

## Capital Structure in a Perfect Market

### Should a Company Issue Stocks or Bonds?

How should entrepreneurs and managers think of the multitudes of instruments with which they can finance the firm? To understand how a firm should choose its capital structure, we start with the world that is easiest to understand and that you already know: the “perfect market” (no opinion differences, no transaction costs, no taxes, and many buyers and sellers). This chapter shows (again) that the value of the firm’s capital in a perfect market is determined by the present value of its projects, and not by whether the firm is financed with debt or equity. This is because in a perfect financial market, many investors would compete immediately to correct any value-reducing mistakes managers could commit. As a result, the value of the firm’s capital cannot depend on the claims a firm might choose to issue. This chapter also explains the simplest version of the weighted average cost of capital formula (WACC). The next few chapters will then explain how financing in the real world differs from financing in this perfect-market world.

### 17.1 Maximization of Equity Value or Firm Value?

Now that you understand the claims that firms *can* and *do* issue, let’s focus on what kinds they *should* issue. The best way to conceptualize an optimal firm structure is as follows: You are the entrepreneur who owns all of the firm. You want to sell your firm for the highest possible price. Your first step is to design your firm — including your corporate charter and capital structure — in a way that maximizes its total market value *today*. This value is the price that new investors are willing to pay to buy the firm from you. If your firm’s charter or its capital structure allows or even induces you or your managers to take negative-NPV projects or steal from investors in the future, then who would want to buy your firm today? Thus, the better you design your firm today, the higher the price that you can get from outside investors. (The design of the firm is also a central subject in the web companion chapter on corporate governance.)

Let’s first talk about what management’s incentives are. Who does management represent (other than themselves)? Who *should* management represent? Does it make a difference whether management is representing just the shareholders or all the claimants on the firm? A popular misconception is that managers should only be concerned about shareholder wealth maximization. In the presence of other claims — such as financial debt, pension

obligations, and accounts payable — shareholder wealth maximization can require caring also for non-shareholders and focusing exclusively on shareholders may even be illegal.

In the United States, shareholders in publicly traded corporations must elect the corporate board of directors at least once a year. Legally, shareholders are *not* the principals of the firm. Their elected corporate board is.

In turn, the board appoints management. Both the board and its appointed managers have a legal fiduciary duty to their board and shareholders. This is eminently sensible — management should negotiate with suppliers, creditors, and so on — not on the behalves of these other parties, but on behalf of its own residual equity owners. It should not willingly pay other parties more than the firm has to.

However, the legal situation changes when insolvency becomes a possibility. In this case, management's legal fiduciary responsibility extends to other claimants, too. Again, this makes sense, because if the firm is underwater, it may already belong more to the creditors than the shareholders. However, these formal fiduciary responsibilities are not laws of nature. They are different in other countries.

In practice, U.S. managers see themselves primarily as representatives of shareholders and not creditors. Yet, even if managers seek to maximize shareholder wealth, it is not necessarily so obvious as to how they should think and what they should do. Let me explain what I mean. When both bondholders and shareholders benefit from a manager's actions, there is no problem. But what if there are situations in which optimizing the value of the equity is the opposite of optimizing the overall firm's value?

For example, assume it is possible for managers to increase the value of equity by \$1, but at a cost to the value of financial debt of \$3. (You will soon learn how easy it is to do exactly this.) This “expropriative” transaction would destroy \$2 in the net value of the firm. Even in our perfect world, this is the type of situation that can create a dilemma for management: Should management maximize firm value or shareholder value? Recall that it is shareholders who ultimately vote managers into office and allow them to stay there. When the time comes, managers may find it in their interest to execute such a transaction because doing so raises the equity value — and with it their executive bonuses. Whether this transaction hurts creditors or destroys value may not even enter their minds.

However, there is one big wrinkle in this logic. Put yourself in the shoes of the original entrepreneur today. You are trying to set up a corporate charter and capital structure that maximizes the value of your firm — that is, the price you could get if you sold it today. You want to find the best capital structure *today*. How can you attract new investors and in particular creditors? How can you persuade them to part with their hard-earned cash? Clearly, any potential creditor contemplating purchasing your bonds will take into consideration what your managers may do to them in the future. If it looks as though managers will want to execute the aforementioned dubious transaction, your potential creditors would rationally demand much higher interest rates. If you do not commit the firm today *not* to undertake the \$3-for-\$1 transaction in the future, your prospective bond buyers will realize today (before the fact, or *ex ante*) that you or your management will have the incentive to execute it later (after the fact, or *ex post*), no matter how much you sweet-talk them today.

If potential investors believe your firm will undertake this transaction in the future, what will your firm be worth today? The answer is “less than a firm that had been committed not to destroy \$2 of value in the future.” Therefore, you have a choice:

- You can avoid debt altogether, but this may hamper you for other reasons explained later.
- You can find a way to commit yourself today not to exploit bondholders in the future.
- You can sell the firm today for a lower net present value. This takes into account your value destruction tomorrow — because everyone realizes that you will be irresistibly tempted to destroy \$2 of firm value.

It should be clear to you that if you want to attract creditors who are not stupid, you should want to do everything in your power to commit yourself visibly today not to exploit them in the future. Committing yourself can optimize the value of your overall firm in the future, which in turn can maximize the value of your firm today.

Internalization — the fact that it is the principal who reaps all benefits and suffers all costs *today* due to all actions in the future and even if they affect only other claimants — is one of the most important insights with respect to capital structure, and one worth repeating again and again and again.

The cost of *ex-post* actions against smart claimants who can voluntarily walk away from the transaction today is then not really borne by these claimants tomorrow, but it is primarily internalized by the existing owners today. Thus, it is in owners' best interests today to commit themselves not to exploit future claimants tomorrow — especially if everyone knows that when the time comes, owners will want to change their minds. The advantage of a firm that is committed to maximizing firm value in the future is that it can obtain a better price for its claims (e.g., a lower interest rate for its bonds) today. Therefore, it is the firm itself that has the incentive to try to find ways to commit itself today (*ex ante*) to treating claimants well in the future (*ex post*).

From a financial perspective, the *ex-ante* capital structure that results in the highest firm value today is the optimal capital structure. This entire argument is based on the implication that *caveat emptor* ("buyer beware") works: Bond and stock purchasers are forward-looking. Moreover, they can be hurt only to the extent that future opportunistic actions by management are unforeseen surprises.

In a perfect capital market, what will happen if your current management team cannot commit to avoid such bad future \$3-for-\$1 exchanges? In this case, another management team that has the ability to restrain itself would value the firm more highly than the current management team. It would buy the firm and make an immediate profit. The competition among many management teams with this capability would push the firm toward the best capital structure. At the risk of sounding repetitive, the most important point of this chapter is that firms that can commit to doing "the right thing" tomorrow (*ex post*) are worth more today (*ex ante*). *It is a direct consequence that entrepreneurs should maximize firm value and not just shareholder value.*

## Begin Important

- In deciding on an appropriate price to pay, the buyers of financial claims should — and smart claimants usually do — take into account what the firm is likely to do in the future.
- The basis of optimal capital structure theory is the insight that entrepreneurs want to maximize the value of the firm in an upfront sale today, and not necessarily the value of equity today or in the future.
- When we discuss the optimal capital structure, we mean the one that maximizes overall value today.

## End Important

In our theoretical perfect world, firms should commit themselves to maximizing overall firm value, not shareholder value. In real life, existing lenders such as commercial or investment banks are smart enough to write contracts that do not allow firms to walk away from their promises in normal situations. And, therefore, the popular mantra of “shareholder value maximization” is normally synonymous with “total value maximization.” However, in existing companies, shareholder and firm objectives can diverge when firms get closer to financial distress. This will all be explained below.

Note that the need to raise capital in the future may, on occasion, help restrain managerial or entrepreneurial opportunism, but this is not necessarily the case. Today’s funders and firms alike realize that potential future funding providers will understand that the past is the past. Even if a firm has not expropriated its past capital providers earlier, it is no guarantee that it will not do so in the future. (And, even if it has expropriated them, it is not a guarantee that it will do so again.) The logic is not primarily about judgment and building reputations in order to satisfy future funding needs. They may matter, but the primary logic is about cold anticipation about what managers will find to be in their self-interest *after* they have received funding.

In the United States, managers tend to be less conflicted with respect to favoring shareholders at the expense of bondholders than they are conflicted with respect to their own welfare. (These are the agency conflicts that we first discussed in Section and that we will take up again at great length in a web chapter on corporate governance.) In some cases, managers’ own self-interests may even lead them to take projects that favor creditors over shareholders — a force that mitigates their incentives to expropriate creditors on behalf of the shareholders.

## Digression on Stakeholders

The above discussion was largely from the perspective of the owner of a startup in the United States who is interested only in the maximization of her own wealth. This often means treating other stakeholder[stakeholders] (like employees, customers, suppliers) fairly, too. After all, stakeholders have outside opportunities. They can vote with their feet and leave! Misanthropes rarely succeed in business. Sometimes, the owner has non-financial preferences, too — such as treating employees even better than necessary or improving the environment. This is the entrepreneur’s prerogative and to be admired. After all, it is her money.

For many publicly-traded companies, environmental, social, and governance (ESG) concerns have become important, too. Many ESG activists argue that professional managers should take a broader view, too. However, the philosophical questions are more difficult when professional managers are trusted with and acting on behalf of many shareholders. Are managers really the right decision-makers when it comes to donating their investors’ money, or should they return the money and allow the shareholders to donate their money to whatever causes *they* would like? How would the manager even know what the shareholders’ preferences are and how they can be different? Tell me — should managers sacrifice investors’ earnings to support *pro-life* or *pro-choice* initiatives? *Inequality*, *diversity*, or *school education*? How much money should they dedicate to fighting [\*climate change\*](#)? ([The Economist](#) even argues that E, S, and G are inherently incompatible.) These are tricky questions, especially in companies in which the original entrepreneur has long since disappeared and managers (with less skin in the game) are effectively in charge and supposed to act on behalf of millions of small unorganized shareholders.

In the 2021 Duke CFO survey, only 16% of CFOs claimed to believe companies should be run on behalf of their investors. The most common answer was that companies should be run half for investors (shareholders), half for other stakeholders. 4% of CFOs even no longer cared about shareholders, at all. Table ?? describe who and what other stakeholders these managers cared about. Their legal fiduciary responsibility to investors to act in their interest did not trump their concern to operate the firm on behalf of employees (presumably themselves included) and customers. Other concerns seemed less important.

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In some countries, stakeholders' rights even have a legal basis. For example, in German joint stock companies, limited liability companies, and cooperatives with more than 500 employees, one-third of the supervisory board must be employees. Perhaps not surprisingly, many corporate headquarters have taken advantage of the freedom to move out of Germany to other countries within the European Union.

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## 17.2 Modigliani and Miller

In order to explain how to think conceptually of capital structure, we now take the perspective of managers who maximize investor wealth.

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The famous Modigliani-Miller (M&M) propositions (honored with two Nobel Prizes) are a good start to understanding firms' capital structure decisions. Although the M&M theory can be expressed with complex algebra, it is really based on very simple ideas, described in the anecdote on Page ?? . The essential point that Modigliani and Miller argued is that in our familiar perfect market (no transaction costs, perfect competition, no taxes, no disagreement), the total value of all financial securities is the same regardless of whether the firm is financed by equity or debt, or anything in between.

### Begin Important

The Modigliani-Miller propositions state that in a perfect world, the value of a firm is independent of how it is financed. Instead, it is the underlying projects that determine the value of the firm. **End Important**

There would be arbitrage opportunities if the value of the firm depended on how it is financed. Because there should be no arbitrage, it follows that firms should be able to choose any mix of securities without impact on their values. You already know that these assumptions are the basis of all modern finance, even though they do not hold *perfectly*.]sect:imperfect-marketsImperfect capital markets However, you can only begin to understand how capital structure works in the real world if you also understand how it works when these assumptions hold. Indeed, the next few chapters will be all about what happens if the world is *not* perfect.

How does the M&M proof work? For simplicity, take it as given that the firm has already decided on what projects to take. (M&M stated this as one of their necessary assumptions, but it turns out not to matter in a fully perfect market.) The firm now considers how to finance its projects. Because we all agree on all current and future projects' expected cash flows and proper discount rates, we agree on the present value of these projects today. Call the value of the projects under a hypothetical best capital structure "PV." (This is almost by definition the present value that the firm's projects can fetch in our perfect capital market, of course.) The M&M proposition says that the present value of the firm's projects must equal the present value of the firm's issued claims today. In other words, if the firm has no debt and issues 100% equity, the equity must sell for the PV of the projects. If the firm instead finances itself by 50% debt and 50% equity, the two together must sell for the same PV. If the firm issues  $x\%$  debt and  $(1 - x\%)$  equity, the two together must sell for PV, too. The capital structure cannot change the project PV.

Of course, this should not come as a surprise to you. In Section 5]sect:splitpayoffsSplitting payoffs into debt and equity, without calling it M&M, you already used it in the context of financing a building. You learned that neither the building value nor the weighted cost of capital were influenced by your debt versus equity mix: The building was worth what it was worth. This is M&M precisely. It is the very same argument.

M&M then allows you to think of financing as a decision that can be made independent of the underlying projects. Recall that net present values are additive, so

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The M&M proposition states that any method of financing in a perfect market has an NPV of \$0. Neither debt nor equity, nor any combination of debt and equity, can change the present value contribution of financing. Any type of financing is obtained from perfectly competitive investors. For the M&M proposition to break down, it would have to be the case that some kind of financing scheme could add or subtract net present value.

## An Algebra Version

M&M is so important that it is worthwhile to put this general but verbal-only proof into a more concrete scenario analysis. To accomplish this as simply as possible, let's work with a firm worth \$100. Assume that all claims have to offer the same expected rate of return of 10%, which also means that investors are risk-neutral. (You will work an example in a risk-averse world in Section ??). Risk neutrality is just for convenience, not because it makes any difference.) There are two ways to prove that it makes no difference how the firm is financed:

**1. The full restructuring (takeover) argument** Assume that the managers could find — and actually did choose — a capital structure that makes the firm worth \$1 less than its PV. For example, assume that the firm is worth  $PV = \$100$  under the optimal capital structure of 80% equity and 20% debt; and assume further that the firm is worth only \$99 under the capital structure of 50% equity and 50% debt that the firm has actually chosen. Then, all you need to do to get rich is to buy all old equity and all old debt, that is, the entire firm, for \$99. Now issue claims duplicating the optimal capital structure (assumed to be 80% equity and 20% debt). These claims will sell for \$100, and you pocket an instant arbitrage profit of \$1. Of course, in a perfect market, you would not be the only one to discover this opportunity. After all, opinions are universally shared. Other arbitrageurs would compete, too. The only price at which no one will overbid you for the right to buy the

firm's current claims is \$100. But notice what this means: the value of the old claims is instantly bid up to the firm value under the optimal capital structure. The logical conclusion is that, regardless of the financial structure that managers choose, they can sell their claims for \$100, that is, the present value of their projects.

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Table ?? shows the only logical arrangement for a firm whose project will be worth either \$60 or \$160. The expected future value is \$110; the present value is \$100. Under hypothetical capital structure LD ("less debt"), the firm issues debt with a face value of \$55. Consequently, bondholders face no uncertainty, and they will pay  $\$55 / (1 + 10\%) = \$50$ . Equity holders will receive either \$5 or \$105, and they are thus prepared to pay  $\$55 / (1 + 10\%) = \$50$ . The value of all the firm's claims adds up to the same \$100. Under hypothetical capital structure MD ("more debt"), the firm issues debt with a face value of \$94. Consequently, bondholders will now receive either \$60 or \$94, and they are willing to pay \$70 today. Equity holders will receive \$0 or \$66, and they are willing to pay \$30 for this privilege. Again, the value of all claims adds to \$100.

**2. The homemade restructuring argument** A more surprising proof relies on the fact that outside investors can revalue the claims themselves — you do not need to own the entire firm to do it. The idea is that you do not buy 100% of the firm, but only 1% of the firm. If you buy 1% of all the firm's claims, you receive 1% of the projects' payoffs. You can then repackage and sell claims that imitate the payoffs under the presumably better capital structure for 1% of the firm's higher value, receiving an arbitrage profit of 1% of the value difference. For example, assume that the firm has chosen capital structure LD, but you and other investors would really, really like capital structure MD. Perhaps you would really, really like to own a claim that pays \$0.60 in the bad state and \$0.94 in the good state. This would cost you 1% of the bond's \$70 price, or \$0.70. How can you buy the existing LD claims to give you the MD-equivalent claim that you prefer *without* any cooperation by the LD-type firm?

First, work out what your claims are if you buy  $d$  bonds and  $e$  stocks in the LD firm. You will receive payoffs of  $d \cdot \$55 + e \cdot \$5$  in the bad scenario, and  $d \cdot \$55 + e \cdot \$105$  in the good scenario. You want to end up with \$0.60 in the bad scenario, and \$0.94 in the good scenario — two equations, two unknowns:

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If you buy 0.0106 LD bonds and 0.0034 of the LD equity, you will end up with \$0.60 in the bad state, \$0.94 in the good state — exactly the same as an MD firm would have given you! How much would you have to pay to get these payoffs? The cost today would be  $d \cdot \$50 + e \cdot \$50 = 0.0106 \cdot \$50 + 0.0034 \cdot \$50 = \$0.70$ , exactly the same as your desired payoffs would have cost you if the firm itself had chosen an MD capital structure. In effect, you have manufactured the capital structure payoffs that you like without the cooperation of the firm itself. By repeating this exercise (buying some securities, selling others), you can replicate the payoffs of *any* financial claims in *any* kind of capital structure.

From here, it is an easy step to the M&M argument. If the value of the firm is higher under the MD capital structure than it is under the LD capital structure, you can yourself transform the lower-cost claims under the capital structure into the higher-value claims under a better capital structure. You could sell them, and thereby earn an arbitrage profit. This would contradict the conjecture that the firm value could depend on its capital structure — in a perfect world, this cannot be possible.

However, there is an important caveat to this homemade restructuring proof: Homemade leverage allows you to obtain only the cash flow rights of claims under any different arbitrary, and presumably better, capital structure. *It does not give you the control rights!* It can fail, for example, if a better capital structure has more value *only* if you obtain majority voting control that allows you to fire the management and change policy to what the firm should really be doing.

Let me explain in more detail why the “full restructure” argument with control rights is more universal. The “homemade restructuring” argument must assume that the payoffs are not influenced by the capital structure. What happens if a firm finances itself with securities that are just bad — for example, with securities that have covenants requiring the firm to change management every week? Is the firm worth as much under this awful capital structure as it would be under a reasonable one?

There are two ways to think about this question:

1. You can avoid all control rights-related issues by assuming that the projects and cash flows of the firm are already fixed. Thus, it does not matter whether the management changes every week. Control rights are then irrelevant, too. Even if the firm changed its capital structure, its projects would still generate the same (lousy) cash flows. This is the path that the original M&M paper took — as we did above, too.
2. You can rely on the full restructuring (takeover) argument, discussed above. It leans more heavily on the perfect market assumption, because you must be able to freely buy and sell not just enough securities to restructure 1% of the firm's payoff promises, but enough securities to take full control of the firm. And this is also the real reason why the M&M argument worked: It assumes that if you own all the shares, you own all the control rights. This allows you to fire the old management and restructure the firm's capital structure optimally. (It also assumes you can undo any damaging plans this bad management may have begun to set into action.) Thus, a firm with the bad capital structure that requires changing management every week could simply not exist. Again, you would not be the only one to recognize that this creates value. Therefore, in this perfect world, firms not only end up with the optimal capital structure but also with the optimal set of projects. They are always priced at exactly what they should be worth under the optimal operating and financing policy that they would indeed be pursuing.

## Reflecting on the Arbitrage Argument

Let's recap it all. In a perfect M&M world, the value of all claims is the same, regardless of how much debt or equity the firm has issued.

- The value of the firm is independent of cash flow (or even control rights), because arbitrageurs can — and always will — rearrange claims into an optimal structure.
- An “absence of arbitrage” relationship ensures that the sum-total value of all the firm's claims is equal to the total underlying project values.
- Claims merely “partition” the firm's payoffs in future states of the world. For financial securities, this is often contractually arranged at inception.

The M&M implications are sometimes misunderstood. Yes, they do state that capital structure cannot influence value. But you should now realize why even the most awful possible capital structure would be worth just as much as the best capital structure. It is because the former would instantly disappear — competitive markets would bid to buy all the (badly aligned) securities and restructure them into something better. Therefore, it is more accurate to think of the M&M proposition as stating not only that all capital structures are worth the same (which is true), but that bad capital structures are immediately eliminated and thus never observed in real life. If a capital structure persists, it couldn't be really bad.

- Bad *capital structures* would be instantly eliminated and are thus never observed.

The same insight really applies to (reversible or avoidable) bad project choices:

- Bad *project choices* would also be instantly eliminated and are thus never observed.

Of course, if the world is *not* perfect, capital structure and dumb project choices could matter to the value of the firm.

To the extent that the M&M proposition has some degree of realism, it is both good news and bad news. It is good news that you now know where to focus your efforts. You should try to increase the value of your firm's underlying projects — by increasing their expected cash flows, reducing their costs of capital, or both. It is bad news because you now know that you cannot add too much value by fiddling around with how you finance your projects if your financial markets are reasonably close to perfect.

A very useful consequence of the perfect financial market assumption is that:

- Managers can make their real operations choices first without paying any attention to their debt and equity choices.

## Perceived vs. Real Value

How robust is the M&M premise when it comes to real-world financial claims? Here, we must distinguish between value and belief.

In terms of total corporate value, the M&M proposition holds quite well — unless firms have such high debt ratios that financial distress is a real possibility. This is true both theoretically and empirically. In normal times, it rarely matters whether a large, publicly traded firm has a debt ratio of 0%, 10%, or 20%. For such companies, the value function is quite flat — although you may be able to finetune it just a little as you will learn in the next few chapters. Both theory and evidence suggest that firms in the same industry operate with different capital structures and few ill effects from one or the other. Of course, there are firms for whom capital structure matters: Startup firms rarely have low debt ratios and rarely operate in a near-perfect capital market; and near-bankrupt firms and financial services firms regularly operate with leverage ratios of 90% or more, where capital structure differences can matter quite a lot more.

In terms of managerial beliefs, the M&M proposition fares less well. Many large-firm managers seem to believe that capital structure matters and/or that they can add value by “trading” it. They may thus spend too much attention on fine-tuning it — of course, firms with very high leverage ratios should, but for others the value effects are likely to be small. This is not to say that worrying about capital structure is always a complete waste of time (e.g., when interest rates change, obtaining new competitive bids for a debt refinance is a good idea), but it is to say that managers would often be better off searching for other higher-NPV projects in less competitive markets (where they have specialized skills, knowledge, or scale) elsewhere.

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## 17.3 The Weighted Average Cost of Capital (WACC)

Stating that “the value of the firm does not depend on its financing in a perfect market” is equivalent to stating that “the overall cost of capital to the firm does not depend on its debt ratio.” To show that our capital-structure irrelevance proposition also works when the world is not risk-neutral, let’s repeat the “building with mortgage” example from Section .5]sect:splitpayoffsSplitting building payoffs into debt and equity. However, we now allow riskier claims to have higher expected rates of return. You can draw on your knowledge of net present value, risk-averse benchmark pricing, the capital asset pricing model, and capital structure concepts as we revisit this example. Another reason why this example is important is that it reintroduces the “weighted average cost of capital” (WACC) in the corporate context. The next chapter will cover a generalized and widely used WACC formula for the case when corporations pay income tax.

### Risk Aversion and Higher Equity Cost of Capital

When investors are risk-averse, riskier claims have to offer higher expected rates of return. To work them, our basic tools remain exactly the same as those in Section : payoff tables, promised rates of return, and expected rates of return.

From Chapter , you know that debt and equity are contingent claims on the underlying project. Although we continue calling this project a building (to keep correspondence with Section ), we now extend the metaphor. Consider the corporation to be the same as an unlevered building, the mortgage the same as corporate debt, the levered building equity ownership the same as corporate equity, and the possibilities of sun and rain as future good or bad product demand scenarios. There are no conceptual differences. However, we do take one shortcut: We ignore all nonfinancial liabilities and pretend that our firm is financed entirely by financial debt and equity.

The parameters of the problem are as follows:

- The probability of sun is  $3/4$ ; the probability of rain is  $1/4$ .
- If it is sunny, the project is worth \$100; if it is rainy the project is worth only \$60.
- The appropriate cost of capital (at which investors are willing to borrow or save) is 20% for the overall project. We retain this cost of capital for the overall project (though not for the debt and equity). You had also computed earlier that the building must then be worth \$75:

The expected payoff on the project is  $1/4 \cdot \$60 + 3/4 \cdot \$100 = \$90$ , and the price today is  $\$90/(1 + 20\%) = \$75$ .

The novelty is that we now assume that investors are risk-averse and thus U.S. Treasuries pay a lower *expected* rate of return. The debt on the building is not exactly risk-free, either. Let's assume that you want to raise \$65 today. Your investment banker informs you that you have to offer bond investors an interest rate of 16.92% if you want to raise so much. (Still, it's less than the 20% discount rate on the overall project.) If you do this, how much will you expect to get as the residual equity claimant? And what will be the firm's overall cost of capital? This will turn out to be like a fun crossword puzzle.

► In Terms of Project Value

Step 0: Let's first collect all the inputs you have:

	Financing Scheme All Equity (AE)		Financing Scheme Debt and Equity (DE)	
	100% Equity		Bond promises 16.92%	Levered Equity after Bond
Prob( Sun ) =	3 / 4	\$100	\$100	
Prob( Hurricane ) =	1 / 4	\$60	\$60	
E Future Payoff		\$90		
Price P Now		\$75	\$65	
E Rate of Return		20%		

Step 1: Figure out how much the bondholders are really getting. At the 16.92% interest rate, they will get  $\$65 \cdot (1 + 16.92\%) \approx \$76$  — but only if it's sunny. Otherwise, they get what's left: \$60. Thus, their expected return is

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and their *expected* rate of return is

(Omitted eq)

Add all these figures into the table:

	Financing Scheme Scheme AE		Financing Scheme Scheme DE	
	100% Equity		Bond promises \$76	Levered Equity after \$76 Bond
Prob( Sun ) = 3 / 4	\$100	\$100	\$76	
Prob( Hurricane ) = 1 / 4	\$60	\$60	\$60	
E Future Payoff		\$90	\$72	
Price P Now		\$75	\$65	
E Rate of Return		20%	10.77%	

**Step 2:** How much is your levered equity going to get in each state? Here we invoke the perfect market assumptions.

Everyone can buy or sell without transaction costs, taxes, or any other impediments. By “absence of arbitrage,” the value of the building if it is financed by a bond plus levered equity must be the same as the value of the building if 100% equity-financed. Put differently, if you own all of the bond and levered equity, you own the same thing as the building — and vice-versa. Now use the arbitrage condition that the value of the levered equity plus the value of the bond should equal the total building value. The equity gets just what is left over, and the debt and equity together own the firm today. With the debt raising \$65 today and the firm being worth \$75, your equity must be worth \$10. Write all these quantities into the table:

		Financing Scheme AE		Financing Scheme DE
		100% Equity	Bond promises \$76	Levered Equity after \$76 Bond
Prob( Sun ) = 3/4	\$100	\$100	\$76	\$24
Prob( Hurricane ) = 1/4	\$60	\$60	\$60	\$0
E Future Payoff		\$90	\$72	\$18
Price P Now		\$75	\$65	\$10
E Rate of Return		20%	10.77%	

**Step 3:** What is the expected rate of return on equity? Easy! Your equity is worth \$10 and expects to receive \$18.

Thus, its rate of return is  $\$18/\$10 - 1 = 80\%$ .

		Financing Scheme AE		Financing Scheme DE
		100% Equity	Bond promises \$76	Levered Equity after \$76 Bond
Prob( Sun ) = 3/4	\$100	\$100	\$76	\$24
Prob( Hurricane ) = 1/4	\$60	\$60	\$60	\$0
E Future Payoff		\$90	\$72	\$18
Price P Now		\$75	\$65	\$10
E Rate of Return		20%	10.77%	80%

### ► In Terms of Cost of Capital (WACC)

Given the prices of the two claims and their payoffs in each state, you can work out all the rates of return:

	Contingent Rate of Return		Expected (Appropriate)
	Hurricane	Sun	Rate of Return
Unlevered (100% Equity)	$\frac{\$60}{\$75} - 1 = -20\%$	$\frac{\$100}{\$75} - 1 \approx 33\%$	$\frac{\$90}{\$75} - 1 = 20\%$
Loan (Bond)	$\frac{\$60}{\$65} - 1 \approx -7.69\%$	$\frac{\$76}{\$65} - 1 \approx 16.92\%$	$\frac{\$72}{\$65} - 1 \approx 10.77\%$
Shares (Levered Equity)	$\frac{\$0}{\$10} - 1 = -100.00\%$	$\frac{\$24}{\$10} - 1 = 140\%$	$\frac{\$18}{\$10} - 1 = 80\%$

Let's recap: You started knowing only the costs of capital for the firm (20%) and worked out the cost of capital of the firm's bond (10.77%). This allowed you to determine the cost of capital on the firm's levered equity (80%). Neat!

As was also the case in the example with risk-neutral investors in Figure 2]fig:histosplainRisk-neutral investors, the rates of return to levered equity are riskier (−100% or +140%) than those to unlevered ownership (−20% or +33%), which in turn are riskier than those to the corporate loan (−7.69% or +16.92%). But whereas these risk differences did not influence the expected rates of return in the risk-neutral world, they do in a risk-averse world. The cost of capital (the expected rate of return at which you, the owner, can obtain financing) is now higher for levered equity ownership than it is for unlevered ownership, which in turn is higher than it is for loan ownership. Moreover, you could work out *exactly* how high this expected rate of return on levered equity ownership must be. You only needed the “absence of arbitrage” argument in the perfect M&M world: Given the expected rate of return on the building and on the bond, you could determine the expected rate of return on levered equity ownership. (Alternatively, if you had known the appropriate expected rate of return on levered equity ownership and the rate of return on the bond, you could have worked out the appropriate expected rate of return on unlevered ownership. Of course, the exact differences in expected rates of return should ultimately also be governed by some model — perhaps one similar to but better than the CAPM.)

(Omitted solvenow)

## The WACC Formula (without Taxes)

The weighted average cost of capital (WACC) is the value-weighted average cost of capital of all the firm's claims. Because the firm value is determined by the assets and is independent of how debt and equity are divided, the same independence should hold true for the cost of capital. Let's check, then, that if the perfect-market arbitrage condition holds — that is, if bonds and stocks together cost the same as the firm — then the cost of capital for the overall firm is the weighted cost of capital of stocks and bonds.

The constant WACC implies that the costs of capital of debt, equity, and the overall firm are directly linked. If you know the costs of capital for the debt and the equity, you can infer the cost of capital for the firm. Alternatively, if you know the cost of capital for the firm and the debt, you can infer the cost of capital for the equity. *If you know any two costs of capital, you can compute the third one.*

Let's show this again to translate the numerical example into a formula for the WACC. In either state, the debt and equity together will own the firm:

(Omitted eq)

(I am omitting the time subscripts to avoid clutter.) Therefore, the expected value of debt and equity together must be equal to the expected value of the firm.

(Omitted eq)

Rewrite this in terms of today's values and expected rates of return ( $E(r)$ ),

(Omitted eq)

In the last row, debt, equity, and firm are as of now, and expected rates of return are from now to the future. Divide each term by the firm value today ( $Firm = \$75$ ) to express this formula in terms of percentages of firm value:

(Omitted eq)

Compute the fractions:  $Debt/Firm \approx 86.7\%$  and  $Equity/Firm \approx 13.3\%$ . These are the financing weights of the two securities in the firm *today*. Therefore, you can write this formula as

(Omitted eq)

The "1+" cancels on both sides, because  $86.7\% + 13.3\% = 100\%$ . You have just discovered the perfect-market WACC formula:

(Omitted eq)

No one bothers adding the expectation operator in front of the WACC, although this would be more accurate. The next two chapters will explain how WACC must be modified in the presence of corporate income taxes and other perfect-market distortions.

### **Begin Important**

The Weighted Average Cost of Capital formula (when there are no corporate taxes) is

(Omitted eq)

### **End Important**

## Leverage, Cost of Capital, and Quoted Interest Rates

You now understand how to compute costs of capital. But let's look at a few more trees to understand the forest better. How do shifts in capital structures generally influence individual securities' costs of capital? Return to the original debt-and-equity-only numerical example. In capital structure "DE-0," the bond promises \$36; in "DE-1," it promises \$76; and in DE-2, it promises \$88.

Everything included, we just worked out:

		Financing Scheme AE	Financing Scheme DE-1	
		100% Equity	Bond promises \$76	Levered Equity after \$76 bond
Prob( Sun ) = 3 / 4	\$100	\$100	\$76	\$24
Prob( Hurricane ) = 1 / 4	\$60	\$60	\$60	\$0
E Future Payoff		\$90	\$72	\$18
Price P Now		\$75	\$65	\$10
E Rate of Return		20%	10.77%	80%
Financing Weight		100%	\$65/\$75 $\approx$ 87%	\$10/\$75 $\approx$ 13%

How would the promised rate of return, the expected rate of return, and the debt-equity ratio change if the firm changed the amount it borrowed? Let's say the firm has explored the capital markets and learned that in capital structure DE-2, a bond promising \$88 in debt payments would raise \$70 today. (Trust me that this is consistent with the same economy-wide risk-aversion that we used in the previous example.) The payoff table is now

		Scheme AE	Scheme DE-2	
		100% Equity	Bond promises \$88	Levered Equity after \$88 bond
Prob( Sun ) = 3 / 4	\$100	\$100	\$88	\$12
Prob( Hurricane ) = 1 / 4	\$60	\$60	\$60	\$0
E Future Payoff		\$90	\$81	\$9
Price P Now		\$75	\$70	\$5
E Rate of Return		20%	15.71%	80%
Financing Weight		100%	93.3%	6.7%

Finally, let's determine what happens if debt promising \$36 can be raised at a price of \$35 today. This debt is risk-free.

		Scheme AE		Scheme DE-0
		100% Equity	Bond promises \$36	Levered Equity after \$36 bond
Prob( Sun ) = 3 / 4	\$100	\$100	\$36	\$64
Prob( Hurricane ) = 1 / 4	\$60	\$60	\$36	\$24
E Future Payoff		\$90	\$36	\$54
Price P Now		\$75	\$35	\$40
E Rate of Return		20%	2.86%	35%
Financing Weight		100%	46.7%	53.3%

Putting this together, here are the capital-structure tradeoffs:

	Debt Promises		Expected Rate of Return			Weight	
	Payoff	Intrst Rate	Debt	Equity	Firm	Debt	Equity
No Debt	\$0	2.86%	2.86%	20%	20%	0.0%	100.0%
Low Debt	\$36	2.86%	2.86%	35%	20%	46.7%	53.3%
Med Debt	\$76	16.92%	10.77%	80%	20%	86.7%	13.3%
High Debt	\$88	25.71%	15.71%	80%	20%	93.3%	6.7%
All Debt	\$100	33.33%	20.00%	-	20%	100.0%	0.0%

I also added that when you borrow nothing, your marginal interest rate is still the risk-free rate; and if you promise \$100, you expect to deliver \$75 — the debt is the firm.

Do not confuse expected and quoted rates of return. For high debt ratios, equity may well have to offer seemingly astronomical *expected* rates of return. In our example, if the 20%-discount-rate firm raises \$76 in debt, it has to offer an expected rate of return of 80% to the equity. This is common — for high leverage ratios, equity costs of capital often seem astronomical. This is not usury. It is simply fair.

(Omitted solvenow)

## ► Graphing Financing Schemes against Leverage Ratios

(Omitted fig)

I have done the calculations for many more debt weights, and graphed the expected rates of return to both debt and equity in the upper graph in Figure ?? . (This is the “forest” view I wanted to get to.) When leverage ratio is low, the debt is risk-free. Yet more debt still increases the risk of the equity and thus the equity's cost of capital. Eventually, with enough debt, the debt itself becomes risky, too. In this region, more debt means more risk for creditors, and thus a higher required rate of return on debt. (The promised rate of return is, of course, above the expected rate of return.)

In the real world, the plot can look a little different, because most projects do not have “binomial” but more “normally distributed” (bell-shaped) payoffs. This is the lower graph. In fact, it may well be possible that the firm will end up being worth nothing. Thus, it is impossible for the firm to issue truly risk-free debt. However, over a wide range, debt is “practically” risk-free, because the firm is very likely to be worth enough to pay its debt. Thus, the probability of default is tiny for modest debt loads. Eventually, as the debt ratio of the firm increases ever more, the debt’s expected rate of return must increase noticeably, too. And again, the cost of equity rises with the fraction of debt of the firm over the whole domain. (Unlike in the earlier graph, there is no sudden end to the riskiness of equity.) *Importantly, in both plots, the WACC is constant, regardless of the firm’s mix of equity and debt.*

### **If all Securities are Riskier, is the Firm also Riskier?**

If you remember nothing else from this chapter, please remember to avoid a common logical fallacy. Many practitioners start with two correct statements:

1. If the firm takes on more debt, the debt becomes riskier and the cost of capital for the debt ( $E(r_{\text{Debt}})$ ) increases.
2. If the firm takes on more debt, the equity becomes riskier and the cost of capital for the equity ( $E(r_{\text{Equity}})$ ) increases.

However, they then commit a serious logical error when they argue:

3. Because the firm consists of only debt and equity, the firm also becomes riskier when the firm takes on more debt, which must mean that the firm’s cost of capital ( $E(r_{\text{Firm}})$ ) increases. A financier may even want to reduce the firm’s debt in order to avoid such increases in volatility of the firm.

The first two statements are correct. With more debt, the cost of capital for debt increases because it becomes riskier. In corporate default, the debt is less likely to receive what it was promised. The equity also becomes riskier: The cost of capital on equity rises, because in financial default, which is now more likely to occur, more cash goes to the creditors before equity holders receive anything.

But the final conclusion — “the firm also becomes riskier” — is wrong. When the firm takes on more debt, the weight of the (safer) debt ( $w_{\text{Debt}}$ ) increases and the weight of the (riskier) equity ( $w_{\text{Equity}} = 1 - w_{\text{Debt}}$ ) decreases. Because the cost of capital (CoC) for debt ( $E(r_{\text{Debt}})$ ) is lower than the cost of capital for equity ( $E(r_{\text{Equity}})$ ), the weighted sum remains the same. Confirm this on the binomial example:

(Omitted eq)

Check that statements 1 and 2 are correct and that statement 3 is incorrect: The costs of capital for both debt and equity are (weakly) higher when the firm has more debt, but the overall cost of capital for the firm has not changed. In the perfect M&M world, the overall cost of capital is independent of the mix between debt and equity.

(Omitted solvenow)

Leverage, Earnings Per Share, and Price/Earnings Ratios

What is the effect of debt on earnings per share (EPS)? This is a meaningless question, because EPS depends mechanically on the number of shares. The same capital structure can exist under different numbers of shares. Equity can be worth \$7 million with 1 million shares valued at \$7/share (an expected EPS of \$0.70/share) or with 100,000 shares valued at \$70/share (an expected EPS of \$7/share). Any EPS figure is possible.

A more meaningful question is how leverage influences P/E ratios. The answer is “it depends.” I had already sneaked this into Section .4]subject:leveringcompsDebt adjustment for P/E ratios, but you had to trust me blindly that debt offers a lower expected rate of return than equity. The examples in that section (which had the M&M constant WACC) showed that more debt can sometimes cause lower P/E ratios (especially in value firms) and sometimes cause higher P/E ratios (especially in high-growth firms).

(Omitted solvenow)

17.4 Credit Derivatives as Risk-Shifting Insurance

Credit derivatives ]subject:CDSCredit Derivatives are a multi-trillion dollar financial business. The easiest way to think of this market is as one party (like a hedge fund) writing insurance to another party (like a pension fund) in case the bond fails to pay. For example, go back to our example:

		Bond promises \$88	Levered Equity after \$88 bond
Prob( Sun ) = 3 / 4	\$100	\$88	\$12
Prob( Hurricane ) = 1 / 4	\$60	\$60	\$0
Price P Now		\$70	\$5
E (Rate of Return)		15.71%	80%

What would you think if I was willing to sell you a CDS that paid \$1 when it rains and \$0 when the sun shines?

We already worked the example of the opposite, the \$1-Sun state claim: If \$12 of Sun-promise cost \$5 today, then \$1 of Sun-promise must cost  $5/12 \approx \$0.42$  today. Thus, the \$88 bond promise for the Sun-state is worth  $5/12 \cdot \$88 \approx \$36.67$  today. The remaining \$60 Hurricane-promise must therefore be worth  $\$70 - \$36.67 = \$33.33$  today. And if \$60 of Hurricane-promise cost \$33.33, then \$1 of Hurricane-promise must cost  $\$33.33/\$60 \approx \$0.56$  today. You can now check that the \$88-promise bond is indeed worth \$70:

(Omitted eq)

The prices of such pure state claims are not just of academic interest. If you purchased the debt plus \$28 of my Hurricane-promise, you would hold a risk-free position paying off \$88, no matter what! These \$28 of “bond insurance” would cost you about  $\$0.5555 \cdot \$28 \approx \$15.56$  today. The aforementioned desire by pension funds to transform risky securities into risk-free securities has been the main reason for the large size of the CDS market.1]subject:CDS

What are the expected rates of return of the two pure state claims?

(Omitted eq)

This is not an error: investors are willing to purchase the rain-claim even at a stark negative rate of return! After all, insurance is not free.

If you buy a combined portfolio of one \$70 bond and \$15.56 worth of rain-claim, you have 81.82% investment in the bond and 18.18% in the CDS — and your portfolio has become risk-free! Check that this risk-free portfolio has the correct risk-free rate of return (ignoring rounding error):

(Omitted eq)

## 17.5 Cost of Capital Nuances and Non-Financial Liabilities

There are some small subtleties, however, when it comes to nonfinancial claims. Product markets are often not perfect. In these cases, the firm's average and marginal costs of capital can be different. Nevertheless, if the financial claims exist in a perfect market, then it is often still the case that the firm's marginal cost of capital — which is what managers ultimately want to know — is that of its financial claims. The financial claims' weighted average cost of capital would then still be the firm's marginal cost of capital. (However, this cost of capital would *not* be the firm's average cost of capital.)

In Table ]tbl:intcmajorIntel, you saw that Intel's total liabilities were about half as large as its financial debt. This is typical for many U.S. companies. Does the M&M proposition — that firm value is not influenced by capital structure and thus that capital structure is irrelevant — still apply in the presence of nonfinancial claims?

### Value Irrelevance With Nonfinancial Liabilities?

The argument is actually somewhat subtle. Start by recalling the logic of the M&M perfect-market argument: The value of the firm's financing does not depend on how it is divided between debt and equity. The proof was by contradiction. If a firm instituted a capital structure with a dumb debt covenant — that is, one that forced it to pay all its future cash flows to charity — could this firm be worth less than a more intelligently financed firm? No! A horde of arbitrageurs would immediately compete to buy all these bad claims (at their presumably lower value) and undo the dumb capital structure. Therefore, this dumb capital structure could not trade for a lower price than the optimal capital structure. It would have the same value as the best capital structure, but it would exist for only half an instant before it was undone. The perfect market provided two aspects important to the M&M argument:

1. The capital market is perfectly elastic, which here means that all financial claims that the firm could dream up would be snatched up by a perfect capital market (only) at the appropriate price.
2. There is no link between the firm's operations and the financial claims that a firm is able to take on. (In the original M&M paper, the authors assumed that all operating decisions were already made.)

These two assumptions can fail on nonfinancial liabilities. Let me give you two respective examples:

**1. Income tax liabilities:** If you do not pay your taxes until April 15 (tax day), you can use your tax liability for your own investment purposes. Your effective cost of capital on these funds is zero. However, you cannot

raise more funds at will at this same zero interest rate from Uncle Sam. You also cannot return this financing to the provider at a fair market cost of capital. If you prepay your taxes, Uncle Sam will not credit you with interest for early payment.

**2. Trade credit:** It is not uncommon for suppliers to give firms 0% financing as trade credit. This is *not* the perfect-market appropriate price for financing and you would want to take as much of this trade credit as possible. However, this trade credit is usually only available to you if you buy more of the underlying good. Your supplier would not provide you more trade credit in order to pay your rent if you did not buy his goods. Consequently, if you were to buy your supplier's goods, a capital structure with more trade credit would be better than one without. Conversely, you may not even buy these goods without trade credit.

Now think back to how the value of your firm was determined by the net present values of your project. Formula ?? stated that

(Omitted eq)

Under M&M, the financing NPV was always zero. However, your trade credit in this example would be a positive-NPV project in itself. The consequence is that you might choose different real operations (buying the supplier's goods) if you were financed with rather than without trade credit. The separation between operations and financing has just broken down. On the contrary, if trade credit is a bargain, it now makes sense to think of a bundle that includes the project and the project-specific financing that comes with it.

It is possible to put forth a perfect-market scenario for operations that unlinks their nonfinancial claims in order to get a full M&M proposition also for nonfinancial claims. However, this is not particularly useful for two reasons: First, we are interested primarily in finance, not in operations. Second, nonfinancial markets are generally far from perfect — much more so than financial markets — and many operational choices are irreversible once made. With such a large discrepancy between the necessary perfect-market conditions and reality, such a proposition would not be very helpful in thinking about real-world problems. But you do need to understand how to think of the firm's financing claims in a broader real-world perspective. Fortunately, this is easy.

## **Begin Important**

- The M&M proposition is helpful for thinking about the division of claims into debt and equity. This is because the markets for raising financing through these claims are fairly perfect, and the firm pays fair prices either way.
- Thus, for financial claims, managers can think about financing and operational choices separately.
- The M&M proposition is less helpful for thinking about the division of claims between financial and non-financial liabilities. This is because the markets for raising financing through non-financial liabilities are rarely perfect. Such financing, e.g., trade credit or delayed tax payments, often offer better deals but are available only together with certain project choices.

- Thus, for non-financial claims, managers need to think about financing and operational choices together.

## End Important

(Omitted solvenow)

## The Marginal vs. The Average Cost of Capital

There is one more important issue that you did not yet have to worry about in the M&M world. The marginal cost of capital applies to the next dollar of capital the firm would raise; the average cost of capital is the financing cost for all of the firm's existing projects. As a manager, you ultimately want to learn your projects' marginal costs of capital, because these rates are what you would compare to your projects' marginal rates of return. The firm's average cost of capital is really quite irrelevant. Fortunately, under M&M, the two are the same. Thus, if you compute the weighted average cost of capital, you know the marginal cost of capital for raising one more dollar.

Unfortunately, in the real and imperfect world, the average and marginal costs of capital can be different. For example, it could be that the first dollar of financing obtained by the firm is internal (or trade credit) and thus cheaper than the billionth dollar of financing. Thus, when you compute a WACC from a firm's existing capital providers (and published in the financial data), be aware that even if the project is typical for the firm, it may only be your average cost of capital — not the marginal cost of capital that you may need.

Now recall that the firm's weighted average cost of capital is

(Omitted eq)

In the context of a firm financed only with financial capital (debt and equity),

(Omitted eq)

The original M&M proposition states that this cost of financial capital is not affected by shifting  $w_{\text{Debt}}$  to  $w_{\text{Equity}}$ . A convenient way to think about the cost of capital is that neither debt nor equity are positive-NPV or negative-NPV projects. Thus, shifting between them does not change the value of the firm.

In the presence of nonfinancial liabilities (NFL), the definition of the firm's weighted average cost of capital expands into

(Omitted eq)

where FL are the financial liabilities. Unfortunately, you cannot expand or contract the nonfinancial liabilities at will. Consequently, even if you finance and operate your projects optimally, you will probably not face the same risk-adjusted cost of capital on the margin for your nonfinancial liabilities as you will for your financial liabilities. For example, think again about income tax liabilities. They have an interest rate of 0% if you delay paying before April 15 (the tax-due date). But you cannot expand the amount borrowed from Uncle Sam. Thus, you have a fixed and nonexpandable pool of financing at a cost of capital of 0% until you reach your tax liabilities, and the equivalent

of an infinite cost of capital thereafter (i.e., you can't get any more). Put differently, your average cost of capital would increase if you shifted financing from  $w_{NFL}$  to  $w_{Debt}$  or  $w_{Equity}$  by paying your taxes unnecessarily early.

The firm's best financing strategy now is to select the lowest-cost marginal source of financing.

- If your source of financing is tied to the firm (but not to particular projects), it may not influence your selection of projects. In this case, you should first finance projects with the lowest cost of capital (e.g., delay paying income taxes or suppliers) before you proceed to more expensive sources of financing. Eventually, once you have gone up the ladder of financing costs, you reach the cost of financing via financial claims. Assuming debt and equity exist in a perfect capital market, you can then raise as much capital as you wish at their appropriate marginal costs of capital.
- If your cheapest source of financing is tied to a particular project, it may be best to include it in the costs and benefits of the project. For example, if a retail branch can be financed with trade credit from suppliers, and if this is cheaper than financial capital, then you could count the trade-credit NPV as part of the retail store project NPV. If trade credit is not cheaper, you would not use it and rely on the perfect capital market instead. (In the real world, it may also be difficult to measure the cost of capital. For example, what exactly is your cost of capital for accounts payable, given that delaying payment can mean your suppliers could treat you differently in the future?)

Note that in both cases, you use the cheapest nonfinancial sources of funds until you reach the cost of your financial capital. At this point, you rely solely on the perfect-market financial capital as your source of marginal funding. The financial cost of capital then becomes your firm's marginal cost of capital.

### Begin Important

- If a source of low-cost (nonfinancial) financing is tied to a specific project, it is usually convenient to consider it as part of the project. You would include the financing's net present value in the project's return.
- If financing is not tied to specific projects, firms should first use up all sources of capital that are cheaper than what the financial capital markets are demanding.
- If the financial capital markets are perfect, and *after* the firm has already exhausted all cheaper sources of financing from the imperfect nonfinancial markets, then the firm's *marginal* cost of capital is determined by the cost of capital of debt and equity. In other words, for a firm that has optimized its nonfinancial sources of funding, the plain WACC formula holds,

(Omitted eq)

You would compare this marginal cost of financial capital to the rate of return of your marginal project.

- You can still use the original M&M proposition, but only within the context of financial claims — that is, the value of the firm's *financial* claims is indifferent to whether the firm is financed by debt or equity.
- This *marginal* cost of *financial* capital is also the *average* cost of *financial* capital in a perfect capital market. However, it is decidedly *not* the firm's *overall average* cost of capital. The firm's average cost of capital can be lower because some non-financial liabilities could have lower costs of capital.

## End Important

Again, don't get too carried away. The M&M propositions are helpful only for thinking about the subject of capital structure. They are not intended to be realistic. They are thought experiments. In the real world, capital structure can matter, and you have to think about how your cost of capital changes with different capital structures, whether it is financial or nonfinancial claims. This is the subject of the next chapters.

(Omitted solvenow)

## Summary

This chapter covered the following major points:

- *Ex-ante* entrepreneurs have an incentive to set up a capital structure that maximizes firm value, not equity shareholder value. This is because capital providers know that entrepreneurs later would want themselves or their managers to behave opportunistically. If entrepreneurs fail to set up the proper incentive structures for themselves and their managers, they lose value *now*. If possible, entrepreneurs would often even like to write contracts today that forbid their managers to favor them (the entrepreneurs) tomorrow.
- The Modigliani-Miller (M&M) capital structure proposition states that it makes no difference in a perfect market whether a firm finances itself with debt or equity.
  - Competitive arbitrageurs can own all cash flow and control rights if they buy all debt and equity.
  - Arbitrageurs can instantly eliminate and undo any bad capital structure choices (and/or any bad project choices).
  - Arbitrageurs would compete to bid up the value of any bad capital structure to the value of the firm under the optimal capital structure (and/or optimal operating policy).
  - The value of all claims under *any* capital structure is therefore that of the value under the *best* capital structure. It is the value of the underlying projects. Claims simply partition who gets how much in what state of the world.
  - The firm's cost of capital is therefore invariant to the split between debt and equity. It is always equal to the same weighted average cost of capital (WACC).

An even simpler version assumes that project choices were already fixed and are now immutable. The M&M propositions are interesting not because they are realistic, but because they are benchmarks that point out when capital structure (and/or operating policy) would not matter.

- More debt does not imply that the overall cost of capital increases, even though both debt and equity become riskier.
- The bank may demand an interest rate that is higher than the expected cost of capital for the equity. This does not mean that the cost of debt capital is higher than the cost of equity capital, because the debt's cost of capital is not its *promised* interest rate.

- For most securities, equity requires higher expected rates of return than debt. (In a CAPM world, this is the case for securities with positive market betas.)
- Assuming that the firm is financed only with debt and equity, the absence of arbitrage implies that the capitalization-weighted average expected rate of return (WACC) is:

(Omitted eq)

where the weights  $w_{\text{Equity}}$  and  $w_{\text{Debt}}$  are the values of equity and debt when quoted as a fraction of the overall firm value *today*. The project's WACC remains the same, no matter how the firm is financed. It is determined by the underlying projects.

- A model like the CAPM is compatible with the M&M perfect-market point of view. It can provide costs of capital for financial debt and equity. However, it cannot provide costs of capital for other liabilities that do not originate in a perfectly competitive market, such as tax obligations. Such loans could even be interest-free.
- The marginal and average costs of capital are the same for claims that arise in a perfect market.
- Nonfinancial liabilities usually do not arise in a perfect capital market. Thus, their average costs of capital are often lower than their marginal costs of capital.
- When cheap financing (such as special trade credit) is tied to a particular project, it is often convenient to combine it with the project.
- After an optimizing firm has exhausted all its lower-cost nonfinancial sources of funding, the (infinitely elastic) perfect capital markets' financial funding becomes its marginal source of capital.

## Preview of the Chapter Appendix in the Companion

The appendix to this chapter is conceptual. It shows that the CAPM, WACC, and NPV all seamlessly fit together. There are no inconsistencies between them. (I used this when I made up the required costs of capital in the WACC example for different leverage ratios.)