Many of the financial products offered by insurance and derivatives industry participants today are increasingly similar to one another. Commentators on this phenomenon call it “convergence.” The interesting question is not really whether convergence is occurring in these two markets—it is—but rather toward what are the markets converging?

The common theme underlying many of the new financial structures in insurance and capital markets is that of capital structure optimization. In short, insurance and capital market products are increasingly similar because they are increasingly designed to help firms reduce their cost of capital or to allocate their capital across business lines more efficiently on a risk-adjusted basis.

We thus must begin with a discussion of capital itself: What is the nature of capital? What is a firm’s capital structure, and how does it relate to a firm’s cost of capital? When and why can the capital structure of a firm affect the value of a firm? And how are capital structure, firm value, and risk management interrelated? These are the questions that are explored in Part I of this book.

This chapter tackles the first of these questions. An especially important part of our initial exploration of capital is the development of a common perspective we can use to evaluate different sources of capital and their costs. The perspective we adopt is to view capital, capital structure, and sources of capital from an options perspective. Specifically, we attempt in this chapter to provide answers to the following questions:

- What is capital, and, in particular, what is the difference between real capital and financial capital?
- How do firms utilize financial capital?
- What are the fundamental building blocks firms can use to create financial capital claims or claims on their real capital assets?
How can the fundamental building blocks of capital structure be viewed through an options framework?

How does the mixture of the types of claims issued by a firm define the company’s capital structure?

WHAT IS CAPITAL?

To define “capital” properly would involve a heavier dose of economic theory and philosophy than space or time permits here. Appendix 1-1 at the end of this chapter provides a brief survey of capital theory from an economic history perspective. For our purposes here, it is sufficient to draw a critical distinction between what we may call “real” and “financial” capital.

Specifically, what firms do is act as organic production transformation functions, turning capital into a sequence of goods. How firms finance that process is where the crucial distinction between what we shall call “real capital” versus “financial capital” comes into play.¹

In their classic work *The Theory of Finance* (1972), Fama and Miller define “total net investment” as “the value in money units of the net change in the stock of [real] capital,” thus providing us with a bridge to link real and financial capital. In short, real capital is what gives firms their productive role in the economy, but financial capital is what is required to fund the acquisition and maintenance of real capital.

The following equation expresses the relation between financial capital and real capital at any one point in time algebraically as follows:

\[
[E_{t-1}(t) + \delta(t)] + [D_{t-1}(t) + \rho(t)] = X(t) - I(t) + V(t) \tag{1.1}
\]

where

- \(E_{t-1}(t)\) = time t market value of the firm’s stock outstanding at time \(t-1\)
- \(D_{t-1}(t)\) = time t market value of the firm’s debt outstanding at time \(t-1\)
- \(\delta(t)\) = dividends paid at time \(t\) to stockholders
- \(\rho(t)\) = interest paid at time \(t\) to bondholders
- \(X(t)\) = time \(t\) earnings on prior investments in real capital
- \(I(t)\) = time \(t\) investments in new real capital
- \(V(t)\) = discounted expected present value of future net cash flows

The left-hand side of equation 1.1 above is the value of the financial capital of the firm, and the right-hand side is the value of its real capital expressed as current earnings, current investment spending, and the discounted future income the firm’s capital assets are expected to generate over time.

Modigliani and Miller (1958) showed, among other things, that the right rate to use in discounting the uncertain future input values and output values of a project is the cost to the investing firm of raising the investment capital—that is, the financial capital—required to support such a project.
Referring to the liabilities that firms issue to fund their acquisitions of real capital as another form of capital may seem a bit confusing. But there is good reason for this use of terminology. Namely, financial economists like to refer to financial capital assets such as stocks and bonds as “capital” because they are capital to investors. Indeed, the celebrated “capital asset pricing model” was developed not to explain how the value of televisions and drills are determined in equilibrium but rather how the value of stocks and bonds as claims on televisions and drills are determined in equilibrium. But if the model works for stocks and bonds, it should also work for plants and equipment—hence the use of the term “capital” to describe both.

To avoid confusion, however, when we subsequently refer to “capital” without any modifying adjectives, readers should assume that we are talking about financial capital. References to real or physical capital will be qualified accordingly. Similarly, terms like “capital structure” also are used here in the financial context—the structure of claims issued by a corporation to finance its net investment spending. This is at odds with the use of the same phrase in macroeconomics, where “capital structure” often refers to the relation between the productive real capital stock, other factors of production, and total output.

**CORPORATE UTILIZATION OF FINANCIAL CAPITAL**

Financial capital can be defined quite broadly as the collection of contracts and claims that the firm needs to raise cash required for the operation of its business as an ongoing enterprise. Operating a business as an ongoing enterprise, however, often—if not usually—involves more than just raising money to pay employees and finance current investment expenditures. It also includes keeping the business going, and doing so efficiently.

Firms may need financial capital for at least five reasons, each of which is discussed briefly below. These sections are included mainly as a preview to the rest of Part I. We will return to all of the issues raised here later and in much more detail.

**Investment Capital**

In Chapters 2 through 5, we focus on the primary reason that firms are thought to need financial capital—to fund their investment activities. Accordingly, we call this investment capital.

Fama and French (1999) find that an average of about 70 percent of all spending on new investments by publicly traded nonfinancial U.S. firms from 1951 to 1996 was financed out of those firms’ net cash earnings (i.e., retained earnings plus depreciation). Accordingly, a large bulk of most firms’ investment
capital comes in the form of internal funds—"internal" because the firm’s need not go to outsiders to raise the money.

Despite the dominance of internal finance as a source of investment capital, the 30 percent average shortfall of net cash earnings below investment spending had to come from somewhere. To generate the funds required to close such deficits between net cash earnings and investment, firms issue "claims." In exchange for providing firms with current funds, "investors" in those financial capital claims receive certain rights to the cash flows arising from the firm’s investments. In other words, by issuing financial capital claims, corporations can fund their investments and get cash today by promising a repayment in the future that will depend on how the firm’s investments turn out. In this sense, financial capital claims issued by firms to generate investment capital are direct claims on the firm’s real capital.

Note that investment capital as we define it is actually not strictly limited to investments but also includes operating expenses such as salaries, rent, coffee for employees, jet fuel for the company plane, and the like. Unless specifically indicated otherwise, in this chapter all of those operating expenses are lumped into the term "investment spending."

**Ownership and Control**

Financial capital claims also serve as a method by which the ownership of a firm—or, more specifically, ownership of the real capital assets that define the firm—can be transferred efficiently. In lieu of selling individual plants, machines, and employees, firms can sell claims on those real assets.

In turn, financial capital assets convey some form of control rights and governance responsibilities on the holders of those claims. By receiving a financial claim on the firm’s real capital, investors naturally want some say in how the firm uses that real capital—including its acquisition of new real capital through its investment decisions.

For the most part, we will not deal with the connections between the existence of financial capital claims sold to investors and the governance issues those claims create.5

**Risk Capital**

As noted, Chapters 2 to 5 will focus on investment capital, because all firms need investment capital. Even if the financial capital used to fund investments is internal, all firms invest. Otherwise, they would not be engaged in production activities.

In Chapters 7 and 8, we explore three other reasons why firms might need financial capital. But unlike investment capital, these reasons do not hold true at all firms. The discussions in Chapters 4 and 5 lay the foun-
The Nature of Financial Capital

The first reason, discussed in Chapter 7, is risk capital. In order to operate its business as a going concern, some firms must carefully avoid the dangerous territory known as financial distress. Especially if financial distress costs increase disproportionately as a firm gets closer to insolvency, the more likely it is that the firm may need to use financial capital as a buffer against incurring those distress costs. When some firms find it necessary to raise risk capital, this capital is virtually always capital held in excess of that required to finance investment in order to avoid going bust.

Although the basic concept of risk capital is developed in Chapter 7, we will revisit the notion of risk capital repeatedly throughout Parts II to IV. In particular, we will see that risk capital is capital held by firms either to absorb or to fund losses that the firm elects to retain. Risk capital also can be acquired "synthetically" when a firm decides not to retain all of its risks, but rather to transfer some of its risks to other capital market participants. Although we review in detail different methods by which firms can access such synthetic capital in Parts III and IV, a very early understanding of the distinction between capital used for risk financing and capital obtained directly or de facto through risk transfer is fundamental.

Signaling Capital

A second reason that some firms might wish to hold financial capital over and above that required to fund current operations and investments occurs when managers have better information about the true quality of their investment decisions and growth opportunities than external investors. In this situation, firms often have significant trouble communicating the value of their investment decisions and their financial integrity to public security holders—trouble that ultimately can prevent firms from undertaking all the investment projects they would otherwise choose to make if everyone had access to the same information. The nature of these sorts of problems is the subject of Chapter 5.

For many years, people have conjectured that firms can use their financial capital in order to signal certain things about the information managers possess that investors do not. Quite often the issuance of financial capital claims is itself a signal. The Miller and Rock (1985) model, for example, says that firms issue financial claims only when they have information that future profits will be lower than expected. Conversely, firms pay dividends only when they perceive higher future profits than investors expect. Consequently, the issuance of financial claims and the dividend payout policy of the firm are both signals of the firm’s future profits.

In the Miller and Rock world, issuing certain types of financial claims is a negative signal to the market about future profits. But especially in recent
years, some contend that the signal sent to the market by issuing a financial claim depends on what the claim is and who holds it. Issuing new stocks through seasoned equity offerings or exchange offerings is widely considered to signal bad news at a firm, whereas taking out a bank loan is usually a positive signal.

Apart from the signal sent by the issuance of new financial capital, some also believe that the funds generated by issuing new claims can have benefits that exceed the costs of obtaining additional external finance. As will be explained in Chapter 7, signaling capital can provide firms with a means of indirectly communicating the value of their investment decisions to market participants, thereby reducing the firm’s cost of raising new capital and, in particular, helping the firm to avoid situations in which positive net present value investment projects might have to be forgone because of an inability to convince investors that the investment makes sense.

Regulatory Capital

A final reason why some firms issue financial capital is because they have no choice if they wish to comply with the regulations to which they are subject. Banks, insurance companies, securities broker/dealers, savings institutions, and other firms are all subject to minimum capital requirements.

Unfortunately, regulation does not always define financial capital in the same way as corporate treasurers. Consequently, as we will see in Chapter 8, many firms are forced to issue specific kinds of financial capital in order to satisfy regulatory requirements. Regulatory capital is what we call the financial capital firms must hold for this reason.

FUNDAMENTAL BUILDING BLOCKS OF INVESTMENT CAPITAL

Investment capital is the financial capital that virtually every firm needs in order to do what firms do—“produce” something. As mentioned, the bulk of investment capital comes in the form of retained earnings and depreciation. But when firms need to go beyond these sources of funds to pay for current investment expenditures, they can offer two fundamental types of claims in exchange for cash:

1. Residual claims
2. Fixed claims

When a firm raises cash by promising investors a claim whose value rises as the net cash flows of the business rise, the firm has created a residual claim. When a firm raises cash today and promises to repay investors in the future a
specific amount of cash plus some “interest”—that is, an amount that does not increase when the firm’s cash flows or asset values increase—the firm has created a fixed claim. Both types of financial capital can be viewed by invoking some basic concepts of options theory.

**Residual Claims**

A residual claim gives its holder a claim on the net cash flows of a firm. As long as the firm remains in business, this claim represents a claim on the net cash flows on the firm’s assets (i.e., real capital investments). If the firm shuts down, the residual claim is a claim on the net cash flows obtained from the liquidation of the firm’s real capital assets. In return for this residual claim on the firm’s net cash flows, the holder of this claim gives the company cash that it can use to fund its assets, service its investments, and the like. Residual claims are more commonly known as equity.

Exhibit 1.1 depicts the economic balance sheet of a firm that issues only equity in order to fund its acquisition of some assets. Suppose the firm otherwise has no liabilities and no internal funds. At any time $t$, the assets have a market value of $A(t)$. The market value of the firm’s equity, $E(t)$, is thus exactly equal to the market value of its assets.

Suppose the firm whose balance sheet is depicted in Exhibit 1.1 liquidates its assets at time $T$ for a total value of $A(T)$. The time $T$ value of the total distribution to equity holders of the firm would be equal to $E(T)$. This liquidation payoff is shown in Exhibit 1.2 and varies dollar for dollar with the

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### Exhibit 1.1: Economic Balance Sheet of a Firm with Only Equity Claims

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities and Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets:</strong></td>
<td><strong>Liabilities and Equity:</strong></td>
</tr>
<tr>
<td>$A(t)$</td>
<td>$E(t)$</td>
</tr>
</tbody>
</table>
liquidation value of the firm’s assets. Note that the figure assumes that equity holders have limited liability; equity holders can at worst have a claim worth zero and cannot be called upon to make an additional payment to the firm or its liquidator.

We can express the value of equity at time $T$ in an all-equity firm more formally as

$$E(T) = \max[A(T), 0]$$

At any given time, a corporation can fund the acquisition of new assets or the assumption of new investment projects by issuing new equity claims. If the value of new equities issued at any time $t$ is denoted $e(t)$ and the time $t$ market value of equity claims outstanding from prior period $t-1$ is now denoted $E_{t-1}(t)$, then the time $t$ value of the firm can be expressed as

$$V(t) = A(t) = E_{t-1}(t) + e(t) \quad (1.2)$$

Equity holders of a firm can earn income from their claims even if the firm does not liquidate its assets. Some equity holders can generate income by selling their claims to others and pocketing any capital gain that may have oc-
curred over the holding period. Other equity holders can obtain income through dividends, if the firm in question both has the cash flows to pay dividends and decides to do so.

A firm’s ability to pay dividends to its equity claimants is dictated by its “cash flow constraint.” (We shall return to the firm’s willingness to pay dividends later.) At time $t$, the firm earns a total gross cash inflow from its assets of $X(t)$ and may invest a total of $I(t)$ in new investment projects or assets. Recall also that we include in $I(t)$ operating expenses such as salary and overhead.

The sum of dividends paid to equity holders at time $t$, $\delta(t)$, can be no greater than the net cash flow of the firm plus the proceeds from any new security issues. Assuming the firm retains no net cash flows and distributes all excess cash flows to equity holders in the form of dividends, the following relation holds:

$$\delta(t) = X(t) - I(t) + e(t) \quad (1.3)$$

Substituting the firm’s cash flow constraint in equation 1.3 into the value of the firm given in equation 1.2 allows us to express the total wealth of all equity holders as follows:

$$E_{t-1}(t) + \delta(t) = X(t) - I(t) + V(t) \quad (1.4)$$

If the firm winds up its operations and liquidates its assets at some time $T$, the resulting distribution to equity holders can be viewed as a liquidating dividend, such that

$$E_{T-1}(T) = X(T) + A(T) \quad (1.5)$$

where the left-hand side of equation 1.5 is the liquidating dividend.

**Fixed Claims**

The second way that a firm can raise cash is by issuing claims whose maximum payoff does not rise as the net cash flows of the firm increase. The value of such claims still depends on the firm’s net cash flows because they must be adequate to make the promised payoff. But because that payoff is fixed and does not rise with the firm’s profitability, this second type of claim is called a fixed claim and is more commonly known as debt.

Exhibit 1.3 depicts the economic balance sheet of a firm that has both debt and equity in its capital structure. The market value of the firm is equal to the market value of its assets at any time $t$, which in turn is equal to the sum of the market values of the firm’s debt and equity, or
V(t) = A(t) = D(t) + E(t)

Suppose the total amount borrowed by the firm through the issuance of debt instruments is denoted FV, for the “face value” of all its fixed claims. Suppose further that the debt pays FV on some date T and nothing before then. If the firm liquidates its assets on that date T for A(T), debt holders will receive at most FV. If the liquidation value of assets exceeds the face value of debt, equity holders, in turn, receive the residual—that is, A(T) − FV. But if the liquidation of the firm’s assets generates insufficient cash to pay off debt holders, the creditors to the firm as a group will receive only A(T) < FV. Accordingly, the liquidation value of all debt claims issued by the firm at time T is equal to

D(T) = min[FV, A(T)]

This liquidation payoff is shown in Exhibit 1.4. When the market value of assets exceeds the promised debt repayment of FV, the payment to debt holders is constant at FV. When assets are below total debt liabilities, the payment to debt holders declines dollar for dollar with the liquidation value of the firm’s assets. As in Exhibit 1.2, we continue to assume limited liability so that debt holders can never be called on to make an additional payment to the firm or its liquidator.

The issuance of fixed claims by the firm also affects the payoff of residual claim holders, because, as the term “residual claim” implies, residual claimants
are entitled only to what is left after the firm has honored its other obligations—which now include debt. To see this, consider the distribution of proceeds obtained by liquidating the assets of a firm whose payoff to debt claimants was shown in Exhibit 1.4. Exhibit 1.5 now shows the market value of the residual claimants of this firm upon liquidation. Clearly, equity holders as residual claimants receive nothing until the total face value of outstanding debt has been paid off. But at that point, the residual claimants enjoy a dollar-for-dollar gain for every dollar of asset value above the debt obligation.

A corporation that issues both debt and equity claims can fund the acquisition of new assets or the assumption of investment projects either by issuing new equity claims or by borrowing through debt contracts. If the value of new debt issued at any time $t$ is denoted $d(t)$ and the time $t$ market value of debt claims outstanding from prior period $t-1$ is denoted $D_{t-1}(t)$, then the time $t$ value of the firm at any time $t$ can now be expressed as

$$V(t) = A(t) = [E_{t-1}(t) + e(t)] + [D_{t-1}(t) + d(t)]$$

Like equity holders, debt holders of a firm can earn income from their claims before the claims are due or before the firm wraps up and liquidates its assets, either by selling their claims or through receiving “interest payments” on the debt. Although we assumed in the example above that debt holders received a single payment—FV—only on date $T$, that need not be and often is not the case.
Interest paid to holders of debt securities is similar to dividends paid to equity holders—although, unlike dividends, interest on debt is defined in advance for the whole term of the debt contract. Consequently, interest payments are again restricted by the firm’s cash flow constraint. At time $t$, a firm financed with both debt and equity capital that distributes all its excess net cash flows (i.e., $X(t) - I(t)$) to security holders must abide by the following cash flow constraint:

$$\delta(t) + \rho(t) = X(t) - I(t) + e(t) + d(t) \quad (1.7)$$

where $\rho(t)$ is the interest paid to existing debt holders at time $t$. Substituting the new debt-and-equity cash flow constraint given in equation 1.7 into the value of the firm shown in equation 1.6 allows us to express the total wealth of all security holders as follows:

$$[E_{t-1}(t) + \delta(t)] + [D_{t-1}(t) + \rho(t)] = X(t) - I(t) + V(t) \quad (1.8)$$

### VIEWING THE FUNDAMENTAL BUILDING BLOCKS AS “OPTIONS”

Readers already familiar with the basics of option markets will recognize Exhibits 1.4 and 1.5 as the payoffs at maturity to the holders of financial prod-
ucts known as options. Indeed, one of the most versatile and insightful ways of viewing corporate financing strategies is from an options perspective. (Appendix 1-2 provides a brief survey of the essentials of options.)

If we return to Exhibit 1.2, we can see that the payoff to the residual claimants of a firm that issues no debt is equivalent to a call option on the value of the firm’s assets with a strike price of zero. Or consulting Exhibit 1.5, the payoff to residual claimants of a firm that issues debt with face value FV is equivalent to a long call option on the firm’s assets with a strike price equal to the face value of the outstanding debt issued by the corporation. Turning back to Exhibit 1.4, the debt issued by the firm with face value FV is equivalent to a short put option on the assets of the firm with a strike price of FV plus a riskless loan in the amount FV.

At the maturity date of the firm’s debt T, we know that the value of the firm V(T) must equal the value of the firm’s assets A(T). In turn, the value of the firm’s assets is equal to the sum of the market values of the firm’s debt and equity. We thus can express the value of the firm as

\[ V(T) = A(T) = C(T) - P(T) + FV \] (1.9)

Expression 1.9 is a restatement of what is known in the options world as put-call parity. (Appendix 1.2 provides a more detailed discussion of this concept.)

Let us consider only the debt component of the firm for a moment. Residual claimants have a call option on the firm’s assets. Subtracting that value from the market value of the firm’s assets allows us to rewrite equation 1.9 as

\[ A(T) - C(T) = FV - P(T) \] (1.10)

where the total value of debt is now the right-hand side of expression 1.10. The total debt position is thus equivalent to a risk-free bond with face value FV and an option written to residual claimants to accept the assets of the firm in exchange for the debt. At time T, debt holders thus get FV but then also have given shareholders the right to demand the FV back and give debtors A(T) instead. When A(T) < FV, shareholders will exercise that option. The time T payoff of this position is

\[ FV - \max[FV - A(T), 0] = FV + \min[A(T) - FV, 0] = \min[A(T), FV] \]

The above expression is the payoff at maturity for a special type of option called an option to exchange the better asset for the worse, or a type of what is called an “exchange option.” Exhibit 1.6 illustrates.

In Exhibit 1.7, we can now put the pieces together to express the whole firm as a portfolio of options. When the firm’s assets are worth A(T) and
EXHIBIT 1.6 Value of Risky Debt from an Options Perspective

(a) Risk Free Debt

\[ D(T) = \min\{FV, A(T)\} = FV - P(FV) \]

(b) Put on the Firm's Assets

\[ P(FV) = \min\{A(T) - FV, 0\} \]

EXHIBIT 1.7 Value of the Firm from an Options Perspective

(a) Residual Claimants/Equity

\[ E(T) = \max\{A(T) - FV, 0\} \]

(b) Fixed Claimants/Risky Debt

\[ D(T) = \min\{FV, A(T)\} \]
that amount is less than the face value of the debt, the firm is worth only the value of the assets. Debt holders then receive a pro rata distribution of those assets, and residual claimants receive nothing. When \( A(T) \) has a market value greater than \( FV \), debt holders receive \( FV \), equity holders receive a pro rata distribution of the surplus in asset value above \( FV \), and the firm is again worth \( A(T) \). In either case, the value of the firm is equal to the value of its assets. The nature of the two types of claims issued by the firm to obtain capital to acquire those assets does not change the nature or value of the assets themselves.

A FIRST LOOK AT "CAPITAL STRUCTURE"

If we assume that all types of claims issued by a firm can be classified as either residual or fixed claims, then we can define a very basic notion of capital structure. The capital structure of a corporation is, very simply, the relative mixture of fixed and residual claims that a firm issues.

An easy way to characterize the capital structure of a firm at this most primitive level is through a “leverage ratio,” or the proportion of fixed claims the firm issues relative to its total external financial capital outstanding:

\[
\text{Leverage Ratio} = \xi(t) = \frac{D(t)}{D(t) + E(t)} = \frac{D(t)}{V(t)}
\]

A leverage ratio of .30, for example, means that 30 percent of the capital structure of the firm is comprised of debt, or that 30 percent of the capital of the firm is in the form of fixed income obligations.

Note that the above expression is defined in terms of the variables with which we have been working—market values of debt and equity. Some also like to characterize this ratio in terms of book values, depending on the purpose of the analysis.

A firm’s dividend payout policy is also often considered to be part of its capital structure.

NOTES

1. Real capital is traditionally studied in a macroeconomic context. See Garrison (2001).
3. See, for example, Brealey and Myers (2000).
4. This finding is consistent with statistics reported in Eckbo and Masulis (1995), Brealey and Myers (2000), and elsewhere.

5. Closer to the topics we do address here is the belief held by some that the “value” of the control rights and governance responsibilities conveyed by the financial capital claims issued by a firm are directly related to the value of the firm. Harris and Raviv (1991) provide a useful survey of the academic literature on this subject.