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A Primer on Capital Structure

1. What is Capital Structure?

The best way to think about an optimal firm structure is that the current owners of a firm are thinking about how to sell their firm today. Their goal is to design a corporate charter that maximizes the total market-value of their firm today, that is the price that new investors will be willing to pay to acquire the firm from the old investors. The corporate charter must not only specify the voting rules, the procedure to replace incumbent managers and how the charter can be changed in the future, but also how future earnings are to be split among different owners (such as bondholders and stockholders) and stakeholders[1] (such as customers, workers, and suppliers). The agreement how to split up future earnings - either explicitly outlined or implicitly allowed to be changed in the future - is the firm's financial structure: rules that specify who receives the proceeds of (possibly uncertain) future cash-flows.

Historically, corporations have been using bonds and stocks (equity). In general, bonds ("leverage") are like loans, promising certain payoffs. Equity is like ownership, receiving whatever is left over after the promises to bondholders have been honored. In addition, modern corporations can use a variety of financial instruments that promise different future payoffs to various buyers under various scenarios: convertible debt, equity, warrants, derivatives, leases, trade credit. Firms can also collateralize assets and/or borrow from banks. Our discussion will focus mostly on the choice between simple debt and equity, although the purpose of our article is to provide the reader with the necessary intuition to understand why other financial instruments can be useful.

2. Maximization of Equity Value or Firm Value?

A good starting point for our analysis is the common misunderstanding that in order to optimize the firm's capital structure, managers should maximize the value of equity. Even though equity is a part of the firm's capital structure, there is also debt and many financial instruments with both debt and equity features that managers should take into account. We show in the next section that if an alternative capital structure would lead to a higher

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value for the overall firm (the sum of the values of all securities), the latter would be the better capital structure.

To see the difference, assume there was a way (known by everybody) in which managers could increase the value of equity by $1 if they could reduce the value of debt by $3.[2] This would reduce the value of the firm by $2. Managers are now faced with a dilemma: should they maximize the firm value, or should they maximize the value of equity, who after all vote managers into office and allow them to stay in office? Thus, managers may find it in their interest to do this exchange - even though this lowers the value of the firm (i.e., the total value of all assets and projects, both current and future, which equals the total value of all financing instruments). Yet, note that today's (ex-ante) purchasers of debt will take into consideration the possible future (ex-post) loss in the value of their debt, and will rationally demand compensation (an extra $3 discount) for the possibility of this transfer. If managers cannot commit em not to undertake the 3-for-1 exchange, everyone will realize that ex-post managers will like to do this when the time comes. Therefore, managers today either would reduce the value of the firm (equity) by $2 today, or they would have to forego issuing debt (as we will see later, debt in the capital structure could have valuable tax benefits). Even if the firm does not need to raise debt today, if it could possibly become advantageous to raise debt in the future, the value of a firm today with a management team unable to commit not to do the 3-for-1 exchange would be lower. For example, if there is a 10% probability that the firm might want to raise debt next year, it would then have to reduce its debt price by $3 and lose $2 in firm value. If investors are risk-neutral, with the 10% probability, the loss in firm value today of the firm's inability to commit itself in the future is thus 20 cents.

The important insight is that the cost of ex-post actions is born not only by bondholders tomorrow, but also by the owners today. Indeed, caveat emptor ("buyer beware") applies; bond and stock purchasers can only be hurt to the extent that future opportunistic actions by management are unforeseen surprises. Thus, it is in management's (owners') own interest today to commit not to exploit future owners and bondholders tomorrow - especially if everyone knows that when the time comes, management would like to change its mind. Another important insight is that competition can force firms towards the best capital structure. When one management team cannot commit not to do bad 3-for-1 exchanges, and a firm with debt would be worth more than a firm without debt, then another management team (that can commit) can bid for the right to take over the firm - up to the value that the firm is losing by not having debt. Again, in general, a thread emphasized throughout this paper is that firms that can commit to do "the right thing" tomorrow (ex-post) are worth more today (ex-ante). It is a direct consequence that firms that maximize firm value are worth more than firms that maximize equity value.

3. Perfect Capital Markets: The Modigliani-Miller Theorem

The famous MODIGLIANI-MILLER(MM) propositions (honored with two Nobel prizes) provide a good start to understanding firms' capital structure decisions. Modigliani and Miller argued that under certain conditions, the total value of all financial securities is the same regardless of the mix of different securities. They proved their argument by showing that there would be arbitrage opportunities if the value of the firm depended on how it is financed. Because there should be no arbitrage in real life, it follows that firms should be able to choose any mix of securities without changing their value. Yet MM's argument only works if the following assumptions are satisfied:

- There are no transaction costs. This is the most important assumption. If there are no transaction costs, virtually nothing else matters. Any investor can fire the managers and restructure the firm anytime if a suboptimal decision (capital structure or operating decision) was to

reduce the value of the firm - especially at the outset of the firm.[2]

- There are no taxes and bankruptcy costs (including costs of financial distress before bankruptcy).
- There are no differences in opinion and information;
- Capital markets are perfectly competitive, with a large number of investors competing for many securities.[3]
- Borrowing and lending interest rates are equal.[4]
- The firm's investment plan has been determined; it does not depend on its choice of financing.

(The first five assumptions are typically referred to as "perfect capital markets".) None of the six assumptions holds in reality. However, once you understand how the MM argument works, it becomes easier to understand what happens when these assumptions are violated, and to understand how important such violations can be.

Here is how Modigliani and Miller's argument works: We have assumed that the firm has already decided on what projects to take, and now wishes to consider how to finance these projects. Because we have also assumed that we all agree on all current and future projects' expected cash flows and proper discount rates, we must agree on the present value (PV) of these projects today. The MM claim is that the PV of the firms' projects must equal to the PV of the firms' issued claims today. In other words, the claim is that if the firm issues 100% equity, the equity must sell for the PV of the projects. If the firm issues 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.

Why? Call the value of the projects under the best capital structure V. (This is [almost by definition] the present value that the firm's projects can fetch in our perfect capital market, of course.) Assume that the managers could find - and actually did choose - a capital structure that makes the firm worth 1M less than V. For clarity sakes, assume that the the firm is worth V=$100M under the optimal capital structure of 80% equity and 20% debt; and assume that the firm is worth only $99M under the capital structure of 50% equity and 50% debt that the firm has actually chosen. Then, all you or I need to do is to purchase all old equity and debt for $99M. We now own the entire firm, that is all claims on the firm. Now we issue claims duplicating the optimal capital structure (assumed to be 80% equity/20% debt). These claims will sell for $100M, and we pocket $1M.[5]

Unfortunately, you and I would not be the only ones to notice this opportunity. After all, all available information is assumed to be common knowledge (both by the firm and other investors). So, the old managers would simply ask for bids from other investors. The only price at which no one will overbid us for the right to purchase the firm's current securities is $100M. But notice that we have bid up the value of the old securities to the price that the firm is worth under the optimal capital structure. So, regardless of the financial structure that managers choose, they can sell their claims for $100M, i.e. the present value of their project.

Has it ever happened that some managers chose an inferior capital structure, and outside investors bid up the prices of firms' securities in order to sell repackaged securities? Indeed, it has. Up to the early eighties, the IRS taxed bond coupons, the cash interest payment that bondholders received each year. In 1982, Pepsico invented the first long-term zero-coupon bond, which allowed bondholders to in effect reinvest coupon without being taxed.[6] Realizing this opportunity, investment banks began to bid up the prices of outstanding coupon bonds, and repackaged these securities' promised pay-offs into long-term zero-coupon bonds. "Unfortunately", this process did not continue until the prices of old coupon bonds reflected the repackaging profits; instead the I.R.S. stepped in and changed the tax rules, taxing accrued interest instead of coupon payments.[7]

One can illustrate the MM argument that the cost of capital is not influenced by the chosen capital

structure with a specific example, considering two different capital structures. Assume that the value of the firm's projects will be either $100 or $200 with equal probability next year. The firm's value today will be $150/(1+$r_p$) where r_p is the appropriately risk-adjusted interest rate. In real life, this interest rate depends on the correlation of the project payoffs with market-wide risk factors, and consequently is higher for equity than for debt instruments. However, to illustrate our arguments expediently, the remainder of this article assumes that investors are risk-neutral, so regardless of the risk, the interest rate is 10% (the argument is harder to illustrate if we assume a risk-premium, but remains the same). The firm's projects are thus worth $136.36 today. Under hypothetical capital structure 1, the firm issues debt with face value $50. Consequently, bondholders face no uncertainty, and will pay $50/(1+10%)=$45.45. Equityholders will receive either $50 or $150, and are thus prepared to pay $100/(1+10%)=$90.91 (in a real-life example, the interest rate would have to be higher to compensate investors for risk). Simply adding the value of the firm's claims adds up to the same $136.36. Under hypothetical capital structure 2, the firm issues debt with face value $150. Consequently, bondholders will now receive either $100 or $150, and are willing to pay $113.64 today. Equityholders will receive $0 or $50, and are willing to pay $22.73 for the privilege. Again, the value of all claims adds to $136.36.

Table 1: Illustration of the MM Proposition with Risk-Neutral Investors

	Bad Luck	Good Luck	Today's Exp.
prob	1/2	1/2	Value
Project	$100	$200	$136.37
Capital Structure 1: Bond with Face Value $50			
B(F=$50)	$ 50	$ 50	$ 45.45
Equity	$ 50	$150	$ 90.91
Capital Structure 2: Bond with Face Value $150			
B(F=$150)	$100	$150	$113.64
Equity	$ 0	$ 50	$ 22.73

An important observation is that if investment decisions are reversible, the above assumptions would also allow us to prove that the firm's investment decision does not influence the firm's value. By the same logic that was used to prove the MM claim, investors would simply bid up the price of the company for the right to control the firm, to reverse the firm's sub-optimal investment decision, and to implement the optimal investment decision.

There are of course many ways to skin a cat. Yet another way to prove the MODIGLIANI-MILLER proposition relies on the ability of investors to effectively lever or unlever the firm themselves. For example, in the previous example, assume that the firm has chosen capital structure 1, but one investor prefers capital structure 2, because he prefers the equity payoffs of $50 in the good state, $0 in the bad state instead of the $150/$50 payoffs. How can he "replicate" these payoffs? All he needs to do is borrow the present value of $25 (i.e., $22.73), and purchase only half a $90.91 share at $45.45. In the bad state, he now receives 1/2 x $50 from his equity holdings and repays $25, so he ends up with zero. In the good state, he now receives 1/2 x $150, repays $25, and thus ends up with $50 - but these are precisely the payoffs this investor wanted! How much did it cost the investor to "replicate" the payoffs from capital structure 2? He paid $45.45, received $22.73, so his capital outflow was $22.73 - exactly the same cost as it was if the firm had chosen capital structure 2 for him.[8]

4. Imperfect Capital Markets and The Real World

4.1 Taxes

The most obvious violation of the MM proposition involves taxes. Although the tax code changes annually, the most important features have remained constant for a number of years, and are similar

across countries. For brevity, most of my discussion focuses on the U.S. tax code. In brief, in the U.S., individuals and corporations face similar tax schedules, and investors face equal tax rates regardless of whether income is in the form of interest income, dividend income, or realized capital gains - although losses in one category can by and large not be used to offset gains in another category. The tax code in other OECD countries is somewhat similar (perhaps with the exception of the tax treatment of dividends), and the reader is therefore advised to concentrate more on the logic of this section than on the details. The details vary year-to-year, country-by-country, and sometimes even state-by-state.

U.S. corporations pay taxes on their earnings net of interest payments. That is, interest payment is treated as an expense, not as a distribution of earnings.[9] Therefore, a corporation saves taxes when earnings are distributed as interest payments. In contrast, dividend payments or share repurchases are treated as distributions from after-tax earning. For example, if IBM earned $100, IBM could reinvest the $100 (internally or externally) which increases the value of its outstanding claims by (a little less than) $100.[10] If not reinvested, IBM could either distribute $100 in debt coupon payments from pre-tax earnings, or use its post-tax earnings, $66 assuming IBM is in the 33% capital bracket, either to pay a dividend of $66 or to repurchase $66 worth of IBM stock.[11]

MERTON MILLER, however, noticed that this is not the end of the story. If you were to own a corner shop, you would care how much you could ultimately consume, not whether the IRS taxes you at the cash register or taxes you personally at year-end. The investor who receives coupons or dividends and who must pay personal taxes only cares about after-tax receipts. In effect, owners (and managers on their behalf) should try to arrange their firms' capital structures to minimize the total taxes paid after earnings are distributed to their owners.

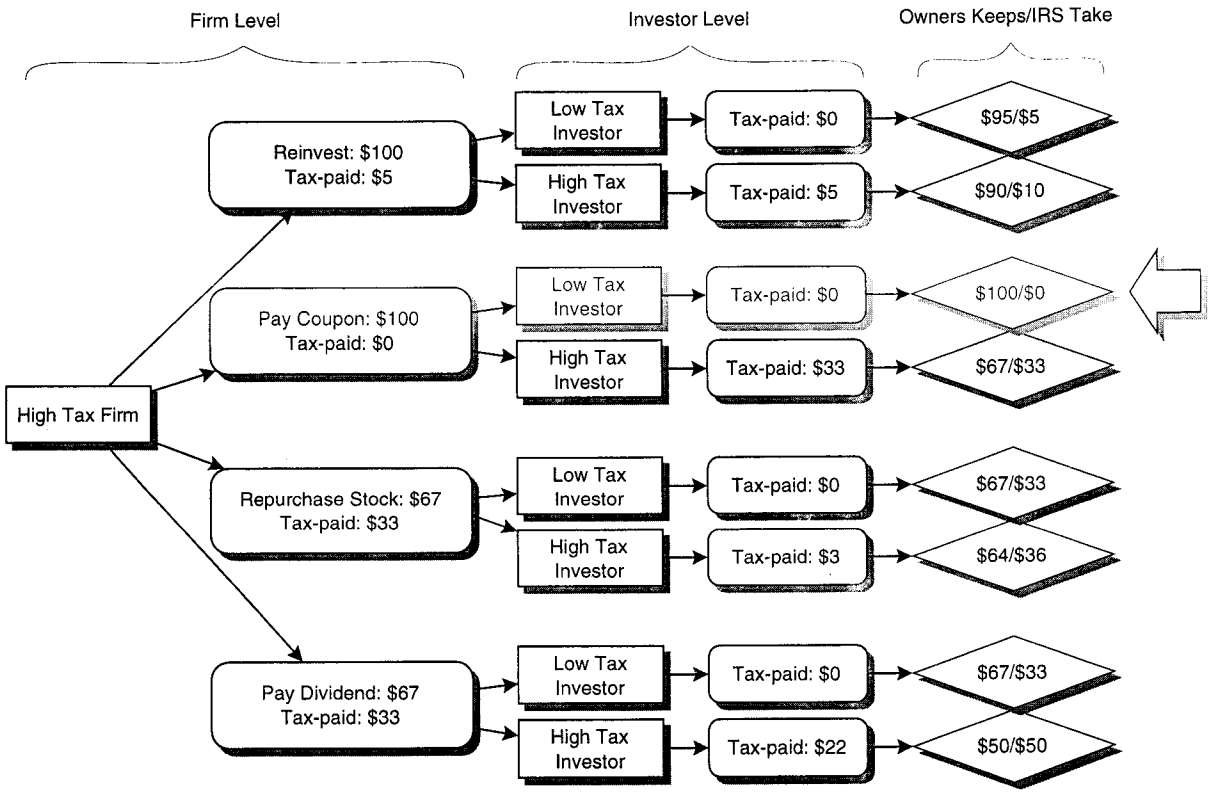
To make matters more complicated, in real life, not every investor faces the same tax rate. Low-tax investors, like pension funds, pay no or low personal taxes on dividend or coupon distributions. High-tax investors pay lower taxes when they receive income as capital gains instead of as coupons. Because they pay income taxes only when they realize the capital gains and then only if they do not have offsetting capital losses (which are typically easy to produce), they can often defer and thereby weaken the tax-bite.

The net effect of putting personal tax and corporate tax considerations together is that there should be "clienteles": Firms with low taxable income neither pay corporate taxes, nor receive corporate tax interest deductions, so the tax rebate advantage of debt is less important to them. For example, instead of paying tax-deductible interest, firms that have undergone financial distress in the past with current carry-forward net operating losses (NOLs) can use their earnings to instead repurchase equity shares (to generate capital gains). Similarly, small high-growth firms can reinvest their typically sparse internal earnings (again to generate capital gains). This behavior minimizes the net tax burden for low-income firms held by high-income investors.[12] In contrast, firms with high taxable income can reduce their corporate income taxes by distributing their earnings in interest payments. For example, cash-cow firms such as R.J.R. Nabisco, should take on debt to distribute earnings to owners from pre-tax income rather than taxed income.Unfortunately, personal investors cannot shelter interest income as easily as they can shelter capital gains.Therefore, firms with high earnings and substantial debt should be owned by low personal tax-bracket investors, such as pension funds or investing firms, which have net operating losses they can use to shelter interest income.

Application: Tax Arbitrage Before Ex-Dividend Days.

An interesting case arises when the clientele changes predictably. For example, the following "tax-arbitrage" is a well-known and important determinant of stock prices around dividend dates: Assume for a moment that high-tax investors believe that high-dividend stocks are likely to appreciate. How can these investors hold these stocks and avoid

Figure 1: Payouts to Owners of High-Tax Firms and total Taxes in the United States. The arrow denotes the "best" method to avoid taxes.



paying personal income tax on the dividends? Because pension funds do not have to pay dividend taxes, they are willing to pay up to the value of the dividends in exchange for the right to receive the dividend. These funds can purchase their shares right before they pay dividends, and sell them back to the high-tax investor the following morning. In real life, this "tax-arbitrage" indeed happens; tax-exempt funds compete to purchase these shares, somewhat driving up the share price before the ex-dividend date. Of course, there are limits. Some high-tax investors would have to pay capital gains taxes when they sell their shares, and thus prefer paying taxes on the dividends instead of on their capital gains. Furthermore, the round-trip transaction costs limit the possible profits from the avoidance of dividend taxes. (The Financial Times reports that such transactions are known as "bed-and-breakfast" deals for equity, "bond-washing" for bonds - even though the Bank of England has specifically prohibited such tax arbitrage and imposed a 1-week holding period for tax-free institutions purchasing around dividend dates.)

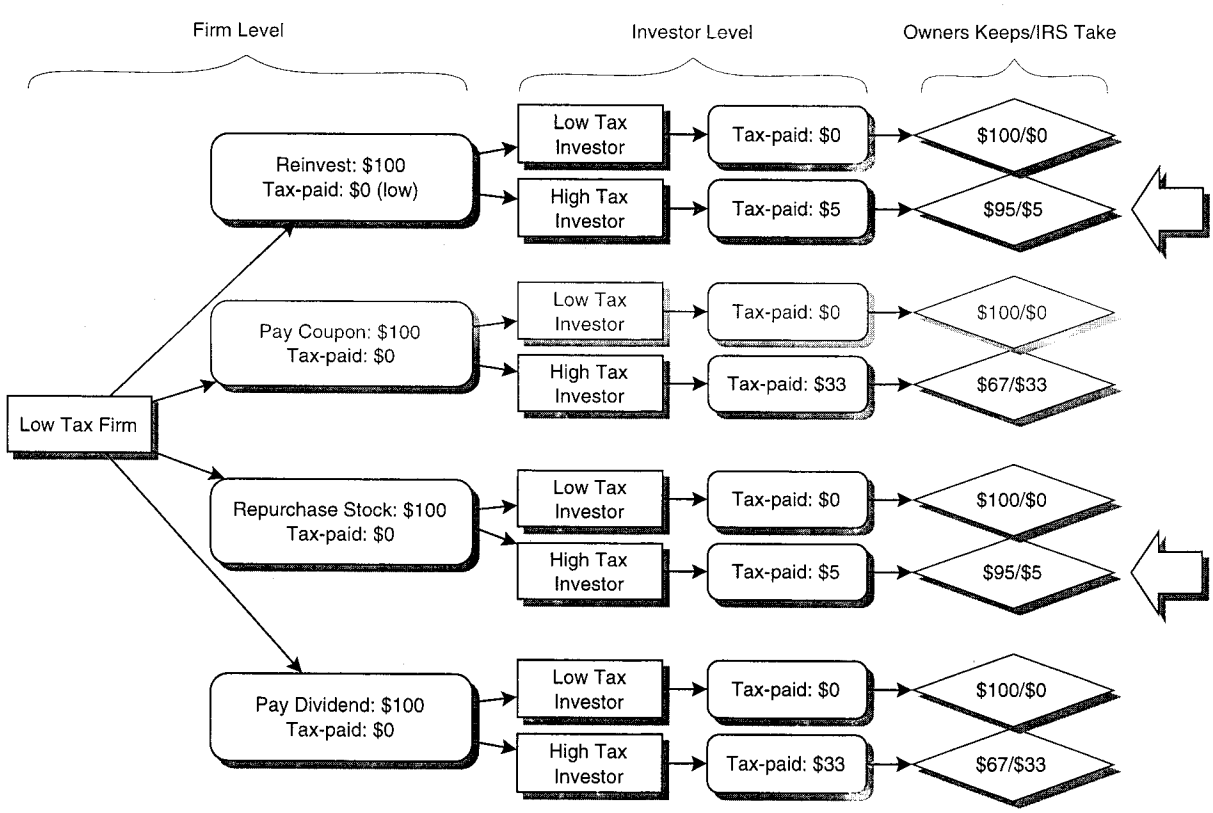
Application: Dividend Tax Arbitrage.
What if a low-income investor does not want to hold debt to receive interest, but prefers the payoff pattern of equity? Payoffs to equityholders would not change if each investor were to receive a long-term coupon-paying junior bond (packages of securities are often called "units"). Then, the residual payoffs accruing to the old stockholders would accrue to the holders of the combination of the new equity and the new junior bond - except that the distribution to

shareholders could now be called a (corporate tax-deductible) coupon, and not a dividend.

Figures 1 and 2 illustrate the various choices available to firms and investors. We assume that when firms reinvest, they pay a small tax penalty (5%). Analogously, when investors receive capital gains, we assume that they cannot delay taxes forever and/or cannot always find appropriate capital losses to offset these gains, so we assume a 5% penalty. Figure 1 shows that when one adds up total taxes-paid, high-tax firms are best off issuing debt to pay coupons to low-tax investors. Figure 2 shows that low-tax firms are comparatively better off than high-tax firms if they use earnings to generate capital gains, likely held by low-tax investors. In effect, low-tax firms could be considered "investment funds" to shelter income for high-tax individuals. (We have greyed the boxes for low tax investors, because high-tax firms are competing for their services.)

While this explains why some investors prefer holding equity over debt (to receive capital gains instead of taxable coupon payments) and why dividend taxes are not as important as one might think (low-tax investors can avoid personal income taxes on dividends), why do firms pay dividends instead of repurchasing their equity or paying a coupon? After all, academics have pointed out for a long time that every investor has to pay the same personal taxes on coupon and dividends, and every firm is at least as well off paying interest coupons as it is

Figure 2: Payouts to Owners of Low-Tax Firms and total Taxes in the United States. (Grey boxes indicate that both high-tax and low-tax investors compete for the services of low-tax investors.) The arrows denote the "best" methoeds to avoid taxes.



paying dividends. No one really knows the answer, although managers no longer appear to know either. BAGWELL and SHOVEN (1989) find that big firms paid out about seven times more through dividends than they paid out through share repurchases in 1977. In 1987, this ratio had declined to about one-and-a-half!

In sum, in the U.S., from a tax-perspective, high-corporate tax bracket firms should distribute their earnings in interest payments to minimize corporate taxes. Their investor clientele should primarily be low-tax individuals who do not have to pay interest taxes. High-tax firms' next-best alternative is to reinvest earnings to produce an increase in the value of outstanding equity. Their next-best alternative is to repurchase shares with after-tax earnings. Only investors facing low capital gains taxes would tender their shares, thus at least reducing personal taxes received by Uncle Sam to a minimum. The worst alternative is to pay dividends (from after-tax earnings), which all investors regardless of their personal tax bracket receive and are taxed on. (This is what is often called the "double taxation" of dividends.) In contrast, low-corporate tax bracket firms should distribute their earnings in share repurchases, or reinvest earnings to produce an increase in the value of outstanding equity. Their clientele should primarily be high-tax individuals who cannot easily shelter interest or dividend income. Yet even in the U.S. with its simple tax code and its armies of academic finance researchers, taxes remain a complex and empirically unresolved issue. Academics are still debating who benefits most from tax arbitrage, dividend-paying issuers or tax-exempt investors. If there are many tax-exempt institutions to compete with one another for the privilege of conducting tax arbitrage, firms could borrow at rates as if all their investors were tax-exempt. Yet, if there are too many firms paying dividends, they will compete to pay a premium to find tax-exempt institutions, up to and including the cost of paying taxes - and it would be the tax-exempt investors who would benefit most from their tax-exempt status. As always, the truth is probably in the middle, where the tax-arbitrage benefits are shared by tax-exempt investors and taxed firms.

Even less is known about the actual behavior of investors and firms in other countries. We know there are differences, such as in Britain and Germany where investors receive a partial credit for taxes paid by the companies when dividend tax obligations are computed. The reader is advised to carefully think how this changes the analysis. (Briefly, this tax credit is designed to reduce or eliminate the double taxation of dividends, and, as a result, high income tax investors would be more inclined in favor of dividend distributions). In general, European countries tend to have more byzantine tax codes, with many exceptions and rules to either allow or reduce tax arbitrage, depending on the political influence of various constituents. To complicate matters even further, multinational companies face a whole range of international tax issues, such as the best method by which they can recognize profits in the lowest-tax country in the lowest-tax form. Although the generally best strategy can be deduced using similar logic as that described above for the United States, the details are tedious, complicated, and as-of-yet rarely explored by academics.

Application: Inflation.

In addition to the government's direct benefits of printing money, inflation has an interesting indirect effect. Holding the agreed-upon interest fixed, inflation benefits borrowers and hurts lenders. Lenders who receive interest must pay taxes on the nominal amount of interest, not the real amount of interest. The reverse holds for borrowers. For example, assume interest rates are 3% and there is no inflation. A savings account holder with $100 in the 33% tax bracket has to pay 1% to Uncle Sam ($1), and gets to keep 2% ($2). Now assume that interest rates are 12% and inflation is 9%. The savings account holder would now have to pay 4% ($4) in taxes, and own $108 the coming year. However, because money has lost 9% of its value, the $108 is worth less than $100 the following year. In effect, although real rates are identical in the no-inflation and inflation scenarios, a lender who pays taxes on nominal interest receipts gets to keep

less in real terms if there is inflation. (It is straightforward to check that the opposite is true for borrowers.) The implication of this argument is simple: to compensate lenders for their additional tax burdens (on nominal interest), real interest rates must rise with inflation.

Taxes are important, but they are not the sole determinant of capital structure. Witness for example that many profitable pharmaceutical and computer companies have low or no debt in their capital structure, whereas many unprofitable airlines are highly levered. In the real world, why would smart managers choose capital structures that do not minimize the tax obligations? Read on!

4.2 Bankruptcy Costs

The second important violation of the MM assumptions - and thus determinant of capital structure - are deadweight bankruptcy costs. Of course, if there is only one security (called "equity"), there is no bankruptcy.

However, when a firm's capital structure includes debt, the company may default on its debt: "bankruptcy", The first important lesson is that it is not bankruptcy per se that is the problem, but only the deadweight losses in and around bankruptcy (with its possible liquidation) that matters. To see this consider the second capital structure in table 1. If we called the bad state "bankruptcy", because the bond payments are not met and the bond officially defaults, the firm value today is still $136.37. Everyone (including bondholders) knows that the firm is transferred to bondholders, their payoffs in the bad state are $100, and this is priced appropriately when the bond is sold. However, if (from the $100 in the bad state) $20 were lost as deadweight costs in bankruptcy, then firm value today under capital structure 2 would no longer be $136.64, but $9.09 less - a worse capital structure of course.

So what could produce such deadweight losses? The most obvious costs are the resources (legal fees and management time) that the bankruptcy process consumes. Some not-so-obvious costs of bankruptcy are described below: (1) firms can shed promised claims in bankruptcy, even if they do not like to em ex-ante, and (2) the uncertainty other claimholders face in bankruptcy, given that legal institutions can impose substantial uncertainty.[13]

For example, the value of a computer is not only determined by its hardware, but also by the manufacturer's continued provision of hardware and software support and development. An "obsolete" computer or software, no matter how good, is practically worthless. Even if the firm had promised to continue development of faster hardware to preserve their customers' software investments, if liquidated, a bankrupt firm may not be able to keep this promise. The inability of the firm to commit to honoring its promises in the future hurts its business today. For example, on May 1, 1995, the computer trade magazine em PCWeek's cover story read "Besieged by ongoing financial turmoil...Latest Lotus woes leave some customers skittish", Customers aware of the possibility of bankruptcy may choose an (inferior) product from a competing vendor with a lower possibility of bankruptcy, which in turn reduces the value of our firm today. Likewise, airlines depend on frequent flier plans to attract business travellers. When the promise of future free flights loses its credibility, an airline becomes severely handicapped. In effect, any firm whose products require warranties and which wants to have debt faces this problem. Another good example is Chrysler. On July 23, 1981, the Wall Street Journal reported on Chrysler's first positive quarterly earnings after a long hiatus:

Telegraphing even this tiny profit via the nightly news to dealers and potential customers is extremely important for Chrysler which is trying to shore up its image as a viable automaker. In the past, every time Chrysler's losses mounted, customers fled its showrooms, fearing the company would collapse.

Furthermore, most of us who have considered travelling with near-bankrupt airline have wondered whether the management (in the interest of equity-

holders) is cutting corners on maintenance to get out of a desperate financial situation. Consequently, the price at which such an airline can sell tickets is below that of an ongoing airline. Similarly, wholesalers will not deliver their goods to near-bankrupt retailers unless they are assured of payment. Because bankrupt retailers may no longer be able to purchase on cheap trade credit, the costs of their goods increases - and their competitiveness declines. In sum, indirect bankruptcy costs can derive from inefficient operation such as the (common) liquidation of firms: sold piecewise, assets may be worth less; name-brand capital of a bankrupt firm may be lost; customers may lose confidence and leave the sinking ship; lawyers have to be paid. If the bankrupt firm could easily be bought as a bundle by someone else with no such deadweight costs, bankruptcy would simply be a capital structure reorganization, and em ex-ante not a problem.

What firms are likely to suffer high deadweight losses in bankruptcy? We know that many U.S. railroads declared bankruptcy dozens of times without interruption in service or high legal costs. Airlines have at least some easily transferable and collaterizable assets (airplanes), and thus may have few deadweight losses. In contrast, firms with large intangible assets (warrants, name recognition, etc.) are much better off reducing the probability of future bankruptcy by choosing a low-leverage capital structure.

The expected financial distress losses provide an upper bound on the amount of debt in a firm's capital structure. That is, even a high-tax firm should increase its debt only to the point where the marginal net tax savings (after personal and corporate taxes) equals the marginal cost increase in expected bankruptcy costs. Still, there are natural limits to the importance of bankruptcy costs. If potential bankruptcy costs were large because of legal fees, firms could write detailed lower-cost arbitration rules into their capital structure to avoid them. More simply, all investors could buy units, consisting of equity shares and bonds. If a missed coupon or bankruptcy forced a reorganization in which debtholders would receive more or all of the firm (then called equity), there would be no dissent: after all, debtholders and equityholders are the same individuals. Note that the unit-based capital structure had its own advantages: in good times, payoffs are called coupons and thus tax-exempt to the firm.

Even if investors have unbundled the units, if bankruptcy occurs, it pays one investor to repurchase all equity and all junior bonds to eliminate the lawyers. Thus, bankruptcy costs can be considered a special form of transaction costs.[14]The expected bankruptcy can be at most as much as the expected cost of rebundling the capital structure. Still, as with taxes, the importance of bankruptcy costs as an important determinant of capital structure remains an empirical issue. The current academic consensus is that bankruptcy costs do matter for some firms and industries, particularly during recessions, but are small for most of the Fortune 500 companies most of the time.

4.3 Operating Policy

Another crucial MM assumption was that the firm's investments are fixed. (That is, investments cannot be costlessly changed.) When they are not, certain capital structures can create problematic incentives and "corrupt" managers to take or forego projects (in the future or today) that are not in the interest of the firm. This foregone net present value is capitalized into the stock em today. Choosing a different capital structure could increase firm value. The most important capital structure related incentive problems are the free-cash flow problem, the ex-post expropriation problem, the under-investment problem and the no-liquidation problem.

4.3.1 Free Cash Flow

The free cash-flow problem is that managers, no matter how well-intentioned at the outset, will prefer spending money internally on their pet projects once the opportunity comes around instead

of returning money to claimholders. For example, in the 1980's, many large oil companies continued exploring for oil - even though it was well-known that oil companies could be bought at a stock exchange for significantly less than the expected cost of finding equivalent oil reserves. Debt which requires coupon payments has the advantage of forcing managers to perform. Managers who fail to generate enough income to pay the coupon are subject to bankruptcy, and (as has been shown empirically) more likely to be fired. Therefore, firms with more debt may be worth more em today.

4.3.2 Bondholder Expropriation through Project Risk Changes

The ex-post expropriation problem is that managers - acting on behalf of their employers, i.e. equityholders - will have the opportunity and incentive to exploit debtholders once the debt is issued. They can do this either by issuing more debt of similar or more senior seniority, or by accepting new and more risky projects. For example, assume that the firm will pay off either $50M or $150M, with equal probabilities. Assume further that there is a (senior) bond (SB) with face value of $60M outstanding, plus equity. Finally assume that there are no taxes and everybody is risk-neutral. The payoffs to the project and its stakeholders are illustrated in table 2. Would (risk-neutral) bondholders be willing to pay $55M for the promise to receive $60M? Ostensibly, the answer is yes. Now assume that half the time has passed, and the managers find a new, independent project that pays off either $40 or loses $50 (with equal probability). Note that any Las Vegas casino provides better investment opportunities, so it would not be too hard for managers to find such projects. Table 2 shows the value of the firm if it were to add the new project, and the resulting value of equity and bond claims. There are now 4 states, each with probability one-quarter, and total firm value changes by the present value of the second project (-$5). Would the managers accept this project? Remember who votes them into and out of office! In essence, managers can expropriate $10 from bondholders, waste $5 of this money, and hand $5 to equityholders. As explained on page 2, although ex-post this is good for equityholders, ex-ante it is bad for them and the firm. If the managers expressed an intent not to accept the high-risk project, would bond purchasers pay $55 for this bond, believing that management will not be able to create other higher-risk projects when the time comes?[15] Because "good faith" is difficult to convey, bond investors may not believe managers and demand a premium payment that they they would not demand if the firm could commit not to ex-post expropriate bondholders. Indeed, if uncommitted, even managers with the best intentions could not shield themselves from the pressures to take the negative NPV project. Obviously, this expropriation potential makes it difficult for the firm to raise funds through bonds at fair prices, and tilts the optimal capital structure more towards equity. Who ultimately loses? Smart bond investors do not lose: ex-ante they get their fair compensa-

Table 2: Bondholder Expropriation through Project Risk Changes

	Bad Luck	Good Luck	Exp Value
prob	1/2	1/2	Today's Value
Project	$50M	$150M	$100M
SB(F=$60)	$50M	$ 60M	$ 55M
EQ	$ 0	$ 90M	$ 45M

Table 3: Bondholder Expropriation through Project Risk Changes

	Worst	Bad	Good	Best	Today's Exp
prob	1/4	1/4	1/4	1/4	Today's Value
OldProject	$50	$50	$ 150	$ 150	$ 100
New Project	-$50	$40	-$ 50	$ 40	-$ 5
SB(F=$60)	0	$60	$ 60	$ 60	$ 45
EQ	0	$30	$ 40	$ 130	$ 50

tion. However, the firm is robbed of the opportunity to issue debt (with its other advantages, such as tax savings), which tilts the optimal capital structure more towards equity. Would managers be willing to take em any risky project? It depends on how much NPV is lost and how much is redistributed. If the above project gained only $20 in the good state, managers would not take it. In real life, managers try to protect bond purchasers from expropriation with bond covenants. For example, covenants can state that the firm cannot take any new projects. However, these covenants impose costs, too. What would happen if managers suddenly found a project paying off one million dollars in the good state but had committed not to take any new projects? Clearly, a firm that sometimes cannot take profitable projects in the future is worth less today. Managers need to find a compromise that limits their incentives and/or ability to em ex-post expropriate bondholders, and still preserves the option of the firm to accept new, possibly high-risk projects. One attempt to solve this problem is to write bondholder covenants that allow new projects only if certain accounting ratios are met. Bondholders are aware that they may be expropriated (and demand up-front compensation for this possibility), but will only be expropriated if projects come around that allow management to meet the weaker bond covenants. Unfortunately, covenants are not perfect, and some good NPV projects may come around which do not satisfy the covenants. Partially to retain flexibility, many bonds with strong covenants today are "callable", allowing management to redeem the bonds before maturity at an agreed-upon price. Another solution is for the firm not to issue bonds with strong covenants, but instead to issue "convertible bonds" with weak covenants. Convertible bonds allow investors to participate in the one million dollar project, and thus reduces the risk expropriation problem. It is left to the reader as an exercise to show how a convertible bond can reduce the expropriation.

4.3.3 The No-Liquidation Problem

A problem similar to the ex-post expropriation problem is the no-liquidation problem. Managers acting on behalf of equityholders may not wish to liquidate the firm when it has fallen onto hard times, even if this maximizes the value of the firm. Equityholders always prefer more risky payoffs because equity is essentially like an option. If there is even a small chance of improvement, although deterioration is more likely, equityholders are better off to take their chance than to give up their option and to liquidate. For example, consider a firm that can be liquidated for $100M today, or can operate for another year and be worth either nothing or $150M (with equal probability). Together, the owners (bondholders, stockholders, etc.) would be better to liquidate. But if there is a bond coming due only next year with a face value between $100M and $150M, equityholders are better off waiting. In effect, they have an option on the firm at no cost. This inefficient wait, caused by the presence of debt in the capital structure, reduces the value of a firm with both debt and equity em today.

4.3.4 Bondholder Expropriation through Issuance of Bonds of Similar Priority

There is yet another problem of concern to bondholders. Assume again that our firm has a value today of $100, and payoffs of $50 or $150 with equal probability. Assume that the firm has debt with face value of $60 outstanding, and that covenants prevent the firm from taking any other project. Are bondholders now protected? The answer is no, if managers can issue another bond of similar (or higher) priority. For the sake of illustration, assume that they can issue a bond of equal priority to the old bond with a face value of $60 and use the proceeds to pay a special dividend to equityholders. In bankruptcy (the bad state), the old senior bond would now no longer receive the entire $50 (as per the example above), but would have to share proceeds with the new bond that has equal priority. In real

life, the "spoils" are often allocated according to face-value within bonds of the same priority. So, because in our example both bonds have equal face value, each would receive $25 in the bad state. Thus, thevalue of each bond is only $50% · $25M+50% · $60M= $42.5M today in expected value. The equity receives nothing in the bad state and $30M in the good state - plus the one time dividend of $42.5M. In total, by issuing new debt of equal priority, equityholders have increased their wealth from $45M to $57.5M, old senior bondholders have lost $12.5M, and new senior bondholders just got a fair deal.

Why is this expropriation a problem? Because the first bond's purchasers, will cautiously insist on assuming that expropriation will happen, and demand a higher interest rate. To recoup this higher interest rate, the firm indeed has to later issue more bonds to expropriate the first bond purchasers. In effect, the firm either issues no bonds, or it is dragged into a capital structure that contains too much leverage (perhaps unduly increasing bankruptcy risk). As before, it is the firm which loses ex-ante because of ex-post problems faced by its bond purchasers.

In the real world, firms try to protect bondholders against such expropriation by including covenants that restrict dividend payout to equity holders and covenants that prevent the firm from later issuing debt with higher priority.[16] Are bondholders protected now? The answer is still no. In our example we used only two periods. Yet, in real life, when one bond becomes due before another, it effectively becomes more senior: it is paid first (except when the firm goes bankrupt within six months, in which case the firm's transactions can be unrolled by a bankruptcy court). Again, this problem can sometimes be remedied with appropriate covenants. Without explicit covenants, promises can be broken. But sometimes, flexibility to refinance and take new risky projects is itself valuable, when it would allow firms to accept extraordinarily good projects that come its way. Therefore, successful firms often build a "reputation" that allows them to borrow at rates under which bond investors assume they will probably not be expropriated. Yet, when promises are broken, bondholders stand to lose substantially. For example, R.J.R. Nabisco in the 1980's was presumed to be a safe investment for bondholders. However, when it was bought out in 1988 in the largest LBO ever, R.J.R. tripled its debt overnight, resulting in a 15% one-month loss for bondholders. In the real world, firms have to undertake a delicate balancing act. When debt is issued, it can only be issued at favorable terms when the firm can promise not to exploit bondholders once bonds are issued. The loss of flexibility, however, can be so expensive that firms cannot issue debt - and thus have to forego some other beneficial effects of debt (such as tax advantages) which may put them at a competitive disadvantage.

4.3.5 Underinvestment

The underinvestment problem is that managers acting on behalf of equityholders will slack off and ignore good projects when equityholders have no chance to receive any proceeds when the debt comes due. Because bondholders would receive all proceeds when their payments come due, the firm would not accept good projects ex-post, reducing the firm-value ex-ante. This reduces the value bondholders will receive, and thus the value bond purchasers are willing to pay for the firm today.

For example, consider managers with a firm worth $100M, of which $10M is in cash and $90M in securetized assets. Assume further that the debt has a face value of $150M due in one year, and that a new project comes along that costs $10M but pays off $30M after the debt comes due. Would equityholders prefer a $10M dividend today, or the $30M investment?

The answer is the dividend, because equityholders would not receive any payoffs from the investment. Clearly, this "underinvestment problem" is a cost of debt to the firm. If the firm chooses no debt ex-ante, such profitable future investments would not be ignored, which in turn would increase the value that our hypothetical owner could sell the firm for.

4.3.6 Strategic Considerations

Finally, some financial academics have argued that debt can be used as a strategic device. This is perhaps easiest to understand by analogy. Consider two teenagers playing a game of chicken (two cars driving towards one another; the first to "chicken" out and get out of the way loses). How can a teenager ensure that he wins? All he needs to do is to remove the driving wheel and throw it visibly out of the window. It is easy to see why the other teenager will chicken out. The trick is of course to visibly commit yourself to not give way. (Some people have suggested that driving an old, large and apparently unstable Buick is the equivalent of throwing out the wheel; other cars will be in a hurry to get out of your way.)

The same argument has been made for debt. Assume for a moment that a monopolist has levered up, that there are severe penalties for failing to meet interest payments, and that rearranging the capital structure is expensive. Consider the decision of a potential market entrant who knows that the monopolist is highly levered. The market entrant knows that it is in the interest of the monopolist's managers (acting on behalf of equityholders) to take on the most risky strategy - a price war. Consequently, he will not choose to enter, and the monopolist never has to start the price war - the risky strategy.[17]

4.4 Inside Information

Another important determinant of capital structure is inside information. This argument falls under the general rubric "Never bet with someone better informed than yourself" Typically, firm managers (acting on behalf of the old owners) have better information than new investors. New investors must be careful not to be exploited.

Consider: If you were a potential investor, and you knew that the current owner/manager (who has to raise new capital) already knows whether the project will be successful or not. What would you believe about the project if the present owner offered to make you a full partner sharing in all future profits, vs. if the present owner asked you for a loan to be paid back that she is willing to collateralize with her present assets? If you are offered to become a partner, you should be reluctant to believe that the project is profitable. If, however, the present owners want to keep the profits and simply borrow some working capital, they probably know that the project is profitable.[18] This analogy is directly transferable to capital structure. Sharing in the firm's equity is the equivalent of becoming a partner. More specifically, consider a firm in which managers know whether a firm's projects will pay off $100M or $200M. Outsiders (you) know only that such projects pay off $100M or $200M roughly half of the time. Assume further that managers have to raise $90M to take the project. They can either sell a percentage of the firm (equity), or promise to repay the $90M (debt). Would an investor be willing to assume that when a firm offers to finance with equity, it would be an average firm? Assume for a moment she would. At an expected value of $150M, the firm would have to sell 60% of its equity to raise $90M. The old investors would retain 40% of the firm, and would receive $40M if the firm was a $100M firm, $80M if the firm was a $200M firm. Yet, if the $200M firm raised $90M in debt (which it can always repay), it would keep $110M. Because $80M is less than $110M, a $200M firm will em never use equity, but always use the more senior security, debt! (The reader can show that a $100M firm will always prefer to use equity if investors were willing to assume that both types of firms use equity.) And therefore, no investor would be willing to assume that a firm that offered equity would be an "average" firm.

Because new partners are not inclined to assume that the project is good, equity investors will assume that their new claims are on a project that will eventually develop problems. Thus, the announcement of a new equity offering releases information that the firm's projects are worse than generally known ("average"), and the new equity can only be sold for a very low price. (In real life, we indeed

observe that when firms announce that they plan to raise about $1 by issuing new equity, their old public equity value declines by about 67 cents![19] Sharing in more junior (risky) bonds is the equivalent of the present owners making you a "little partner", when they are not willing to collateralize their loan. Consequently, the announcement of a risky junior security releases information that the firm's projects are not too great, but not too bad, either. In contrast, the new issue of a collateralized loan (or a risk-free senior bond) will indicate that the firm's projects are better than expected. The outcome is that the better the firm's projects are, the more senior the security the managers will offer for sale.[20]

What does this imply for the optimal capital structure? Consider a firm that cannot issue debt easily because it has little collateral or because additional debt would unduly increase expected bankruptcy costs. If it cannot issue equity because of these insider concerns, such a firm may have to pass up on some good (but perhaps not stellar) projects, simply because managers prefer that their owners should not to be perceived as holding low-quality projects. A publicly trading firm thus loses because inside information may force it to pass up on good projects in the future - and debt is the only viable financing alternative.

4.5 Transaction Costs

Finally, in addition to the indirect transaction costs appearing in the other assumptions and already discussed above (e.g., in unbundling costs), there could also be direct transaction costs that some capital structures would minimize. For example, assume that investors' arthritic hands are hurt when they have to clip coupons off their corporate bonds. A more reasonable example of transaction costs are the reporting requirements and liabilities imposed by the em 1933 Acts for publicly traded securities. For small companies, these costs may be large enough to warrant a capital structure consisting exclusively of private securities and bank debt.

5. Interactions and Conclusion

Why should the firm's managers be concerned today about the firm's future ability to expropriate its bondholders or potential other equity investors, or to pursue suboptimal real investment strategies? After all, it could benefit their clientele, current equity. Yet, upon reflection, it becomes clear that when investors can be expropriated in the future, they will demand a higher compensation upfront. This reduces the firm's financing flexibility, and thus typically forces firms to offer a higher expected rate of return today to issue their preferred capital structure, or to make compromises and forego some positive NPV projects. By the same token, a firm that is more likely to take only the best projects in the future is worth more em today. A firm that has both debt and equity, rather than equity only, may not be able to commit itself to the best future actions, resulting in a loss of value and competitive advantage em today.

The real world is considerably more complex in that firms typically do not face each of the above problems in isolation, but all at the same time. The presence of one problem may worsen another. For example, there can be significant costs to move from a suboptimal to an optimal capital structure. If a firm is close to bankruptcy, issuing equity could avoid or reduce bankruptcy costs, which increases firm value. But the infusion of more equity may mostly benefit bondholders, so equityholders may not be inclined to issue more equity. So, although a reorganization (i.e., a new start) could install a capital structure to increase firm-value, there are problems to be resolved to get there, given the current capital structure.[21]

Another important complication of the real world is that managers may be able to establish a reputation, which can lower financing costs, improve incentives, and maximize firm value. Remember the example that started the paper: the presence of the ex-post ability to expropriate bondholders hurt the firm. If managers had a reputation not to take such bad projects, perhaps overly restrictive covenants could be avoided, in effect lowering financing costs

ex-ante. More strongly, the example assumed that everyone knew exactly what expropriation opportunities (3-for-1) exist, and what their probabilities are. But, despite restrictive covenants, when exploitative opportunities can appear unforeseen, bondholders would always have the nagging suspicion that they may be expropriated after all. Only trust and reputation may overcome this suspicion with its associated increase in financing costs. But, do investors trust managers? Can investors trust managers? Should investors trust managers? And, when is it worthwhile for a manager/firm to build such a reputation? How can this effectively be accomplished? These are difficult questions to ans-wer rigorously, but important in the real world. Ultimately, the trick in being a good manager is to weigh costs and benefits of projects, debt, and equity, and to have sound judgment in deciding on a good combination thereof. Although this article could describe many relevant forces, choosing a good capital structure remains as much an "art" as it is a "science". This is good news for today's business students: combined with an ever increasing arsenal of possible financing instruments, capital structure choices are unlikely to be taken over by a computer program anytime soon.

Footnotes

[1] Stakeholders are mentioned explicitly in Germany's law. In other countries, the role of stakeholders is implicit.

[2] Section 4.3.2 shows how to do this.

[3] A large number of investors and claims is sufficient to guarantee perfectly competitive markets when there are no transaction costs (zero entry costs).

[4] This clarifying assumption is redundant, because it follows from the previous assumptions.

[5] Note that this argument also works when you buy not 100% of the firm, but only 1% of the firm. That is, if you buy 1% of all the firm's securities, you will receive 1% of the projects' payoffs. You can then sell your securities repacked to imitate the new (and better) capital structure for 1% of the firm's value, and receive an arbitrage profit of 1%.$1M.

[6] To see this, consider an extreme situation in which the tax rate is 50% and the interest rate is 10%. A $10,000 bond could pay $1,000 for two years, and then return the principal, in which case the government receives $500 each year. The investor could thus reinvest only $500 to earn interest after the first year. In contrast, in a zero-coupon bond, the firm essentially promises to reinvest the full $1,000 dollar on behalf of the investor.

[7] A second mechanism by which investors are often thought to repackage securities to maximize firm value are "leveraged buyouts" (LBOs). In an LBO, leverage can increase dramatically - and, as we shall see later, sometimes this can significantly reduce taxes. One prominent example was First Boston's 1988 plan to take over R.J.R. Nabisco and to exploit an esoteric tax loophole just about to be closed. By "monetizing" its food operations, a fancy way to increase leverage, the deferring of taxes would have saved an estimated $3-$4 billion dollars of taxes - which would have increased the annual federal U.S. deficit by 2 percent!

[8] An equivalent argument is used to prove the BLACK-SCHOLES option price formula!

[9] Current tax-laws allow firms to either receive a refund equal to the excess deductions in the current year for taxes paid up to three years ago, or to carry forward deductions and apply them to future taxes. Further, if a company cannot use its tax deductions, it can sometimes sell itself to a company that can use the tax deductions.

[10] Firms must first pay corporate taxes on the $100, but then receive a tax credit for reinvesting this money.

[11] This benefits all shareholders, although it is owners who would face low capital gains taxes who would tender their shares.

[12] Of course, high-tax firms may be able to purchase low-tax firms, and thereby absorb their NOLs - or vica versa. The Financial Times (Feb 10, 1994) reports that the pounds 2.5B GKN corporation made a hostile bid for the pounds 300M Westland corporation, solely to exploit its own pent-up advance corporation tax. The interested reader should also consider how leasing can be used advantageously to shift tax liabilities from one firm to another.

[13] Deviations from absolute priority, when perfectly known ex-ante, simply change the effective face value of securities, but do not reduce the total value of the firm. Thus, they are simply a redistribution, not a deadweight cost.

[14] Of course, there are further frictions, like individual holdout problems, in which some bondholder extort rents before they allow efficient rebundling to occur.

[15] But note that managers may themselves be risk-averse, which may protect bondholders. In Chapter 11, managers are fired about half the time.

[16] However, debt with higher priority is automatically created when a firm is in Chapter 11 bankruptcy. Therefore, bondholders must take the possibility of em ex-post expropriation if the firm goes bankrupt into account when negotiating an appropriate interest rate.

[17] Note, of course, that if the market entrant is too stupid to understand the message, both players, the monopolist and the entrant, will be hurt badly.

[18] This is sometimes referred to as the em winner's curse. If you receive the offer to become partner, it does not help you very much. If you do not receive the offer to become partner, you would indeed be better off if you had received it.

[19] MODIGLIANI-MILLER assumed that the demand for shares is perfectly elastic, given that there are many alternative securities with similar variance-covariance characteristics. Yet, the mentioned price drop could admittedly also reflect a finite price elasticity of demand for shares.

[20] This theory is called the "Pecking Order" view of capital structure.

[21] But, occasionally, infusing equity can preserve equityholder value. If a coupon comes due, the question for managers trying to maximize equity value is whether to raise more equity to pay the coupon, or to default. Raising more equity (or not paying out dividends to pay the coupon) is typically a wealth transfer from equityholders to bondholders - except that by paying the coupon, the equity (an option) is kept alive and thus perhaps worth more.

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There are at least three good textbooks (which also cover cost of capital computations, omitted here): [1] WESTON and COPELAND; [2] BREALY and MYERS; [3] ROSS, WESTERFIELD and JEFFE. A soon-to-be-released alternative textbook (and my personal favorite) is Grinblatt and Titman. This paper has borrowed ideas freely from many sources - and I apologize to all authors not explicitly recognized either in the text or in this bibliography. My only excuse is that a good reference would swell the size of this bibliography to exceed the size of the text. Thus, I can only list some but not all relevant sources of interest to readers. Some articles whose perspectives were freely absorbed into this description are:

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