely), the whole debt (short-term debt d and long-term debt $D = R - R_{\mathrm{E}} - R_{\mathrm{b}}$) becomes due. Assume for simplicity that the low intermediate profit is equal to 0, so that none of d is repaid and so $(d + D)$ remains due. Debtholders, who have priority over the reorganization value L and receive $(d + D)$ in the case of continuation and success and 0 otherwise, want to interfere if $p_{\mathrm{H}}(d + D) < L$.

Exercise 10.1 studies this general logic in more detail. The following example makes the accounting particularly simple. Suppose that a high (respectively, low) intermediate effort deterministically yields profit r_{H} (respectively, $r_{\mathrm{L}} = 0$), and that a low intermediate income yields private benefit B_0

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55. In this model, this reduced riskiness is extreme, since the value L is taken to be deterministic.

(over and above the private benefit, B, if any, potentially enjoyed under continuation). Assume further that there is just enough pledgeable income to allow funding in the case of a high intermediate effort and continuation,

$$r_H + p_H\left(R - \frac{B}{\Delta p}\right) = I - A;$$

and that the threat of termination suffices to discipline management at the intermediate stage when the entrepreneur's reward in the case of success is set at its minimal incentive-compatible level,

$$B_0 \leqslant p_H R_b = p_H\left(\frac{B}{\Delta p}\right).$$

The NPV is then $r_H + p_H R - I$.

To implement this outcome and receive funding, the entrepreneur can issue short-term debt $d = r_H$ (and, say, no long-term debt, although this is not important), and give control to debtholders in the case of nonrepayment. Provided that

$$p_H d < L,$$

debtholders prefer not to roll over their debt when they are not repaid, as they receive $\min\{d, L\}$ by interfering. And so the entrepreneur receives no income when the firm's short-term profit is low. We also check that shareholders prefer not to interfere when they have control, i.e., when the short-term debt has been reimbursed, since

$$p_H\left(R - \frac{B}{\Delta p}\right) > \max\{L - d, 0\},$$

which results from the assumption that investors' total income is large in the absence of interference.

It is important to point out what the multiplicity of claims accomplishes. Suppose there were a single claim ("100% equity"). When deciding whether to interfere, the investors would compare $p_H(R - R_b)$ and L, and therefore would always continue provided R_b is not too large (or always interfere otherwise) *regardless of the intermediate performance*. Because it would be noncontingent, the exercise of the control right would then have no disciplining impact on the date-1 effort. Indeed, the reader will here recognize an illustration of the *soft-budget-constraint problem* studied in Chapter 5. The control right is exercised with a forward-looking perspective while its use as a disciplining device requires it to be backward looking; or, put differently, the date-1 profit does not affect future prospects and therefore does not change the incentives of the securityholders as a whole.[56]

Finally, the key property of the carrot-and-stick scheme is that the incentives of the controlling investors be made contingent on some measure of performance. This is naturally accomplished as above by transferring control from one class of securityholder to another. Alternatively, and equivalently, a single class of securityholders might retain control, but its returns stream would be adjusted as a function of the measure of entrepreneurial performance so as to duplicate the contingent incentives of the control-transfer mechanism.[57]

10.4.3 The Investors' Coalition Conundrum: Is Modigliani–Miller Back?

A crucial assumption for the theory just described, as for other potential theories of the multiplicity of securities, is that the securityholders do not undo the multiplicity.

In the context of control rights, the carrot-and-stick argument requires that whoever is in control does not renegotiate with other securityholders. In the theory of debt and equity discussed above, debtholders exert a negative externality on shareholders when they interfere. In the absence of full repayment of the short-term debt, debtholders who have control interfere even though the continuation value from the point of view of debtholders *and* equityholders, $p_H(R - R_b)$, exceeds the liquidation proceeds, L. Debtholders could, for example, design

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56. Symmetrically, the same reasoning can be used to derive a security-design version of investor promises to refinance projects or retain management when the firm returns cash to investors (see, for example, the Bolton–Scharfstein model in Sections 3.8, 4.7, and 7.2, as well as Section 11.4 in the next chapter). Suppose that $p_H(R - B/\Delta p) < L$. Because the entrepreneur has minimum stake $B/\Delta p$ in the case of success, investors, taken together, are better off interfering. However, to induce managers to exert effort earlier in the relationship, it may be optimal not to interfere when the intermediate performance is high. Giving control to equityholders in such times and to debtholders (or unbiased investors for that matter) in bad times may provide the required carrot and stick.

57. This more complex implementation may make sense in situations in which a proper exercise of control requires substantial investments in information acquisition by a controlling claimholder. The contingent return-stream scheme then economizes on information acquisition costs relative to the control-transfer scheme described in this section.

a debt-for-equity swap that benefits all investors, since total investor payoff is higher under continuation; or shareholders could inject more funds and repay some of the debt so as to make debtholders willing to continue.

Were all securityholders to renegotiate and gains from trade between them to be realized (that is, were the Coase Theorem to apply), we would be back to the single-claim, noncontingent control case and the theory would have no content. The anticipation of continuation regardless of debt repayment would undermine the entrepreneur's *ex ante* incentive. This is actually a more general result: the investors' net gain to continuing is independent of first-period performance,[58] and so a performance-contingent pattern of investor control cannot be used to discipline the entrepreneur if securities are renegotiated and investors therefore behave in a united way.

In the carrot-and-stick theory, the entrepreneur would no longer fear debtholder control, since debtholders would internalize the negative impact of liquidation or conservative interference on shareholders after negotiating with them. This point is completely general and needs to be confronted by any theory of security design based on the allocation of control rights: while the allocation of control rights between insiders and outsiders matters, security design is irrelevant as long as securityholders re-form the broad coalition when they are about to interfere. Is Modigliani and Miller's result of irrelevance of security design back?

One of two assumptions is usually made to avoid this strong implication of the Coase Theorem. The first is that for some reason (transaction costs associated with investor dispersion,[59] asymmetric information among investors,[60] or cash constraints) renegotiation does not work well or does not happen at all. This failure of renegotiation among investors creates *ex post* inefficiencies, but preserves the *ex ante* commitment created by the multiplicity of securities.

Mathias Dewatripont has remarked[61] that there is a tension between, on the one hand, the existence of multiple securities and, on the other, the practice of facilitating renegotiation involving dispersed securityholders, such as exchange offers and the nomination of bondholder trustees in the case of corporate bonds, as well as the premise of much work on the economics of bankruptcy that efficient renegotiation should be facilitated. Or, put differently, why should one bother designing multiple securities if the desired outcome is that produced by a 100% equity firm?

Two innovative proposals for bankruptcy law reforms are due to Bebchuk (1988) and Aghion et al. (1992). Both papers offer market-based mechanisms for the reorganization of financially distressed firms.[62] Under both recapitalization processes, most senior creditors are turned into equityholders. In Bebchuk's scheme junior creditors are given options to buy senior creditors' shares at a strike price that induces them to exercise the options if the value of shares exceeds what is due to senior creditors. Similarly, former equityholders receive options to buy the shares at an even higher strike price, respecting the claims' initial priority. The Aghion et al. scheme adds a second stage, in which managers and other parties can propose a reorganization scheme to the residual owners. Without going into the details of these two schemes, let us make two points. First,

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58. This independence relies on the absence of serial correlation of profits. The theory can be extended to allow for a serial correlation.

59. Investor dispersion is particularly problematic for public debt. In the United States, public debt restructuring almost always takes the form of a package of new securities plus cash in exchange for the original public debt, as the 1939 Trust Indenture Act requires unanimous consent to modify principal, interest, or maturity of public debt. See Gertner and Scharfstein (1991) for an analysis of workouts of distressed firms with outstanding bank debt and public debt. In an analysis of distressed junk bond issuers in the United States, Asquith et al. (1994) shows that public debt restructuring is crucial for avoiding bankruptcy even when bank debt is restructured; real debt relief tends to come from subordinated public creditors, since banks rarely forgive principal or provide new financing outside formal bankruptcy proceedings.

60. Berkovitch and Israel (1999) emphasize the role of asymmetric information among investors in a bankruptcy context.

61. At the Nobel foundation conference on corporate finance (Stockholm, August 1995).

62. There has been much recent debate about the virtues of various bankruptcy codes (see, for example, Davydenko and Franks (2004) for an international comparison of the effects of bankruptcy codes). For example, Chapter 11 in the United States has been criticized for giving too much control and bargaining power to managers, who usually initiate the bankruptcy process, and for allowing firms that should be liquidated to continue losing money for a couple of years. Chapter 11 stops payments to creditors including secured ones while managers continue to run day-to-day operations and prepare a reorganization plan to propose to the court. New financing can acquire seniority over existing creditors under court approval.

these schemes are attempts at respecting the priority of claims while eliciting market information about the relative merits of liquidation and various forms of ownership and continuation. In that sense, they represent formal mechanisms of renegotiation among investors (and possibly management).[63] Second, they take financial distress as given and attempt to achieve *ex post* efficient outcomes once the firm is in distress. They do not adopt an *ex ante* viewpoint explaining the design of a capital structure that leads to distress. Further research should clarify the consistency of the various theoretical and institutional pieces of the security design puzzle.[64]

The alternative approach to reestablishing the commitment value afforded by the existence of multiple securities with contingent control rights is to assume that the entrepreneur is somehow brought into the renegotiation process and that her post-renegotiation utility increases with her utility in the absence of renegotiation. The key modeling element is then the description of the concession made by the entrepreneur.[65] In Bolton and Scharfstein (1996) the entrepreneur has observable, but nonverifiable, savings. The investors cannot directly put their hands on the savings, but may be more demanding when they know that the entrepreneur is able to make a concession.[66] Alternatively, and

in a situation in which the entrepreneur has private information about the existence of potential profit-enhancing actions, the entrepreneur may offer courses of action that she would not normally volunteer (as in Sections 10.2 and 10.3 the entrepreneur's stake in profit does not compensate for the private cost of undertaking the action) in order to prevent a deadlock in bargaining.

Supplementary Sections

10.5 Internal Capital Markets

This supplementary section is concerned with a *specific control right*: *the ability to decide and contract on future financing decisions*. The right over the refinancing decision matters when future cash infusions are not perfectly planned at the onset, or else if the initial plans are subject to renegotiation. While covenants on indebtedness or on dividend distributions always limit the extent to which certain categories of debtholders can be diluted (see Chapter 2), firms may keep varying degrees of freedom concerning their ability to secure new funds.

At one end of the spectrum, the abandonment of the control right over the refinancing decision is starkly exemplified by the case of divisions, which cannot turn to the capital market but must rather get headquarters' approval. Of course, many more control rights are relinquished by divisions besides that over refinancing. This is also partly true for start-ups, that not only see their staged financing controlled by the venture capitalist, but must also conform to other controls as well. Still another example is provided by highly levered companies; if leverage is so high that the company is unable to face its debt obligations, creditors can threaten to liquidate the firm, and thereby acquire de facto, although not de jure, control over the firm's access to the capital market.[67]

We can formalize the impact of the allocation of this specific control right through its effect on the

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63. In that sense, they belong to the general class of mechanisms eliciting the various parties' information to achieve efficient outcomes (Maskin 1977).

64. See Berglöf et al. (2003) for an analysis integrating security design and bankruptcy procedures.

65. Because the latter is by assumption cash constrained *ex ante* (this is why she borrows in the first place) as well as (in an optimal design) *ex post*, this concession must be of a different nature. For example, it may be the revelation by the entrepreneur of hard information about a first-best suboptimal profit-enhancing action.

66. Furthermore, Bolton and Scharfstein derive a role for multiple creditors by introducing two complementary assets held as securities by two creditors. In the case of default, each creditor decides whether to liquidate his own asset. A buyer of the assets therefore needs to agree with both in order to realize the full value of the liquidated firm (the equivalent of L in this section). Having two creditors rather than one holding the two assets as collateral increases the bargaining power vis-à-vis the buyer under the Shapley value, but under Bolton and Scharfstein's assumptions this increased bargaining power, which tends to discourage the buyer from showing up in the first place, reduces the expected liquidation value when the entrepreneur has no hidden cash. In contrast, having two creditors also forces the entrepreneur to concede more when she has hidden cash. This increases pledgeable income.

67. The content of this right depends, of course, on the creditors' ability to use covenants in order to limit other forms of indebtedness, such as leasing contracts, trade credit, or off-balance-sheet exposures, and to control risk management.

bargaining power in future refinancing stages: an entrepreneur who has not surrendered the control right can play future investors off against each other. This gives the entrepreneur lots of bargaining power in such negotiations. In contrast, a division (or an independent entity that has surrendered the control right) will face a monopoly supplier of funds in the future.

10.5.1 Harnessing Pledgeable Income through Exclusivity: How Internal Capital Markets Facilitate Initial Funding

We first build on Section 9.4 by considering a two-stage financing decision in which, relative to their respective investment costs, the second stage generates plenty of pledgeable income while the first generates little. We can assign the difference between these two stages to differences in income (one may have in mind that the firm takes time to develop a decent product or must build a brand-name or goodwill) or, equivalently and as we will do here, to differences in investment costs.

There are two dates, $t = 1, 2$, and no discounting between the periods. The fixed-investment projects at dates 1 and 2 have respective investment costs I_1 and I_2 (the assumptions to follow imply that $I_1 > I_2$). The two projects may or may not be related (the projects are related if the first corresponds to an "inception" stage and enables the second, "follow-up" stage); for the sake of exposition, let us assume that they are not, and so the second project can be realized without the first. The entrepreneur has initial wealth A at date 1. Except for the investment cost, the two projects are identical. They yield R with probability p and 0 with probability $1 - p$. The probability of success is p_H (if the entrepreneur behaves), or p_L (if she misbehaves, in which case she gets private benefit B). Let us assume that each project has positive NPV ($p_H R > I_t$ for $t = 1, 2$) and that

$$I_2 < p_H\left(R - \frac{B}{\Delta p}\right) < I_1 - A \qquad (10.4)$$

and

$$2p_H\left(R - \frac{B}{\Delta p}\right) > (I_1 + I_2) - A. \qquad (10.5)$$

Thus, the first project cannot be funded on a stand-alone basis; the second project generates enough pledgeable income not only for stand-alone

finance (condition (10.4)), but also to compensate for the shortage of pledgeable income on the first project (condition (10.5)). We also assume that a project's NPV is negative if the entrepreneur misbehaves: $p_L R + B < I_2(< I_1)$.

We make the assumption (without endogenizing it) that the entrepreneur can (1) sign a financing contract with date-1 lenders, and (2), if she wants to, assign a control right over the date-2 refinancing decision to a particular lender. The internal capital market (ICM) case will refer to the situation in which such an exclusive right is contracted for, and the external capital market (ECM) case to that in which the entrepreneur keeps entire freedom on the date-2 refinancing decision, and all date-1 liabilities can be levied only on date-1 income (if any).[68] As usual, we assume that the capital market is competitive.

External capital market. Under an ECM, at date 2, the entrepreneur is able to borrow as condition (10.4) implies that the pledgeable income exceeds the date-2 investment cost. Because the entrepreneur faces a competitive capital market at date 2, she obtains the entire value of date-2 borrowing:

$$V_2 = p_H R - I_2.$$

This implies that date-1 lenders are not able to put their hands on any of the date-2 pie: viewed from the point of view of date 1, V_2 is the equivalent of a private benefit or nonpledgeable income. Because the date-1 pledgeable income $p_H[R - (B/\Delta p)]$ is smaller than the date-1 net investment cost $I_1 - A$, the first project does not receive financing (note that the entrepreneur does not value at date 1 cash (that is, retained earnings) more than current consumption, because the date-2 project is financed regardless of the level of retained earnings). The ECM therefore leads to inefficient credit rationing at date 1.

Internal capital market. Suppose now that the entrepreneur receives date-1 financing from a lender, to whom she gives control over the date-2 refinancing decision. At date 2, the entrepreneur and the lender then bargain over the sharing of the

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68. Under an ECM, one may have in mind that either the entrepreneur makes project 1 a stand-alone corporate entity, or that the same entity implements the two projects but the entrepreneur keeps the right to decide on the date-2 refinancing decision.

date-2 return. Let $(1-\theta)$ and θ denote the bargaining powers of the entrepreneur and the lender in that negotiation. One may have in mind that with probability θ (respectively, $1-\theta$) the lender (respectively, the borrower) chooses the date-2 contract. If the lender were to choose the date-2 financing arrangement ($\theta = 1$), he would give the minimum needed for incentive purposes, $R_b^2 = B/\Delta p$ in the case of success and 0 in the case of failure, to the entrepreneur and keep an expected

$$p_H\left(R - \frac{B}{\Delta p}\right) - I_2$$

for himself. That is, he would appropriate the date-2 NPV, $p_H R - I_2$, except for the minimum incentive payment, $p_H B/\Delta p$, to the entrepreneur. In contrast, if the entrepreneur were to choose ($\theta = 0$), the outcome would be that under a date-2 competitive capital market, and so the lender would receive no surplus. More generally, for $0 \leqslant \theta \leqslant 1$, the lender receives

$$\theta\left[p_H\left(R - \frac{B}{\Delta p}\right) - I_2\right].$$

And hence, if

$$-\left[(I_1 - A) - p_H\left(R - \frac{B}{\Delta p}\right)\right] + \theta\left[p_H\left(R - \frac{B}{\Delta p}\right) - I_2\right] \geqslant 0,$$

allocating the control right over the refinancing decision to a lender enables financing at the initial round. From condition (10.5), this will obtain if θ is sufficiently high.

In short, an internal capital market, as for other control rights transferred to investors, increases the pledgeable income and facilitates financing.

10.5.2 A Dark Side of Internal Capital Markets

The models of Gertner et al. (1994), Scharfstein and Stein (2000) and Brusco and Panunzi (2005) embody, in different ways, the idea that an ICM exposes the entrepreneur to a "holdup" and thereby stifles initiative.

This holdup problem is the flip side of the benefit of ICMs just analyzed. Indeed, the idea in the previous section was precisely that an ICM organizes such a holdup so as to allow the lender to recoup his first-period losses. But because the date-2 entrepreneurial surplus is smaller than when she faces a date-2 competitive capital market, the entrepreneur

has dulled incentives to invest at date 1. To illustrate this in the simplest manner, suppose that the very existence of the date-2 follow-up project requires a private investment cost C sunk by the entrepreneur at date 1, where

$$p_H\frac{B}{\Delta p} < C < V_2. \tag{10.6}$$

Suppose further that $\theta = 1$ (the lender has all the bargaining power under an ICM). The first inequality in (10.6) implies that the entrepreneur has no incentive to invest under an ICM: when the lender has full bargaining power, the entrepreneur receives the minimum incentive payment ($p_H(B/\Delta p)$ in expectation), which is not sufficient to compensate her for her investment. The second inequality in (10.6), however, implies that such an investment is both socially optimal and privately optimal for the entrepreneur under an ECM (under which she appropriates the entire surplus).

This holdup cost of ICMs is closely related to the industrial organization literature on the dulled incentives of parties to a long-term relationship who do not own productive assets (Grossman and Hart 1986; Klein et al. 1978; Williamson 1975) and to the treatment of relationship banking in Chapter 9.

10.5.3 Other Aspects of Internal Capital Markets

The literature on ICMs has emphasized a number of other important features.

10.5.3.1 High-Intensity Monitoring

An internal capital market almost always involves a large and possibly unique lender (although logically this would not need to be the case). As Alchian (1969) and Williamson (1975) have stressed, internal capital markets are therefore usually associated with high-intensity monitoring. This feature, as we have discussed in Chapter 9, has both costs and benefits. Suppose that there is uncertainty about the date-2 profitability for investors and that the presence of a large lender creates an active monitor and reduces the asymmetry of information between the entrepreneur and financiers at date 2. This reduced uncertainty may in some cases facilitate refinancing. On the other hand, we also know that too much information may also be detrimental, because it may stifle

the entrepreneur's initiative (see Section 10.6) or else induce her to try to exploit a soft budget constraint (see von Thadden 1995).

10.5.3.2 Allocation among Divisions

In contrast with venture capital and leverage buyout practices (see Sections 1.6.2 and 2.4.1), headquarters do operate cross-subsidies among divisions of a conglomerate. For example, Lamont (1997), studying the impact of the 1986 drop in the oil price in companies with oil interests, shows that these companies did cut investment across the board, including in nonoil-related divisions. Shin and Stulz (1998) similarly show that investment in one division is generally related to the cash flow of other divisions.

This redistribution of liquidity among divisions has both a bright and a dark side. On the bright side, the better information held by headquarters relative to the capital market makes it more likely that ICMs do a good job at picking winners, especially if the firm operates in related lines of business (Stein 1997): this is the multiple-division version of the high-intensity monitoring argument just discussed.

Also on the bright side, the headquarters may play the role of liquidity pools. In Chapter 15, we will stress that the stand-alone provision of liquidity by productive entities is an inefficient way to proceed, because liquidity is costly and lucky entities, that is, those which turn out to have low liquidity needs, may end up with liquidity that they do not need. The usual way to avoid this waste of liquidity is to have it centralized in financial institutions (banks) that then redispatch the liquidity as needed through the mechanism of credit lines (i.e., options to draw on a liquidity pool). But conglomerate headquarters may perform a similar function by redistributing the conglomerate's cash flow among the divisions. Furthermore, as stressed by Brusco and Panunzi (2005), this redispatching may build on information collected by the headquarters about the divisions' prospects.

Faure-Grimaud and Inderst (2004) compare the sensitivity of investment to cash flow of focused firms and conglomerate divisions. External redispatching of liquidity by the financial sector under project finance (focused firms) cannot duplicate internal redispatching of liquidity within the

conglomerate, since it is assumed that the same entrepreneur runs the divisions and therefore the information structure varies across institutions (so the analysis is akin to a multistage-financing version of the comparison between the Diamond diversified conglomerate and the project-finance stand-alone entity in Section 4.2). A key result of the Faure-Grimaud–Inderst analysis is that conglomerate divisions exhibit a reduced (re)investment–cash-flow sensitivity relative to focused firms performing the same activity, as better-performing diversions cross-subsidize the underperforming ones. They also show that, even though the average probability of refinancing per unit (divisions or focused firm) is higher in a conglomerate, "winner picking" implies that this need not be so at the individual unit's level: if division B has (even slightly) better continuation prospects than division A, then the conglomerate's liquidity will tend to be channeled to division B, and division A will benefit less from generating cash flow than it would if it were run as a focused firm. This redispatching is *ex post* efficient but may dull *ex ante* incentives to produce cash flow.

On the dark side, the competition between the divisions for corporate funding (stressed, for example, by Stein (1997)) may have perverse effects, such as excessive lobbying (Rajan et al. 2000; Scharfstein and Stein 2000). Similarly, collusion between specific divisions and the headquarters may lead to inefficient cross-subsidizations of weak divisions by stronger ones.

10.5.3.3 Product-Market Dimension

Being part of a large firm has implications for product-market competition. For example, Cestone and Fumagalli (2005) show that (endogenous) cross-subsidies from the most profitable to the least profitable divisions serves as a commitment device if these least profitable divisions are also those that face more aggressive competitors. For the interaction between finance and product markets, we refer to the analysis in Chapter 7.

Finally, there is a growing empirical literature on the efficiency of ICMs in allocating investment. The literature so far has pointed at the existence of an impact of ICMs on the investment pattern and showed that the concern about weak divisions

receiving too much capital at the expense of strong ones should be taken seriously. Measuring cross-subsidization is not easy for several reasons, including the facts that conglomerate divisions and stand-alone entities are likely to have different attributes and that apparently unrelated divisions of a conglomerate may be hit by common shocks, such as those affecting a regional economy (Chevalier 2004). We refer to Stein (2003, pp. 145–152) for a careful review of the relevant considerations.

10.6 Active Monitoring and Initiative

As discussed in Section 10.3, high-intensity monitoring has the potential to stifle entrepreneurial initiative. This supplementary section studies the mechanics behind this reduction in managerial initiative, and echoes some of Section 9.2.2's analysis of the externalities attached to monitoring.

As in Sections 10.2 and 10.3, we assume that at the interim stage, a change in the course of action away from the status quo can be implemented, but that this change requires information. Here, we suppose that there are $n > 2$ possible changes in the course of action, and that a random (i.e., uninformed) choice among the n actions proves disastrous (in expectation) to both the entrepreneur and the investors.

The n actions are *ex ante* (i.e., in the absence of information) identical. To formalize the above considerations, we assume that $(n - 2)$ of them end up giving a large negative payoff, that we denote "$-\infty$," to both parties. Therefore only two actions are relevant. One action increases the probability of success by

$$\tau > 0$$

relative to the status quo, while the other does not change the probability of success.

Also, one action imposes a cost

$$\gamma > 0$$

on insiders while the other imposes no such cost.

Preferences are said to be *congruent* if the action that raises the probability of success imposes no cost on insiders, and *dissonant* otherwise. The *ex ante* probability of congruence is denoted

Table 10.1

$-\infty$	$\cdots$	τ	$\cdots$	0	$\cdots$	$-\infty$
$-\infty$	$\cdots$	0	$\cdots$	γ	$\cdots$	$-\infty$
Congruence (ξ)						
$-\infty$	$\cdots$	τ	$\cdots$	0	$\cdots$	$-\infty$
$-\infty$	$\cdots$	γ	$\cdots$	0	$\cdots$	$-\infty$
Dissonance ($1 - \xi$)						

$\xi \in [0, 1]$.[69] Of course, the choice of terminology for the "dissonance" case embodies the assumption that the entrepreneurial stake, R_b, in the case of success is low enough that the entrepreneur would not want to propose an investor-value-enhancing action that would impose cost γ:

$$\gamma > \tau R_b, \tag{10.7}$$

a condition that we will later impose (as we know, this assumption requires that the entrepreneur's net worth be small enough that she has to borrow and therefore reimburse a large enough amount). The payoffs attached to the n actions are summarized in Table 10.1.

For example, the entrepreneur might be a biotechnology or computer science professor running a start-up. The status quo is the strategy defined by the start-up's initial business plan. The professor/entrepreneur may or may not propose a change in the course of action. Such a change may affect the probability of success of the venture; and it may impact the entrepreneur's "outside" (nonventure) payoff, namely, her ability to return to academia in the case of failure, the enhancement of her academic CV, or her capability in alternative ventures. There may or may not be congruence between the venture's commercial goals and the entrepreneur's objectives outside the venture.

Let us assume that

$$\tau R > \gamma > \tau \left[R - \frac{I - A}{p_H + \tau} \right]. \tag{10.8}$$

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69. Thus, the state of nature can be described by the occurrence or nonoccurrence of congruence (a binary variable) as well as by the mapping of payoffs to action names (all permutations are equally likely).

The first inequality in (10.8) says that in the case of dissonance, enhancing investor value is first-best efficient. The second inequality implies (10.7); for, were the investor-value-enhancing action always selected, the lenders would receive R_l in the case of success, satisfying the breakeven condition

$$(p_H + \tau)R_l = I - A.$$

More generally, investors must get at least this value in the case of success, implying that the borrower receives, in the case of success,

$$R_b \leqslant R - R_l = R - \frac{I - A}{p_H + \tau}.$$

Hence, the entrepreneur does not recommend a change in the course of action if preferences turn out to be dissonant.

Any investor can learn the realization of the payoff matrix (which includes the identity of the relevant actions, as described in Table 10.1) with probability x at private cost $c_m(x)$ satisfying $c_m(0) = 0$, $c_m'(0) = 0$, $c_m' > 0$, $c_m'' > 0$, $c_m(1) = +\infty$. The entrepreneur can learn the realization of the payoff matrix with probability y at private cost $c_b(y)$ satisfying $c_b(0) = 0$, $c_b'(0) = 0$, $c_b' \geqslant 0$, $c_b'' \geqslant 0$. (We do not assume that $c_b(1) = +\infty$ since we will initially consider the case in which the entrepreneur learns this realization for free ($c_b(1) = 0$) as a byproduct of her running the firm.)

Thus, each party either perfectly learns the identity of the two relevant actions and the payoffs attached to them, or learns nothing at all (in which case (s)he does not want to choose or propose an action at random as this would have negative consequences in expectation).

Lastly, we assume that the control right is given to the investors. This assumption can be rationalized in several ways. First, and as emphasized in this chapter, there may not be enough pledgeable income, and thus transferring control to investors may (in cases (b) and (c) below) be necessary to secure funding. Second, the left inequality in (10.8) implies that investor control is optimal even if there is no shortage of pledgeable income (up to the caveat discussed in (c) below).[70] That is, investor control is

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70. Third, one could add a third relevant action that, in contrast with the other two, would always be common knowledge and for which entrepreneur control would drastically lower value.

optimal even if there is enough pledgeable income to secure funding under entrepreneur control.

(a) *Fully informed entrepreneur, dispersed ownership.* Cases (a) and (b) assume that the entrepreneur learns the payoff matrix for free as a byproduct of her running the firm; they therefore cannot address the question of the impact of monitoring on entrepreneurial initiative.

Furthermore, case (a) presumes a dispersed (atomistic) ownership. This implies that individual investors have too small a stake to be willing to spend any monitoring cost. The investors are thus uninformed, and, because the entrepreneur only recommends an action that either increases or does nothing to the probability of success, rubber-stamp entrepreneurial suggestions when they arise.

Thus, under dispersed ownership, the entrepreneur has real, although no formal, authority.

(b) *Fully informed entrepreneur, large investor.* Maintaining the assumption that the entrepreneur is always fully informed, suppose now that a large investor holds a fraction R_m/R of the shares, that is, has stake R_m in the case of success.

The large monitor chooses monitoring intensity x (recall that x is this probability of learning payoffs), so as to equate his marginal monitoring cost $c_m'(x)$ with his marginal private benefit. To compute the latter, note that monitoring only turns out to be beneficial to the investors when preferences are dissonant. In that case, which has probability $1 - \xi$, the entrepreneur does not recommend the investor-value-enhancing action. The marginal benefit of monitoring for the large investor is therefore $(1 - \xi)\tau R_m$. Thus

$$c_m'(x) = (1 - \xi)\tau R_m. \qquad (10.9)$$

Let us now compute the optimal monitoring level, assuming that pledgeable income is sufficient to secure funding for the monitoring level maximizing NPV (in Exercise 10.4 a shortage of pledgeable income leads either to increased monitoring or to no funding at all). This level is given by

$$\max_{\{x\}} \{p_H R - I + [\xi(\tau R) + (1 - \xi)x(\tau R - y)] - c_m(x)\}$$

or

$$c_m'(x) = (1 - \xi)(\tau R - y). \qquad (10.10)$$

Comparing (10.9) and (10.10), the optimal monitoring level is obtained when

$$\tau R_m = \tau R - y$$

or

$$\frac{R_m}{R} = \frac{\tau R - y}{\tau R}.$$

Because, by assumption, $y > \tau R_b$ (otherwise preferences would always be congruent), the large investor must not hold all the outside (nonentrepreneurial) shares:

$$\frac{R_m}{R} + \frac{R_b}{R} < 1.$$

This result is another illustration of the overmonitoring principle analyzed in Chapter 9. At the margin, an increase in the large investor's monitoring intensity exerts two externalities: a positive one on other investors and a negative one on the entrepreneur. Only the latter exists if the large investor holds all external shares, resulting in overmonitoring.

(c) *Large investor and entrepreneurial initiative.* Lastly, let us assume that the entrepreneur's information level is endogenous. Her private cost of learning the payoff matrix with probability y (and learning nothing with probability $1 - y$) is $c_b(y)$, where now $c_b(1) = +\infty$ (so as to guarantee an interior solution for the choice of y). The variable y measures the entrepreneur's degree of initiative. We look for a Nash equilibrium (x^*, y^*) of the information-acquisition game between the entrepreneur and the large investor when they have stakes R_b and R_m, respectively.

Learning the actions' payoffs benefits the entrepreneur only if (a) the large investor is uninformed (which has probability $1 - x$), since otherwise the large investor selects the investor-value-enhancing action anyway, and (b) given our maintained assumption that $\tau R_b < y$, preferences are congruent (which has probability ξ). Hence,

$$c_b'(y^*) = (1 - x^*)\xi[\tau R_b]. \tag{10.11}$$

Note in particular that an increase in the equilibrium monitoring intensity x^* reduces entrepreneurial initiative y^*.

Monitoring benefits investors if either the entrepreneur is uninformed (which has probability $1 - y^*$) or the entrepreneur is informed and preferences are
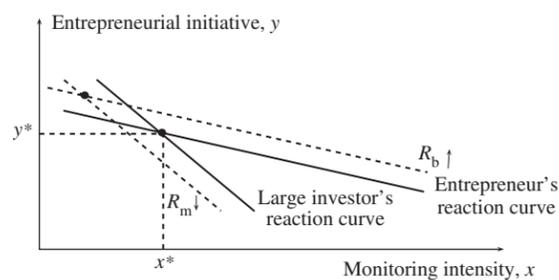
Figure 10.8

dissonant (which has probability $y^*(1 - \xi)$). Hence,

$$c_m'(x^*) = [y^*(1 - \xi) + (1 - y^*)][\tau R_m]. \tag{10.12}$$

We will assume that the Nash equilibrium is stable,[71] as depicted in Figure 10.8.

As shown by Burkart et al. (1997), there are two ways, depicted in Figure 10.8, to boost entrepreneurial initiative at the contract design stage (both of which may reduce pledgeable income and thus may not be consistent with securing financing). The first is, of course, to raise the entrepreneur's stake R_b. The second is to reduce the large investor's stake R_m so as to increase the impact of the entrepreneur's acquired information. Both policies increase y^* and reduce x^*.

Cestone (2004) builds on Burkart et al. by adding an advisory role for the monitor (see Chapter 9). In her model, a venture capitalist has a dual monitoring function: he tries to prevent decisions that are unfavorable to investors and he brings managerial support to the start-up entrepreneur. A high-powered incentive scheme, i.e., a large cash-flow stake for the venture capitalist, has two effects in this multitask environment: it encourages the venture capitalist to provide more advice to the entrepreneur, which is unambiguously beneficial; but it also may induce overmonitoring, since interference kills initiative. This latter effect implies that it may be optimal to turn control rights to the entrepreneur when giving high-powered incentives to the venture capitalist. Put differently, the venture capitalist's control rights and cash-flow rights need not covary: the venture capitalist may have control and limited (but

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71. Stability means that the entrepreneur's reaction curve is flatter than the large investor's, or $c_b'' c_m'' > \xi^2 \tau^2 R_b R_m$.

nonnegligible) cash-flow rights, or no control and more extensive cash-flow rights. Cestone notes that venture capitalists usually lose their control rights when their preferred stocks are converted into common stocks.

10.7 Exercises

Exercise 10.1 (security design as a disciplining device). Go through the analysis in Section 10.4.2 more formally. The date-1 income is r with probability p_H^1 (if the entrepreneur exerts a high effort at date 1) or p_L^1 (if the entrepreneur exerts a low effort at date 1), and 0 otherwise. The entrepreneur enjoys date-1 private benefit B_0 when shirking and 0 otherwise. Let R_b^* be defined by

$$I - A - p_H^1 r - (1 - p_H^1)L = p_H^1[p_H(R - R_b^*)],$$

and assume that

$$R_b^* \geqslant \frac{B}{\Delta p},$$

$$p_H(R - R_b^*) > L,$$

and

$$(p_H^1 - p_L^1)[p_H R_b^*] \geqslant B_0.$$

(i) Interpret those conditions.

(ii) Describe an optimal incentive scheme and security design.

(iii) Suppose that $R_b^* = B/\Delta p$. Argue that a short-term bonus (a payment in the case of date-1 profit r) is suboptimal. Argue more generally that there is no benefit in having such a payment.

Exercise 10.2 (allocation of control and liquidation policy). This exercise considers the allocation of a control right over liquidation. As described in Figure 10.9, the framework has three dates: date 0 (financing and investment), date 1 (choice of liquidation), and date 2 (payoff in the case of continuation). There is moral hazard in the case of continuation. As usual, there is universal risk neutrality, the entrepreneur is protected by limited liability, and the investors demand a rate of return equal to 0.

One will assume that the variables (p_L, p_H, R, B) in the case of continuation are known *ex ante*. As usual, misbehaving (choosing probability p_L) yields a private benefit $B > 0$ to the entrepreneur. Let

$$\rho_0 \equiv p_H\left(R - \frac{B}{\Delta p}\right)$$

and

$$\rho_1 \equiv p_H R.$$

In contrast, the liquidation proceeds L and the fallback option U_b^0 for the entrepreneur may be *ex ante* random, even though they become common knowledge at date 1 before the liquidation decision. Lastly, L is fully pledgeable to investors while none of U_b^0 is.

(i) Solve for the optimal complete (state-contingent) contract, assuming that a court is able to directly verify $\omega \equiv (L, U_b^0)$ (and the profit in the case of success) and to enforce the contract specifying the probability of continuation $x(\omega) \in [0, 1]$ and the allocation of L and R between the investors and the entrepreneur.

(ii) Assume from now on that,

$$\text{for all } \omega, \quad U_b^0 \leqslant \rho_1 - \rho_0.$$

That is, in the absence of a "golden parachute" given to the entrepreneur in the case of liquidation, the entrepreneur always prefers to continue. Compare the sets Ω^{FB} and Ω^{SB} of states of nature in which continuation is optimal in the absence and presence of financing constraint. How does Ω^{SB} vary with the entrepreneur's net worth A? (A diagram will help.)

(iii) From now on, assume that the court observes neither L nor U_b^0. Only the entrepreneur and the investors do. The remaining questions look at how far one can go toward the implementation of the optimal full-observability contract described in (i) using a simple allocation of the control right concerning liquidation.

One will focus on the case in which Ω^{SB} (see question (ii)) is strictly included in Ω^{FB}, and so inefficient liquidation is required.

Suppose first that the entrepreneur has the control right and that renegotiation occurs once ω is realized. Argue that

$$\Omega^{EN} = \Omega^{FB},$$

where Ω^{EN} is the set of states of nature over which continuation occurs under entrepreneur control.
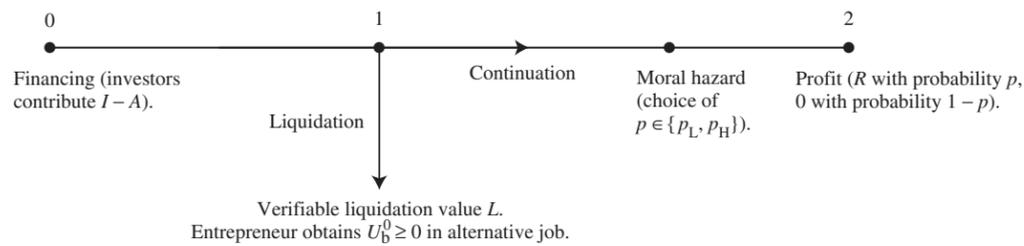
Figure 10.9

Conclude that the project is then not financed.

(iv) *Investor control.* Perform the analysis of question (iii) in the case of investor control in the absence of a golden parachute (the initial contract does not provide for any compensation for the entrepreneur in the case of liquidation). Suppose that the entrepreneur does not keep any savings. Show that

$$\Omega^{\text{IN}} \subset \Omega^{\text{SB}},$$

where Ω^{IN} is the set of states of nature over which continuation occurs under investor control. Is the project financed?

(v) *Investor control with golden parachute.* Argue that a positive golden parachute ($r_b > 0$ given to the entrepreneur in the case of liquidation) is optimal when investors have control.

Exercise 10.3 (large minority blockholding). Consider the active monitor model (see Chapter 9). The firm yields R in the case of success and 0 in the case of failure. The entrepreneur, large shareholder, and small shareholders have shares s_1, s_2, and s_3, respectively, where $s_1 + s_2 + s_3 = 1$. (To complete the model's description, one can, as in Chapter 9, assume that $s_1 R \geqslant b/\Delta p$ and $s_2 R \geqslant c/\Delta p$, using the notation of this chapter.) The small shareholders have formal control (one share bears one voting right and $s_3 > \frac{1}{2}$).

The project can be modified in a countable number of ways ($k = 0, 1, \dots$). Option 0 consists in "not modifying the project" (this option is known to everyone). Options 1 through ∞ do modify the project; all but two of them have disastrous consequences for all parties (so taking a modification at random is dominated by the status quo option 0). The two relevant modifications are such that one increases the probability of success by $\tau > 0$ and the other reduces it by $\mu > 0$. One involves a private cost $y > 0$

Table 10.2 Probabilities: β (state 1); $(1 - \beta)\kappa$ (state 2); $(1 - \beta)(1 - \kappa)$ (state 3).

	State 1		State 2		State 3	
Impact on probability of success	τ	$-\mu$	τ	$-\mu$	τ	$-\mu$
Private cost for entrepreneur	0	$-y$	0	y	0	y
Private benefit for large blockholder	0	0	0	0	0	ξ

or a private benefit $-y$ for the entrepreneur, with $(\tau + \mu)s_1 R < y$, and the other no such cost. Lastly, an action may involve a private benefit ξ for the large blockholder (or one of his subsidiary). There are three states of nature, as shown in Table 10.2. In each state of nature, the left-hand payoffs correspond to the (uninformed) investor-friendly modification and the right-hand payoffs to the (uninformed) investor-hostile modification.

The timing goes as follows:

(1) The entrepreneur learns the two relevant modifications and their impact on payoffs, and makes a proposal to shareholders.

(2) The large blockholder learns the relevant modifications and their impact on payoffs, and either seconds the entrepreneur's recommendation for a modification or makes a counterproposal.

(3) Majority shareholders decide between the status quo and the recommendation(s).

(i) Predict the outcome in each state of nature.

(ii) Add a fourth state of nature in which the entrepreneur and large shareholder see eye-to-eye and both prefer a value-decreasing action (say, the payoffs in state 4 are as in state 2, except that for

the second relevant action, "y" becomes "$-y$" and the large shareholder receives ξ). What would you predict?

Exercise 10.4 (monitoring by a large investor). Section 10.6 assumed that the entrepreneur does not have enough pledgeable income to recommend the investor-value-enhancing action in the case of dissonance, but has enough pledgeable income to induce (through the choice of the large investor's share) the level of monitoring that maximizes the NPV and still receive funding.

Suppose instead that pledgeable income is low so that the level of pledgeable income is not sufficient to attract funding when the NPV-maximizing monitoring level is induced. Go through the steps of case (b) ("fully informed entrepreneur, large investor") assuming that there is no scarcity of monitoring capital (on this, see Section 9.2), and show that the monitoring level x is given by

$$p_H\left[R - \frac{B}{\Delta p}\right] + [\xi + (1-\xi)x]\tau R = I - A + c_m(x)$$

and

$$c'_m(x) > (1-\xi)(\tau R - y).$$

Exercise 10.5 (when investor control makes financing more difficult to secure). The general thrust of control rights theory is that investors are reassured, and so are more willing to lend, if they have control rights over the firm. The purpose of this exercise is to build a counterexample in which investor control is self-defeating and jeopardizes financing.

(i) An entrepreneur has cash A and wants to invest $I > A$ into a (fixed-size) project. The project yields $R > 0$ with probability p and 0 with probability $1 - p$. The probability of success is p_H if the entrepreneur behaves and $p_L = p_H - \Delta p$ ($\Delta p > 0$) if the entrepreneur misbehaves. The entrepreneur receives private benefit $B > 0$ in the latter case, and 0 in the former case. All parties are risk neutral, the entrepreneur is protected by limited liability, and the rate of interest in the economy is 0.

What is the necessary and sufficient condition for the entrepreneur to be able to obtain financing from investors?

(ii) Now add a control right. This control right can raise the expected revenue in the case of misbehavior, but does nothing in the case of good behavior;

namely, the holder of the control right can select an action ("damage control") that raises the probability of success from p_L to $p_L + v$ ($v > 0$) in the case of misbehavior, but keeps p_H constant. This interim action imposes a cost $y > 0$ on the entrepreneur. (If the action is not selected, the probabilities of success are as in question (i), and there is no private cost y.) The choice of action is simultaneous (say) with the entrepreneur's choice of effort.

First assume "entrepreneur control" (the entrepreneur is given the right to select this action or not). Write the two incentive constraints for the entrepreneur to behave. Show that, compared with question (i), the pledgeable income remains the same if $vB/(\Delta p) \leqslant y$, and is decreased otherwise.

(iii) Next consider "investor control." Assume that when indifferent, the investors select the dominant strategy, i.e., the damage-control action (alternatively, one can assume that the action raises p_H as well, to $p_H + \varepsilon$, where ε is arbitrarily small). Show that the financing condition is now

$$p_H\left[R - \frac{B}{\Delta p - v}\right] \geqslant I - A.$$

Conclude that investor control, besides reducing NPV, may also make it more difficult for the entrepreneur to secure financing.

Exercise 10.6 (complementarity or substitutability between control and incentives). This exercise pursues the agenda set in Exercise 10.5 by considering various forms of complementarity and substitutability between the exercise of control rights and managerial incentives. It therefore relaxes the assumption of separability between the two.

(i) An entrepreneur has cash A and wants to invest $I > A$ into a (fixed-size) project. The project yields $R > 0$ with probability p and 0 with probability $1 - p$. The probability of success is p_H if the entrepreneur behaves and $p_L = p_H - \Delta p$ ($\Delta p > 0$) if the entrepreneur misbehaves. The entrepreneur receives private benefit $B > 0$ in the latter case, and 0 in the former case. All parties are risk neutral, the entrepreneur is protected by limited liability, and the rate of interest in the economy is 0.

What is the necessary and sufficient condition for the entrepreneur to be able to obtain financing from investors?

(ii) Now consider the possibility that a profit-enhancing action be chosen. For reasons of simplicity (but not for the sake of realism!), assume that this action is chosen simultaneously with effort. This action raises the probability of success to

- $p_H + \tau_H$ if the entrepreneur behaves, and
- $p_L + \tau_L$ if the entrepreneur misbehaves.

The action is indeed profit enhancing ($\tau_L, \tau_H > 0$) and is

- complementary with effort if $\Delta\tau \equiv \tau_H - \tau_L > 0$,
- substitutable with effort if $\Delta\tau < 0$.

The action further inflicts a disutility γ on the manager, where

$$\max(\tau_L, \tau_H) \cdot R < \gamma.$$

Lastly, assume that the high effort must be induced in order for financing to occur.

Write the pledgeable income under investor control and entrepreneur control. When does investor control increase the pledgeable income (and therefore facilitate financing)?

Exercise 10.7 (extent of control). A simple variation on the basic model of Section 10.2.1 involves a choice between limited investor control and extended investor control, rather than between entrepreneur control and investor control. Suppose, in the model of Section 10.2.1, that entrepreneur control is out of the picture (after you finish the exercise, you may want to think about a sufficient condition for this to be case), but that there are two degrees of investor control:

Limited. The action taken then increases the probability of success by $\tau_A > 0$ and inflicts cost $\gamma_A > 0$ on insiders.

Extended (investors have control over a wide set of actions). The selected action then increases the probability of success by $\tau_B > \tau_A$ and inflicts cost $\gamma_B > \gamma_A$ on insiders.

Assume that

$$\tau_A R - \gamma_A > \tau_B R - \gamma_B.$$

Find conditions under which limited or extended investor control prevails.

Exercise 10.8 (uncertain managerial horizon and control rights). This exercise considers the allocation of control between investors and management when the entrepreneur has an uncertain horizon.

We consider the fixed-investment model. The investment cost is I and the entrepreneur has only $A < I$. The entrepreneur is risk neutral and protected by limited liability; the investors are risk neutral and demand rate of return equal to 0. The profit is equal to R in the case of success and is 0 in the case of failure. In the absence of profit-enhancing action, the probability of success is p; when the profit-enhancing action is taken this probability becomes $p + \tau$, where $\tau > 0$, but the action imposes a non-monetary cost on insiders, γ, where

$$\gamma > \tau R.$$

As usual, $p = p_H$ if the entrepreneur behaves (no private benefit) and $p = p_L$ if she misbehaves (private benefit B).

The twist relative to Chapter 10 is that the entrepreneur may not be able to run the project to completion: with probability λ, she must quit the firm for exogenous reasons. She learns this after the investment is sunk, but before the moral-hazard stage. If the entrepreneur quits (which will have probability λ), a new and *cashless* manager will be brought in. This manager is also risk neutral and protected by limited liability and has the same private benefit, probabilities of success, and payoff in the case of success as the entrepreneur.

Figure 10.10 summarizes the timing.

Let x and y in $[0, 1]$ denote the probabilities that investors receive control when the entrepreneur and the replacement manager are in charge, respectively. And assume that

$$(p_H + \tau)\frac{B}{\Delta p} \geqslant \gamma$$

(interpret this assumption), and that

$$\rho_1 \equiv p_H R > I > \rho_0^+ \equiv (p_H + \tau)\left(R - \frac{B}{\Delta p}\right).$$

(i) Assuming that incentives must be provided for good behavior (by either the entrepreneur or the replacement manager), write down the following.

- The entrepreneur's utility. (Hint: this utility is slightly different from the project's social value. Why?)
- The pledgeable income and the breakeven condition.
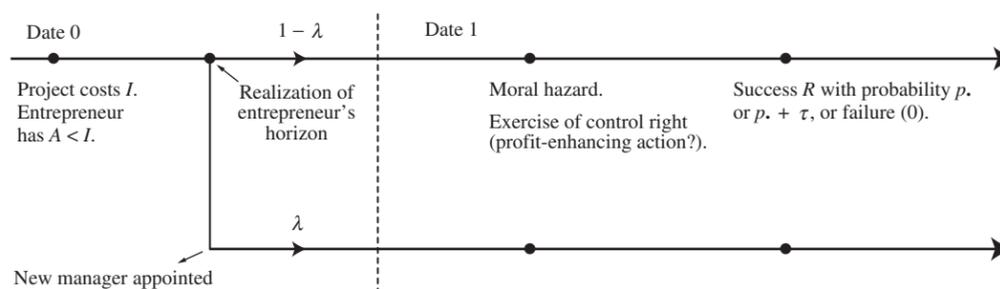
Figure 10.10

(ii) Argue that $y = 1$. Find the conditions under which the project is undertaken. (Warning. Two conditions must be fulfilled: investors must be willing to finance it, and the entrepreneur must be willing to go ahead with it.)

Exercise 10.9 (continuum of control rights). This exercise extends the analysis of Section 10.2.2 to a continuum of control rights. As in Section 10.2.2, consider a risk-neutral entrepreneur protected by limited liability. The entrepreneur has cash on hand A and wants to finance a project with cost $I > A$. The project yields R if it succeeds and 0 if it fails. Investors are risk neutral and demand a rate of return equal to 0. There is a continuum of control rights, where the decision attached to a control right can be thought of as a modification relative to the initial project and is characterized by the pair (t, g): $t \geqslant 0$ is the increase in the probability of success and $g \geqslant 0$ is the private cost borne by the entrepreneur if the decision is taken (the modification is made). Let $F(t, g)$ denote the continuous joint distribution over the space of control rights and $E_F[\cdot]$ the expectations with respect to distribution F.

The probability of success is

$$p + \tau \equiv p + E_F[tx(t, g)],$$

where $x(t, g) = 1$ if the decision (t, g) is taken and 0 otherwise. Similarly, let

$$y \equiv E_F[gx(t, g)].$$

Moral hazard is modeled in the usual way: $p = p_H$ if the entrepreneur behaves (no private benefit) and $p = p_L$ if the entrepreneur misbehaves (and receives private benefit B). Assume that the project can be funded only if the entrepreneur is provided with the incentive to behave.

(i) Solve for the optimal policy $x(\cdot, \cdot)$, assuming that the investors' breakeven constraint is binding (which it is for A small enough or I large enough).

(ii) Show that, as A decreases, τ and y increase.

(iii) Discuss the implementation of the optimal $x(\cdot, \cdot)$ function.

(iv) Consider the degenerate case in which g is the same for all control rights ($g > 0$). Show that

$$\frac{\mathrm{d}^2 y}{\mathrm{d}\tau^2} > 0.$$

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