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In the last decade, executives around the globe have taken dramatic steps to create value for shareholders. A number of companies have radically changed their compensation systems to reward economic profits (as distinguished from conventional earnings), while others have undertaken vigorous cost control and restructuring efforts to unlock shareholder value. At the same time, many firms have launched aggressive share repurchase programs with the expectation that value can be created by returning excess capital to shareholders and moving the firm closer to its optimal capital structure.

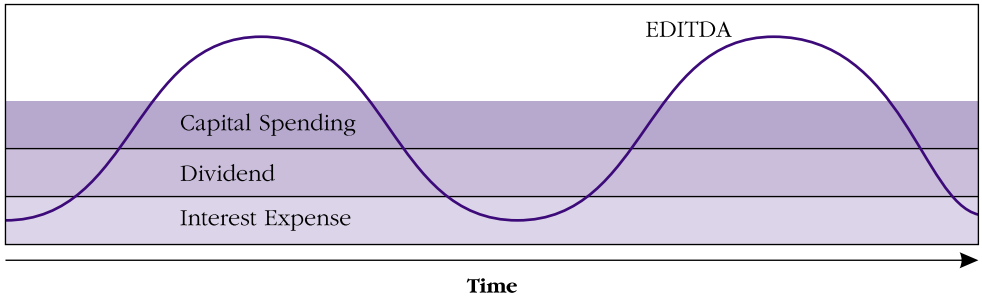
Capital structure decisions offer opportunities to create value for shareholders. Yet these opportunities are often neglected because of the difficulty—especially in companies with complex liability structures—of identifying and quantifying the factors on the right-hand side of the balance sheet that affect shareholder value. Corporate executives often have a general sense of whether their overall capital structure is "about right," but lack the tools that would enable them to assess the likely effects on value of the many alternative liability structures. As a practical matter, liability decisions are often based on partly cosmetic considerations—an insistence on strict adherence to all rating agency guidelines, benchmarking against competitors' ratios, and concern about the effects of financing on EPS—instead of the key economic factors supplied by a framework that directly links these decisions to shareholder value.

Of course, there are many corporate treasury organizations that take a highly sophisticated approach to liability management. A number of companies have well-designed liability management policies structured to minimize their cost of capital—policies that make full use of their debt capacity while at the same time protecting themselves against business disruption. As global capital markets become more open and complex over the next decade, the possibilities for creating value in the treasury organization will expand, as will the need for more sophisticated approaches to liability management.

In this article, we discuss a capital structure model that can be used to create shareholder value in firms with complex liability structures. This model, which quantifies and weighs the costs and benefits associated with any given capital structure choice, is based on the idea that judicious use of debt can add value by reducing corporate taxes and improving management incentives, but that excessive debt can result in a loss of business and perhaps a costly reorganization.[1] We have implemented the model using observable parameters and an analysis of readily obtained historical data. Although running the model is computer-intensive, the output is a set of recommendations that are easy to interpret and communicate to others.

1. This idea arises from a rich tradition of research into capital structure. After beginning by demonstrating the conditions under which capital structure is irrelevant, the research went to show how taxes, costs of financial distress, and agency costs of equity can vary with different capital structures. See Franco Modigliani and Merton Miller, "Corporate Income Taxes and the Cost of Capital: A Correction," *American Economic Review*, June 1963, 53, pp. 433-443; Nevins Baxter, "Leverage, Risk of Ruin and the Cost of Capital," *Journal of Finance* 22 (1967), pp. 395-403; Harry DeAngelo and Ronald Masulis, "Optimal Capital Structure under Corporate Taxation," *Journal of Financial Economics* 8, March 1980, p. 5-29; and Michael Bradley, Gregg Jarrell and E. Han Kim, "On the Existence of an Optimal Capital Structure: Theory and Evidence," *Journal of Finance* 43 (1984), pp. 857-878. For a discussion of the control benefits of debt and agency costs of equity, see Michael Jensen, "Agency Costs of Free Cash Flow, Corporate Finance and Takeovers," *American Economic Review*, 1986, 323-329. For a good review of theory and evidence on capital structure, see Michael Barclay, Clifford Smith Jr., and Ross Watts, "The Determinants of Corporate Leverage and Dividend Policies," *Journal of Applied Corporate Finance* 7, Winter 1995, pp. 4-19.

FIGURE 1
EBITDA OVER TIME FOR A HYPOTHETICAL FIRM



One important benefit of the approach is that it allows *all* liability management decisions to be determined jointly, based on a relatively small and straightforward set of factors. One need not rely on one set of considerations and criteria for establishing policies regarding the choice of a fixed-floating debt mix and a different set when deciding whether to repurchase stock. The framework can also be used to determine appropriate derivative positions and the amount of liquidity to maintain on a firm's balance sheet.

After discussing the theoretical foundations of the model, we illustrate its application to a hypothetical retail company attempting to determine both its value-maximizing debt-equity ratio and its optimal mix of fixed- and floating-rate debt.

A FRAMEWORK FOR ANALYZING CAPITAL STRUCTURE

In Figure 1, we show the variability of a hypothetical firm's earnings before interest, taxes, depreciation and amortization (EBITDA), but after removing the effects of inflation and growth. Earnings and cash flow will fluctuate with the fortune of the business. Sometimes EBITDA dips and the firm cannot fund its capital spending plans. If cash flows drop farther, the firm will not be able to make dividend payments on equity—and if business becomes especially bad, it will not be able to pay interest on debt.

The point of this exhibit is to suggest that, if the firm has no cash reserve and cannot obtain additional capital, the use of debt financing can impose significant costs during sharp downturns in earnings and cash flow. Promising capital projects may have to be postponed. And, if interest payments have to be deferred, the firm is at the mercy of its creditors and may be forced into a costly bankruptcy or restructuring.

There are, of course, countervailing factors that would cause a firm to want to take on the financial risk that comes with greater leverage. Debt is likely to be a cheaper form of capital for a number of reasons. For one thing, debt is tax-advantaged because interest is tax-deductible for the corporation and dividends are not. In addition, outside equity financing will be more costly than debt (even on a risk-adjusted basis) to the extent investors have concerns about the incentives of a company's management to maximize operating efficiency and invest only in value-adding projects. If investors believe managers are raising equity either because they plan to undertake value-reducing investments or because they think the firm's shares are overpriced, the shares must be discounted in order to sell.

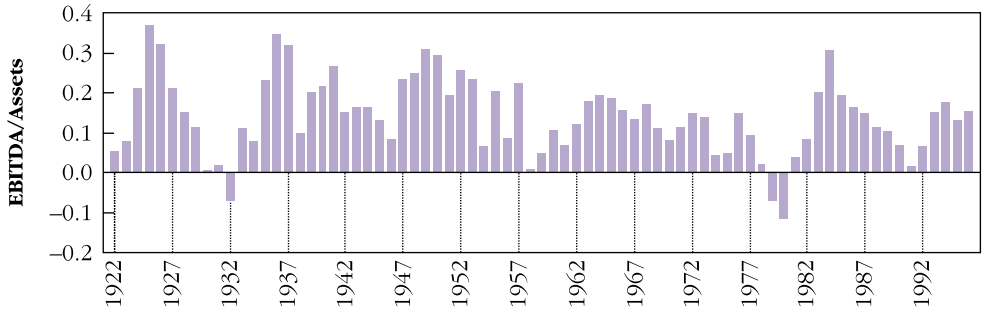
We define an optimal capital structure as the one with the highest net benefits for shareholders. This involves weighing the expected tax and incentive benefits of financial leverage against the costs a firm encounters as it nears insolvency. To determine optimal capital structure, we consider a variety of factors including a firm's expected business risk, its tax position, its exposure to business disruption in cases of financial distress, and any evidence of mispricing of its outstanding securities. To clarify our argument, we shall discuss each of the key elements in this process in more detail below. First let's consider the role of business risk.

Business Risk

A key element in designing an optimal corporate capital structure is the assessment of an organization's business risk going forward. All else equal, firms with higher business risk will prefer less debt because they are more likely to face financial distress due to higher earnings variability. Business risk is the likelihood that a firm will experience a

In the past decade, many firms have launched aggressive share repurchase programs with the expectation that value can be created by returning excess capital to shareholders and moving the firm closer to its optimal capital structure.

FIGURE 2
EBITDA/ASSETS, CHRYSLER CORPORATION
1922-1996



substantial change in its profitability. This risk is typically driven by operating strategy, industry dynamics, and exposure to economic fluctuations that include interest rate movements, currency movements, and changes in commodity prices.

Business risk can be characterized by the expected volatility of a firm's future cash flows as well as the extent to which the earnings are mean-reverting. Although the relation between a company's earnings volatility and its debt capacity is well understood, the importance of mean reversion requires some explanation.

Past research shows that there is a strong tendency for earnings to return toward an average level—again, after adjusting for inflation and a normal growth rate—after a sharp increase or decrease. This tendency to revert to the mean reflects the operation of competitive market forces that push most firms towards average levels of performance. Competitive forces make it hard to sustain abnormally good performance for long. At the same time, firms with abnormally poor performance are generally prodded by capital markets (if not internal board-level pressure) into improvements.

As an example, consider the case of Chrysler Corporation. As illustrated in Figure 2, which shows Chrysler's EBITDA-to-assets ratio from its emergence in bankruptcy proceedings in 1922 through 1996, the company operates in an extremely cyclical industry. Indeed, it has experienced near-zero or negative EBITDA in four separate episodes (1930-31, 1958, 1979-81 and 1991). Chrysler is clearly a firm with *high business risk*. Consistent with this characterization, the standard deviation of annual earnings/assets for Chrysler was 9.8% (and thus more than twice the 3.9% for the largest 100 publicly traded U.S. firms) over the 1922-1996 period.

Companies with strongly mean-reverting earnings can take on significant amounts of debt even if their earnings are quite volatile, because negative shocks to earnings are likely to be temporary. For example, Occidental Petroleum, a leading oil and chemicals company, has relatively volatile earnings because oil and chemical prices are highly volatile. But oil and chemicals prices also tend to be strongly mean-reverting, reflecting the tendency of major shocks to produce rapid adjustments in supply and demand that push prices back to more "normal" levels. And, because of this mean-reverting effect on their year-to-year cash flows, companies like Occidental can afford to maintain relatively high debt ratios.

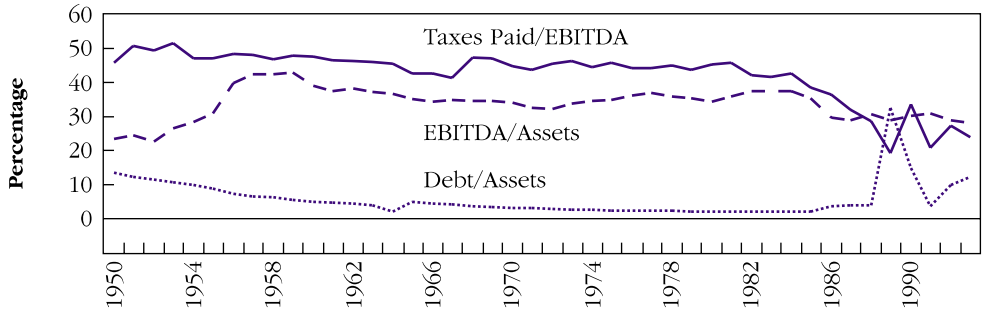
Benefits of Debt

There are a variety of potential benefits from debt financing. As we noted earlier, heavy use of debt is likely to produce efficiency gains in companies with abundant "free cash flow" that don't require much additional capital to fund investment requirements. In such cases, substituting debt for equity is likely to add value by strengthening management's incentive to increase future cash flow and return excess capital to investors.[2]

In addition, taxes also provide an important—and quantifiable—benefit of debt financing. In particular, interest payments to debtholders are tax deductible while dividend payments to equityholders are not. This gives a clear reason for firms to borrow

2. Ideas about the efficiency effects of debt have been discussed in a variety of research papers including: Michael Jensen, 1986, "Agency Costs of Free Cash Flow, Corporate Finance and Takeovers," *American Economic Review*, 323-329; Sanford Grossman and Oliver Hart, 1982, "Corporate Financial Structure and Managerial Incentives," in J. McCall, ed.: *The Economics of Information and Uncertainty*, Chicago, University of Chicago Press and René Stulz, 1990, "Managerial Discretion and Optimal Financing Policies," *Journal of Financial Economics* 26, 3-27.

FIGURE 3
AMERICAN HOME PRODUCTS FINANCIALS



rather than issue equity (at least up to the point where a firm still has income taxed at a high marginal rate).

The value of the tax shield provided by debt in a given year is a function of the interest paid and the marginal tax rate.[3] A firm that expects low earnings in the future will not benefit greatly from the tax shields afforded by debt and should have relatively little debt on its balance sheet, all else equal. On the other hand, a firm with high expected future earnings should consider taking on more debt as a means of shielding earnings from taxes.

VALUE LOST BY UNDERLEVERAGING: The Case of American Home Products.[4] The senior management of American Home Products Corporation had a strong aversion to debt and maintained a "clean" balance sheet for decades (see Figure 3). (It was not until 1989 that management assumed a significant amount of debt.) Because the company had low business risk, its earnings rarely failed to grow from one year to the next, and there was never an instance where the firm would have come close to missing an interest payment even if it had leveraged up to a 40% debt/capital ratio.

American Home Products was in the highest marginal corporate income tax bracket throughout the post-WWII period and has paid over $10 billion in income taxes since 1950. Had the company carried out a steady program of share repurchases to maintain a 40% debt/capital ratio financed at 8% interest from 1950 to 1993, the firm would have reduced its total income taxes paid by *over $1.7 billion* in today's dollars. Were the tax savings invested in a well-diversified portfolio of large stocks (with an average inflation-adjusted post-WWII return of 8%), it could have accumulated a fund valued today at $8.9 billion. This amounts to over 25% of the current market value of the company, which illustrates our contention that capital structure choices can have a tremendous impact on firm value.

And American Home Products is not alone. There are many firms that could improve their bottom line by taking advantage of the tax benefits of debt. Relevant factors that ought to be taken into account include a firm's marginal tax rate, and whether it has Alternative Minimum Tax, ITC, or tax-loss carryforward credits. In addition, one should consider whether a firm could reduce tax payments in other ways—for example, through certain ESOP structures or employer-owned life insurance.

There is, of course, a limit to the tax gains from debt. As many firms discovered after going private in leveraged buyouts in the 1980s, it is possible to become *tax-exhausted*. That is, the firm can reach a point where leverage is so high that taxable income goes to zero and there is no further tax gain to be had from debt.

The current version of our model explicitly considers only the tax benefits of debt, while ignoring the advantages that can arise from improved management incentives. But since we have assumed a relatively large tax gain associated with leverage—one that ignores potential *personal* tax advantages associated with equity financing[5]—some of this tax benefit can be

3. For two discounted cash flow methods for quantifyng the present value of tax shields, see in this issue Isik Inselbag and Howard Kaufold, "Two DCF Approaches for Valuing Firms Under Alternative Financing Strategies," *Journal of Applied Corporate Finance* Vol. 10 No. 1 (Spring 1997).

4. See David W. Mullins, *American Home Products Corp.*, Harvard Business School Case, 3/17/83.

5. This personal tax advantage arises because a fraction of the return to equityholders comes in the form of tax-advantaged capital gains.

Outside equity financing will be more costly than debt (even on a risk-adjusted basis) to the extent investors have concerns about the incentives of a company's management to maximize operating efficiency and invest only in value-adding projects.

viewed as an incentive benefit. The important point to note here is that the expected benefit of debt financing is greatest when corporate taxable earnings and free cash flow are projected to be both large and predictable—and the costs of debt are highest when earnings and cash flow are low and uncertain.

Although the model is somewhat loose in its characterization of the incentive benefits of debt, we have been careful to apply the relevant features of the current tax code in the earnings simulation process. For example, if a firm experiences negative taxable income in a given year, tax loss carryforwards are increased. Or, if taxes paid have been positive, the firm obtains a tax carryback. Then, if its taxable income is positive later, the carryforwards are used to reduce tax payments. The model also checks whether a firm is tax-exhausted and does not allow tax gains from debt once taxable income hits zero.

Costs of Debt

Debt is costly in our model when a firm cannot cover its interest expense because of an earnings shortfall, a condition we henceforth call "financial distress."[6] This penalty can be justified by a variety of arguments relating to the reaction of a firm's stakeholders to its leverage. Customers, suppliers, employees, and competitors are concerned about a firm's financial condition because they understand that a financially distressed firm behaves differently than a healthy firm.

Effects of Financial Distress on Non-financial Stakeholders. For one thing, a financially distressed firm is much more likely to liquidate than an otherwise identical financially healthy firm. When companies go out of business—or just threaten to do so—there are often spillover costs imposed on non-financial stakeholders. Consider, for example, the costs that would have been imposed on Chrysler's stakeholders had it gone out of business when it had financial difficulties in the late 1970s. Its customers would have found it much more difficult to have their cars repaired if Chrysler was no longer producing spare parts. Similarly, employees and suppliers with specific human or physical capital would also have found the firm's liquidation costly (the loss of jobs, etc.).

More sophisticated workers, suppliers, and customers anticipate the costs associated with doing business with a firm that may be liquidated.[7] Suppliers are less likely to extend credit to such firms, and those managers and employees that have other options may require higher wages. Customers will not be willing to pay as much for the products of a firm facing financial distress and in some cases will avoid purchasing from such a firm altogether.

THE "STAKEHOLDER" RESPONSE TO FINANCIAL DISTRESS: The Case of Chrysler. Indeed, this is what happened at Chrysler in the late 1970s. The company had been losing money in 1978 when Lee Iacocca was brought in as CEO. By mid-1979 it was evident to senior management that Chrysler was likely to go bankrupt without a cash infusion. At this point the company was selling approximately 85,000 vehicles a month. After management approached the Treasury Department seeking loan guarantees, controversy erupted and the public learned that Chrysler had a high chance of bankruptcy. New car sales plunged. The percentage of consumers willing just to *consider* buying a Chrysler product reportedly dropped from 30% to 13%.[8] Sales fell to less than 50,000 vehicles a month, far below the number needed to cover the company's fixed costs. According to Iacocca, Chrysler's "share of new car sales dropped nearly two percentage points because potential buyers feared the company would go bankrupt."[9]

Financial Distress and the Underinvestment Problem

Non-financial stakeholders are also likely to be concerned that a distressed firm will become capital constrained, which could then cause managers to make short-sighted cutbacks in value-increasing investments. Critical among such investments are the money and effort spent in maintaining the firm's reputation for dealing honestly with employees and

6. The idea that a firm should limit its exploitation of the tax gains from debt because of the potential of financial distress was noted in the 1960s by several authors. See Alexander Robichek and Stewart Myers, 1965, *Optimal Financing Decisions*, Prentice-Hall and Jack Hirshleifer, 1966, "Investment Decisions Under Uncertainty: Application of the State-Preference Approach," *Quarterly Journal of Economics* 80, p. 262-277.

7. For a further discussion of this idea see Sheridan Titman, "The Effect of Capital Structure on a Firm's Liquidation Decision," *Journal of Financial Economics* 13 (1984), 137-151. See also Alan Shapiro and Sheridan Titman, "An Integrated Approach to Corporate Risk Management," *Midland Corporate Finance Journal* (Summer 1985); and Chapter 16 in Mark Grinblatt and Sheridan Titman, *Financial Markets and Corporate Strategy* (McGraw-Hill/Irwin, 1997).

8. See *Lee Iacocca: An Autobiography*, by Lee Iacocca with William Novak (Bantam Books, 1984), p. 233.

9. See *Wall Street Journal*, July 23, 1981.

suppliers, and for providing quality products to its customers. Under normal circumstances, managers have strong incentives to maintain their firms' reputation because that contributes to higher long-run profitability. Under financial duress, however, the long-run value of a good reputation may be less important than the immediate need to generate cash to stave off bankruptcy. For this reason, a firm may lower the quality of its products in order to raise cash to meet debt obligations.[10]

FINANCIAL DISTRESS AND REPUTATION: The Case of Eastern Airlines. Eastern Airlines offers one of the best recent examples of alleged quality cutting by a firm in financial distress. During its financial troubles in 1987-1990, Eastern's unions accused it of cutting back on safety to save money. The company pleaded guilty to charges maintaining serious maintenance violations. The indictment stated that the violations occurred "as a result of unreasonable demands, pressure and intimidation put on [maintenance personnel] by Eastern's upper management to keep the aircraft in flight at all costs..."[11] In other words, to keep from going under, the firm was forced to cut costs in ways that may have compromised safety.

Unfortunately for Eastern Airlines and other firms in similar circumstances, rational customers understand this incentive, and thus will not be willing to pay as much for the products of firms facing financial distress. Eastern, for example, experienced lower revenues per seat mile than competitors during this period of financial distress, since travelers tended to avoid the airline when they could. For similar reasons, potential employees and suppliers are less willing to do business with a firm in financial distress.

How Financial Distress Affects Competition

Debt can affect competition within an industry because it brings with it the risk of financial distress. Capital structure can affect competition in the sense that corporate decisions to increase (or just maintain) their current market share are effectively investment decisions—that is, decisions to spend money today with the expectation of a future payoff. A company that competes aggressively for market share either by lowering its price or increasing its advertising is likely to suffer reduced profits in the short run but should realize greater profits in the long-run from its increased customer base.

For the same reasons discussed earlier, highly leveraged companies are likely to compete less aggressively for market share when there is greater urgency to produce current cash flows. In some cases, the less aggressive stance taken by a financially distressed firm may actually work to the advantage of all the firms in the industry. Competitors, viewing the distressed firm as less of a threat, may feel free to increase prices, knowing that competition within the industry will be less intense. On the other hand, a firm's financial distress may invite a predatory response from competitors, thus making a bad situation worse.[12] Some have argued that the famous "Marlboro Friday"' incident, when Philip Morris slashed prices on its leading branded cigarettes, was prompted by the highly leveraged condition of its chief competitor, RJR/Nabisco.

Some Recent Evidence on the Costs of Financial Distress Costs

In a study published in 1994, two of the present writers tested the idea that financial distress can be costly by examining a number of economically distressed industries to see whether the more highly leveraged firms in these industries lost market share to their less leveraged rivals.[13] In particular, we studied the changes in market share experienced by companies in industries such as oil and gas, auto manufacturing, and paper over the period 1978 to 1991. The basic premise of our study was that firms with highly leveraged balance sheets are likely to suffer disproportionately in an industry downturn because they are most likely to become financially

10. This idea is discussed at greater length in Vojislav Maksimovic and Sheridan Titman, "Financial Policy and a Firm's Reputation for Product Quality," *Review of Financial Studies* 4 (1991), 175-200.

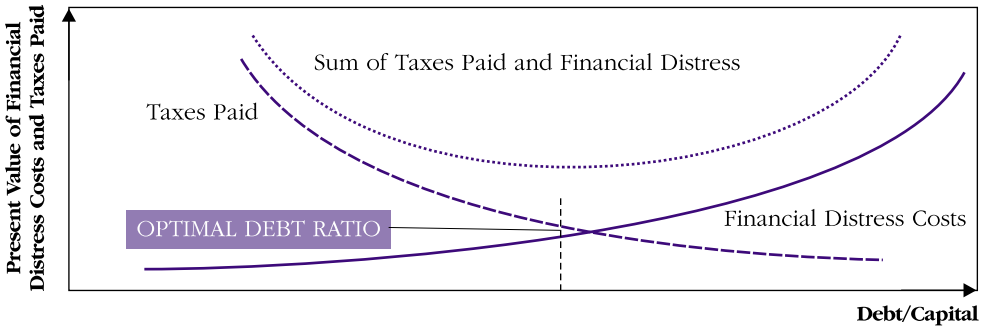
11. This quote is from an excellent book on the topic entitled *Free Fall: The Needless Destruction of Eastern Airlines and the Valiant Struggle to Save It*, by Jack Robinson, HarperCollins, New York: NY, 1992. Also see "Information Problems, Conflicts of Interest and Asset Stripping: Chapter 11's Failure in the Case of Eastern Airlines" by Lawrence A. Weiss and Karen H. Wruck, Division of Research, Harvard Business School, 97-013.

12. See Patrick Bolton and David S. Scharfstein, 1990, "A Theory of Predation Based on Agency Problems in Financial Contracting," *American Economic Review* 80, 93-106.

13. See Tim C. Opler and Sheridan Titman, 1994, "Financial Distress and Corporate Performance," *Journal of Finance* 49, 1015-1040. Also see a classic paper on the topic by Edward Altman, 1984, "A Further Investigation of the Bankruptcy Cost Question," *Journal of Finance* 39, 1067-1089.

Had American Home Products carried out a steady program of share repurchases to maintain a 40% debt/capital ratio financed at 8% interest from 1950 to 1993, the firm would have reduced its total income taxes paid by *over $1.7 billion* in today's dollars.

FIGURE 4
FINDING AN OPTIMAL CAPITAL STRUCTURE



distressed and reduce their investment in market share (or experience defections by their customers concerned about their staying power).

As expected, our findings showed that companies with highly leveraged balance sheets do in fact lose market share to their more conservatively financed competitors during industry downturns. Specifically, companies in the highest-leverage decile in industries that experienced output contractions saw their sales decline by almost 15% more than firms in the lowest-leverage decile. The most highly levered firms also experienced the largest declines in their EBITDA/asset ratios (ROAs) and share prices.

Our evidence suggests that financial distress costs differ across industries. In particular, the financially distressed firms companies lose greater market share in more concentrated industries. This evidence is consistent with the idea that distressed firms are sometimes subjected to predatory behavior when there are dominant competitors in the industry.

We also found a tendency for financially distressed firms with high research and development expenses to give up market share. One plausible explanation for this finding is that the customers of firms in R&D-intensive industries may be reluctant to deal with financially troubled firms because the products in these industries are more likely to be "credence" goods whose quality cannot be immediately observed and that may require future servicing. For example, companies in industries such as automobile manufacturing and computers are likely to see high business disruption costs in periods of financial distress because consumers' purchase decisions are based on assumptions about a firm's ability to provide service, support, and spare parts. By contrast, companies in industries such as food retailing and hotels are likely to experience relatively minor business disruption costs because the products being sold in these industries are not unique and do not require ongoing business relationships and service.

We should note, however, that our finding that leveraged firms lose market share is consistent with each of the three theories discussed above. That is, the competitive strategy theory suggests that less leveraged rivals consciously act to take market share from their more leveraged competitors. But, even without predatory actions by competitors, the debt and underinvestment theory says that financially distressed firms are more likely to choose to forgo value-increasing investments in market share. Finally, the stakeholder theory suggests that the financially distressed firms lose market share simply because customers become concerned about the distressed firms' long-term viability. Of course, these three theories are not mutually exclusive, and each may contribute to our findings.

As we discuss in more detail below, our model accounts for financial distress costs by charging companies a "distress tax" when earnings after interest dips below a prespecified threshold in a repeated simulation of future earnings. We now turn to a description of how this simulation works.

THE CAPITAL STRUCTURE MODEL

Our model estimates the shareholder value added (or lost) by different capital structure choices by computing the expected present value of a firm's equity cash flows, taking into account its earnings uncertainty, financial distress costs, and tax position. The optimal capital structure is that which maximizes the present value of cash flows to equityholders. The model identifies the financing mix that minimizes the expected sum of financial distress costs and taxes paid. As illustrated in Figure 4, the optimal debt ratio occurs at the point where

the sum of taxes paid and financial distress costs reaches a minimum.[14]

The model finds this minimum point through simulation. Specifically, we simulate the future cash flows of a firm using assumptions about interest rate and earnings volatility. The simulation proceeds in the following stages:

1. Project a company's future interest expense based on its assumed capital structure and mix of fixed- vs. floating-rate debt. These interest payments are obtained by simulating the firm's interest expense under several thousand interest rate scenarios over a 20-year horizon.[15] In this process, account for the "option" features (i.e., call and convertibility provisions) built into a firm's bonds, sinking funds, multi-currency structure, and any swap agreements.

2. Define the key variables of a forecasting model of EBITDA/Assets over the next year in well-defined industries such as oil & gas, paper, or retail that are most closely related to each of the firm's core businesses. The forecasting model will capture historical volatility and mean-reversion of earnings.

3. Repeatedly simulate the forecasting model over a period of 20 years to generate many paths of future earnings for the firm, some of which will be poor and others very good.

4. For each future earnings realization, compute the firm's income tax payments using the statutory tax rate. Account for tax-loss carryforwards and existing investment and Alternative Minimum Tax credits.

5. For each future earnings realization, determine if the firm is financially distressed by checking whether earnings after interest are below a critical threshold. If so, then reduce the EBITDA/Assets by the financial distress "tax" (derived from a historical study of the industry and firm). This "tax" or parameter varies from 0.01 to 0.20, depending on the nature of the firm's business. (As we will illustrate in the case study that follows, the financial distress parameter was estimated in our series of industry studies along the lines of those described in the previous section.)

6. Using the distribution of future forecast earnings with a given capital structure, compute the discounted sum of future tax payments and financial distress costs.

7. Holding total debt constant, account for any funding cost/pricing advantages of different ways of structuring debt (e.g., floating-rate debt is less expensive, on average, but more volatile than fixed-rate debt).

8. Try out a range of different capital structures (for example, vary total debt or the amount of debt in a foreign currency) and compute the earnings and repeat steps 1 through 7.

9. Find the capital structure that minimizes the discounted sum of future tax payments, financial distress costs, and funding costs. This is the *optimal capital structure*.

Perhaps the most attractive feature of the model is its flexibility. For example, managers of a firm may have a different view about the most likely distribution of future cash flows than that predicted by an historical model. Or, one's understanding of financial distress costs may be much more detailed than the model's, thus allowing financial distress penalties to be applied at a number of different stages of the simulation. Or, a firm may have entered into contracts that give the firm contingent liabilities based on the levels of currencies, commodity prices, or interest rates that will affect earnings in predictable ways. These considerations can all be factored into the capital structure model.

CASE STUDY: SUPERSTORE CORPORATION

In 1996 a leading general merchandise retailer, which we will call Superstore Corporation, was considering changing both its overall debt-equity mix and the proportion of total debt that floated with short-term interest rates. Changes in the debt-equity mix could be accomplished by issuing or retiring debt, or issuing or retiring equity. Changes in the fixed-floating debt mix could be accomplished either by changing debt maturity structure as issues come due or by using the interest rate swap market.

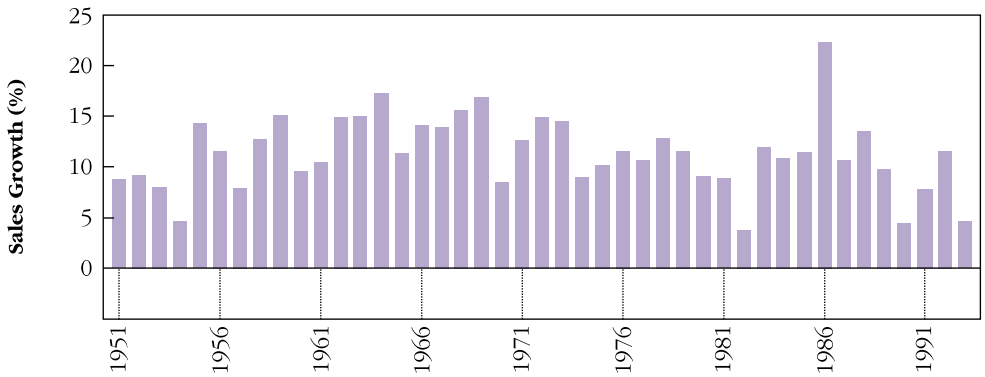
At the time, Superstore had over $8 billion in debt outstanding, of which more than $6 billion was long-term. In addition, the firm had entered into an interest rate swap agreement in which it had agreed to pay floating and received fixed. The effect was a

14. A formal presentation of this idea in a world with uncertain profits appeared in Alan Kraus and Robert H. Litzenberger, 1973, "A State-preference Model of Optimal Financial Leverage," *Journal of Finance* 28, 911-922.

15. Using an arbitrage-free term structure model. The model used is described in further detail in Anlong Li, Peter Ritchken and Sankar Subramaniam, "Lattice Models for Pricing American Interest Rate Claims," *Journal of Finance* 50, 1995, p. 719-737.

Under normal circumstances, managers have strong incentives to maintain their firms' reputation because that contributes to higher long-run profitability. Under financial duress, however, the long-run value of a good reputation may be less important than the immediate need to generate cash to stave off bankruptcy.

FIGURE 5
AVERAGE SALES GROWTH OF SUPERSTORE ND COMPARABLES 1950-1995



30% floating-rate/70% fixed-rate debt mix and a debt/assets ratio in the range of 40% to 50%.

Our analysis of the appropriate changes in the capital structure of Superstore began with an analysis of the company's business risk. Figure 5 shows the mean sales growth for Superstore and a number of industry comparables from 1950 to 1995. The chart shows that the retail segment has experienced highly variable sales growth results over time, although the industry has never (at least since 1950) experienced a year-to-year decline in sales. The largest historical slowdowns in the industry occurred in 1954, 1981-82, and in 1990-91.

We also examined historical earnings volatility for Superstore and comparable firms. The statistical model based on the time series of EBITDA/Assets for the industry indicated relatively low earnings volatility and a high degree of mean reversion. We employed these parameters in the earnings simulation process, making the implicit assumption that Superstore will have future earnings that are similar to past earnings in volatility and mean reversion.

Estimating Expected Tax Payments and Financial Distress Costs

To determine an optimal capital structure we also required information about Superstore's current tax status and estimates of the firm's *further* expected reduction in EBITDA in the event of financial distress. (By "further reduction in EBITDA" we mean the loss in operating income *over and above* that caused by the industry downturn—that is, the loss attributable *solely* to the firm's having a high leverage ratio and becoming financially distressed.) The company was in the highest corporate marginal income tax bracket and did not have available NOL carryforwards, or ITC or AMT tax credits, to be accounted for in the simulation.

At first glance, one would think that a retailer would face very little in the way of financial distress costs. Unlike autos, where customers may be wary about buying a car from a distressed manufacturer, the customers of Sears or K Mart probably do not worry much about the financial condition of the stores at which they shop.[16] But if we examine this case more closely, this conclusion could change.

The leveraged-related risk that retailers face has to do with what we refer to as a "runs problem." To most of us, a run conjures up the image of desperate depositors hoping to pull their money out of a failing bank before the bank fails. The important thing to note is that runs can be self-fulfilling, which is why we now have deposit insurance. When depositors unexpectedly pull out their money, banks are required to liquidate some of their assets (e.g., sell some of their loans), often at a loss. These forced sales create further problems that, in the absence of deposit insurance, might justify depositors' panic. No depositor wants to be the last trying to withdraw money from a failing bank, so just to be safe they tend to withdraw their funds before the situation gets worse.[17]

16. Steve Kaplan makes an argument consistent with this idea in his analysis of the costs of the Federated bankruptcy. He reports that the financial distress costs experienced by Federated were small, and possibly, nonexistent. See "Campeau's Acquisition of Federated: Post-Bankruptcy Results," *Journal of Financial Economics*, Volume 35, (February, 1994), 123-136.

17. As classic analysis of this problem is presented in Douglas Diamond and Philip Dybvig, 1984, "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy* 91, pp. 401-419.

A run on a retailer, to be sure, is very different than a bank run. But it is based on the same idea that a perceived problem can cause a real problem that snowballs. In this case, it is the suppliers that are likely to panic. Just the slightest indication of trouble could cause suppliers to become concerned about getting paid. Like the depositor that doesn't want to be last at the teller's window of a failing bank, no supplier wants to be the only one shipping goods to a distressed retailer. And, once again, we see that beliefs can be self-fulfilling. The retailer cannot continue to do business if a significant fraction of its suppliers refuse to replenish its inventory. And suppliers will not ship their goods if they don't think they will be paid—and chances are they won't be paid if other suppliers refuse to ship.

FINANCIAL DISTRESS COSTS IN RETAILING: The Case of Caldor. The recent Caldor bankruptcy offers an interesting case in point. Caldor had earned $44 million in its 1994-95 fiscal year and $3.3 million in its first (summer) quarter of 1995. In other words, the company was doing reasonably well despite the fact that another prominent retailer, Bradlee's, had filed for Chapter 11 and the industry in general was having problems. But then, in August 1995, trade creditors became nervous when Caldor announced that its sales were down. In response to this announcement, the company's short-term lenders, who finance some of their inventories, chose to cut off credit, and, soon after, Caldor's vendors stopped shipping goods. As a result, Caldor was forced into Chapter 11.

To estimate the costs of financial distress in the retail sector, we examined the historical performance of leveraged retailers in past downturns. There were a number of historical cases where firms in the retailing industry had been financially distressed, which allowed us to estimate financial distress costs for Superstore using the approach described earlier. We concentrated on the downturns of 1981-82 and 1990-91 to estimate distress costs. We split the firms in the retailing industry before each downturn into two groups—highly leveraged and less leveraged—and then measured the decline in EBITDA/Assets for each group through the downturn. We assigned firms to the highly leveraged group if their book debt/assets exceeded 50% and if their pre-downturn ratio of EBITDA-interest over assets was less than 3%. Among this highly leveraged group were Broadway, R.H. Macy, Jacobson's, and Hills Stores.

Our findings showed that companies with high leverage experienced an average drop of 10.2 percentage points in their EBITDA/Assets ratio during the downturn period. Moreover, this was 9.6 percentage points higher than the 0.6 percentage point decline experienced by the firms with stronger balance sheets. Based on this historical experience, we imposed a 10 percentage point financial-distress "tax" on EBITDA/Assets in the simulation model whenever Superstore's interest coverage fell below a prespecified threshold.

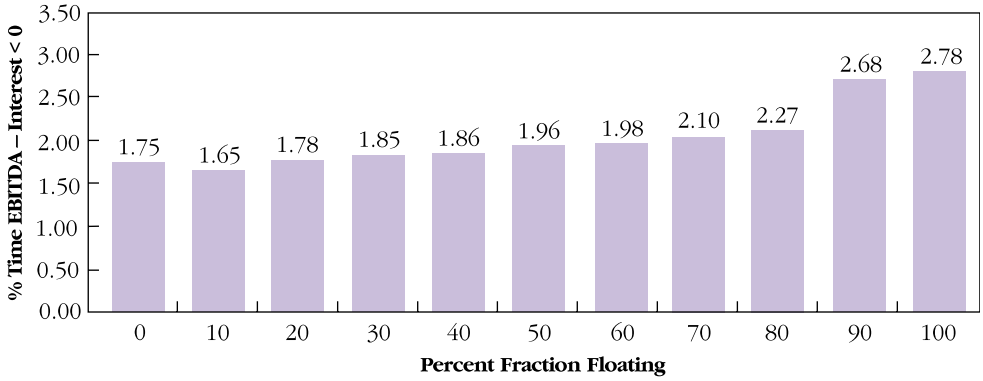
A closer, case-by case-analysis of the performance of leveraged firms in retailing downturns turned up a number of explanations for the poor performance. We found some cases where firms faced difficulty in obtaining shipments from suppliers (the runs problem discussed above). In one case, management became so focused on day-to-day financial survival that little time was spent on business matters. As a result, the quality and timeliness of new merchandise as well as the condition of the stores deteriorated. These troubled retailers also saw credit dry up and had difficulty modernizing stores. In addition, Broadway and R.H. Macy both filed Chapter 11, which of course has its own costs. For example, Macy's spent over $100 million on attorney's fees and court costs in its bankruptcy proceedings.[18]

The Fixed vs. Floating Issue. In the capital structure simulation, we varied both the debt-equity mix and the fixed-floating mix for Superstore using information in the yield curve at the time. The interest rate charged on debt rose in the simulation as the firm experienced deterioration in credit quality. One important question that arose was this: What financing-cost advantage (or disadvantage) should be applied to floating-rate financing. Our historical analysis indicated that floating-rate debt has, on average, been 40 basis points cheaper than fixed-rate debt—a cost advantage that was built into the simulation.

18. The problems encountered by Macy's in its days of financial distress are chronicled in *The Rain on Macy's Parade: How Greed, Ambition, and Folly Ruined America's Greatest Store*, by Jeffrey Trachtenberg, Times Books, 1996.

Firms with highly leveraged balance sheets are likely to suffer disproportionately in an industry downturn because they are most likely to become financially distressed and reduce their investment in market share (or experience defections by their customers concerned about their staying power).

FIGURE 6
FREQUENCY OF SEVERE FINANCIAL DISTRESS AS SUPERSTORE SHIFTS TO FLOATING RATE DEBT



On the other hand, when interest rates rise, borrowing costs increase (generally at a faster rate than revenues), and thus both the probability and the costs of financial distress increase accordingly. This greater interest rate risk associated with the use of floating-rate financing is reflected in the simulation model with a higher financial distress tax.

Simulation Results

The simulation proceeded with 1,000 Monte Carlo paths projected forward over 20 years beginning with fiscal 1996. We tracked distress costs and tax payments as the firm randomly went through good times and bad.[19]

One of the main findings in the simulation was that, even though floating-rate debt appeared cheaper when considered alone, the frequency of severe financial distress (experienced when EBITDA-interest was negative) increased significantly as the company moved closer to 100% floating-rate debt (see Figure 6).

The net result was that Superstore was best off in the simulation with a strategy that involved a mixture of fixed- and floating-rate debt. We found that the firm could reduce the expected present value of financial distress costs, funding costs, and taxes paid by slightly more than $200 million if it followed a strategy that involved the addition of $800 million more debt while shifting to a 60% floating-rate/40% fixed-rate mix. In sum, our simulation results suggested that the firm could create $200 million of shareholder value by issuing $800 million of additional debt and using it to repurchase stock. That is, the net reduction in the present value of expected financial distress costs, taxes, and financing costs associated with these changes in capital structure represent an expected increase of $200 million in shareholder value.

The simulation model also showed interesting interactions between Superstore's fixed-floating choice and its debt-equity choice. For example, if Superstore were to shift to a capital structure with 100% floating-rate debt, our model suggests it should not issue additional debt. Moreover, the model also clearly suggests that the firm would leave considerable amounts of shareholder value "on the table" by shifting to a capital structure with either substantially more or substantially less debt.

CONCLUSION

We expect that the process of liability management will become far more sophisticated in the coming decade as companies increasingly recognize the connections between balance-sheet decisions and shareholder value. The use of quantitative capital structure models like the one discussed here could become an important part of this process. This model uses capital structure theory to arrive at useful recommendations for corporations with complex liability structures.

As illustrated in a case study of a hypothetical general merchandiser, the model makes it possible to pinpoint an optimal debt-equity ratio (and per-

19. In the rare cases where Superstore became permanently insolvent, the simulation paths were truncated. The Monte Carlo earnings simulation approach has been applied in a related article estimating default likelihood for a drug store. See Robert F. Bruner and Kenneth M. Eades, "The Crash of the Revco Leveraged Buyout: The Hypothesis of Inadequate Capital," *Financial Management*, Spring 1992, p. 35-49.

centage of fixed- versus floating-rate debt) that balances the value of the tax shield from debt against the increased risk of financial distress and bankruptcy. One important benefit of using such a model is that allows complete coordination of all corporate liability decisions. This capability allows corporate treasurers to make a wide variety of balance-sheet decisions in a consistent manner.

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