Capital Structure Decisions: Which Factors Are Reliably Important?

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This paper examines the relative importance of many factors in the capital structure decisions of publicly traded American firms from 1950 to 2003. The most reliable factors for explaining market leverage are: median industry leverage (+ effect on leverage), market-to-book assets ratio (−), tangibility (+), profits (−), log of assets (+), and expected inflation (+). In addition, we find that dividend-paying firms tend to have lower leverage. When considering book leverage, somewhat similar effects are found. However, for book leverage, the impact of firm size, the market-to-book ratio, and the effect of inflation are not reliable. The empirical evidence seems reasonably consistent with some versions of the trade-off theory of capital structure.

When corporations decide on the use of debt finance, they are reallocating some expected future cash flows away from equity claimants in exchange for cash up front. The factors that drive this decision remain elusive despite a vast theoretical literature and decades of empirical tests. This stems in part from the fact that many of the empirical studies are aimed at providing support for a particular theory. The amount of evidence is large, and so it is often all too easy to provide some empirical support for almost any idea. This is fine for a given paper but more problematic for the overall development of our understanding of capital structure decisions. As a result, in recent decades the literature has not had a solid empirical basis to distinguish the strengths and the weaknesses of the main theories.

Which theories shall we take seriously? Naturally, opinions differ. Many theories of capital structure have been proposed. But only a few seem to have many advocates. Notably, most corporate finance textbooks point to the "trade-off theory" in which taxation and deadweight bankruptcy costs are key. Myers (1984) proposed the "pecking order theory" in which there is a financing hierarchy of retained earnings, debt, and then equity. Recently, the idea that firms engage in "market timing" has become popular. Finally, agency theory lurks in the background of much theoretical discussion. Agency concerns are often lumped into the trade-off framework broadly interpreted.

Advocates of these models frequently point to empirical evidence to support their preferred theory. Often reference is made to the survey by Harris and Raviv (1991) or to the empirical study

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by Titman and Wessels (1988).[1] These two classic papers illustrate a serious empirical problem. They disagree over basic facts.

According to Harris and Raviv (1991, p. 334), the available studies "generally agree that leverage increases with fixed assets, nondebt tax shields, growth opportunities, and firm size and decreases with volatility, advertising expenditures, research and development expenditures, bankruptcy probability, profitability and uniqueness of the product." However, Titman and Wessels (1988, p. 17) find that their "results do not provide support for an effect on debt ratios arising from nondebt tax shields, volatility, collateral value, or future growth." Consequently, advocates of particular theories are offered a choice of diametrically opposing well-known summaries of "what we all know" from the previous literature. Clearly this is unsatisfactory, and this study aims to help resolve this empirical problem.

This paper contributes to our understanding of capital structure in several ways. First, starting with a long list of factors from the prior literature, we examine which factors are reliably signed, and reliably important, for predicting leverage. Second, it is likely that patterns of corporate financing decisions have changed over the decades. During the 1980s, many US firms took on extra leverage apparently due to pressure from the market for corporate control. Starting in the 1990s, more small firms made use of publicly traded equity. It is therefore important to examine the changes over time. Finally, it has been argued that different theories apply to firms under different circumstances.[2] To address this serious concern, the effect of conditioning on firm circumstances is studied.

In testing which factors are correlated with leverage, it is necessary to define leverage. Many different empirical definitions have been used. Some scholars advocate book leverage, while others advocate market leverage. The opinions on which is a better measure of leverage differ. According to Myers (1977), managers focus on book leverage because debt is better supported by assets in place than it is by growth opportunities. Book leverage is also preferred because financial markets fluctuate a great deal and managers are said to believe that market leverage numbers are unreliable as a guide to corporate financial policy. Consistent with the academic perception of manager's views, in Graham and Harvey (2001), a large number of managers indicate that they do not rebalance their capital structure in response to equity market movements. The presence of adjustment costs prevent firms from rebalancing continuously.[3]

Advocates of market leverage argue that the book value of equity is primarily a "plug number" used to balance the left-hand side and the right-hand side of the balance sheet rather than a managerially relevant number (see, e.g., Welch, 2004). Welch (2004) further objects that the book value of equity can even be negative (although assets cannot be). The book measure is backward looking. It measures what has taken place. Markets are generally assumed to be forward looking. Thus, there is no reason why these two measures should match (see Barclay, Morellec, and Smith, 2006). The literature also uses different definitions of debt. Debt can be defined as long-term or total debt, and it can be defined to include accounts payable or all liabilities.

In presenting our results, our main focus is on the ratio of total debt to market value of assets (TDM). However, given these differing views, we also report results for alternative definitions of

[1] Zingales (2000) also sets out to survey the theoretical capital structure literature but notes that "10 years later, the survey by Harris and Raviv (1991) would not necessitate any dramatic rewriting" (p. 1623). More recently, Baker and Wurgler (2002) helped popularize the old market timing idea.

[2] "There is no universal theory of capital structure, and no reason to expect one. There are useful conditional theories, however. . . . Each factor could be dominant for some firms or in some circumstances, yet unimportant elsewhere" (Myers, 2003, pp. 216-217).

[3] Empirical estimates of the speed of adjustment show, perhaps surprisingly, relatively little differences in the speed whether book value or market value debt ratios are used (Huang and Ritter, 2007).

leverage. We do find reliable empirical patterns that account for much of the variation in market leverage across firms using a sample of publicly traded US firms from 1950 to 2003.[4] With a market-based definition of leverage, we find that a set of six factors account for more than 27% of the variation in leverage, while the remaining factors only add a further 2%. We call this set of six factors "core factors" and the model that includes these factors the "core model of leverage." The core factors have consistent signs and statistical significance across many alternative treatments of the data. The remaining factors are not nearly as consistent. The core factors for the market leverage are as follows:

- *Industry median leverage*: Firms in industries in which the median firm has high leverage tend to have high leverage.
- *Tangibility*: Firms that have more tangible assets tend to have higher leverage.
- *Profits*: Firms that have more profits tend to have lower leverage.
- *Firm size*: Firms that are large (in terms of assets) tend to have higher leverage.
- *Market-to-book assets ratio*: Firms that have a high market-to-book ratio tend to have lower leverage.
- *Expected inflation*: When inflation is expected to be high, firms tend to have high leverage.

This set of core factors raises several important questions. (1) Are all of these effects equally reliable? (2) Can we replace some of the core factors with other common factors and still adequately control for the known facts? (3) How important are the excluded factors? (4) How does this set of core factors relate to the popular theories of leverage?

Question 1. Of course, these factors are not all equally reliable. Expected inflation is likely to be the least reliable factor. It is the only macroeconomic factor to be included and so instead of having over 270,000 firm-year observations, we have just 54 annual observations for expected inflation. Accordingly, we cannot have nearly the same level of confidence that this factor will perform similarly out of sample.

The six core factors provide a more powerful account of a market-based definition of leverage than of a book-based definition of leverage. If we had been focusing on a book-based definition of leverage, the market-to-book ratio, firm size, and expected inflation would all have been excluded from the core model. The remaining factors, that is, industry median leverage, tangibility, and profits, are robust across various alternative definitions of leverage.

Recall that market-based leverage is forward looking, while book-based leverage is backward looking. From this point of view, it would appear that the market-to-book, firm size, and expected inflation factors are reflecting effects that are forward looking. The industry median, tangibility, and profitability are reflecting the effect of the past.

There have been significant changes in the core model over time. The most important of these is the declining importance of profits. In the period before the 1980s, profits played a very powerful role in determining leverage. In the later period, profits—while still statistically significant—became less important in leverage decisions. This result provides yet more evidence of the fact, discussed in Frank and Goyal (2003), that during the 1980s and 1990s,

[4]Dynamic aspects of leverage are important and have recently been a focus of many papers. Leverage changes have played an important role is tests of the pecking order theory (Shyam-Sunder and Myers, 1999; Frank and Goyal, 2003). Leverage changes have also been important in tests of target adjustment. The literature commonly agrees that leverage exhibits mean reversion, but the speed of adjustment is sensitive to the econometric procedure used. See, for example, Hovakimian, Opler, and Titman (2001), Welch (2004), Frank and Goyal (2004), Leary and Roberts (2005), Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), Huang and Ritter (2007), and Tsyplakov (2008), among others. There has been much less recent attention to cross-sectional differences that are the focus of this paper.

equity markets became more willing to fund currently unprofitable firms with good growth prospects.

When we consider firms in different circumstances, the most important fact is the degree of similarity among the factors. However, as should be expected, there are interesting differences to be found. The most noteworthy difference is between high and low market-to-book firms. Tangibility and firm size are more important in explaining leverage for low market-to-book firms than they are for high market-to-book firms.

Question 2. Many studies in the literature have used different sets of factors. Three variations on the list of six factors are likely to be innocuous. First, replacing assets with sales is unlikely to matter, since both reflect the role of firm size. Second, replacing expected inflation with the nominal Treasury bill rate is unlikely to matter since they are highly correlated. Third, replacing tangibility with collateral is unlikely to matter. Tangibility and collateral differ in that collateral includes inventories while tangibility does not. Inventories usually support short-term debt. In addition, inventories as a fraction of total assets have declined significantly over time.

When selecting control factors, some studies point to the four factors used by Rajan and Zingales (1995). Their factors are: market-to-book, profit, tangibility, and sales. These factors are reasonable but this list excludes the effect of expected inflation and median industry leverage. A natural question is how significant are the omissions of some core factors in leverage regressions. We show that these omissions can materially change inferences on other factors that are included in the model. The included minor factors sometimes become insignificant or, even worse, change sign when the set of core factors is changed.

Question 3. Statistically, the excluded factors make little difference. As mentioned above, they add little to the explanatory power of the model and many of them have effects that are not reliable. On the other hand, these factors may be critical for the consideration of particular theories. For this reason we also report the patterns that are observed for the minor factors.

Question 4. The current paper does not provide structural tests of capital structure theories. Instead, the focus is on identifying reliable patterns in the data. If a factor is known to be reliably related to leverage decade after decade, then a useful theory ought to be able to account for that fact. Often the theories make specific predictions about the signs of the coefficients that should be observed. We therefore consider the extent to which some aspects of the evidence pose problems for theory. Using this information, we offer suggestions about directions in which the theories might be developed so they can be more empirically relevant.

Five of the six core factors have the sign predicted by the static trade-off theory in which deadweight bankruptcy costs are traded off against the tax saving of debt. The sign on profits is inconsistent with the static trade-off theory but is consistent with dynamic trade-off models such as Fischer, Heinkel, and Zechner (1989) in which firms allow their leverage to drift most of the time and only adjust their leverage if it gets too far out of line.[5] It is similarly consistent with Tsyplakov (2008) in which, due to time-to-build, firms stockpile retained earnings until the time is right to buy physical capacity.

While the tax versus bankruptcy trade-off is the most common version of the trade-off theory, it is not the only model within the general trade-off theory label. Trade-off theory also includes models such as Stulz (1990) and Morellec (2004) in which agency costs play a crucial role. In Stulz, for example, financing policies matter because they influence the resources under manager's control. This reduces the costs of over- and underinvestment. We suspect that agency costs of

[5]An interesting question is whether the levels of underwriting costs reported by Lee et al. (1996) and Altinkiliç and Hansen (2000) are sufficient to explain the observed periods of inactivity followed by rebalancing. Recent work by Leary and Robert (2005), Hennessy and Whited (2005), and Strebulaev (2007) seems particularly promising in this respect.

managerial discretion and stockholder-bondholder conflicts are likely quite important relative to taxes. Our findings reproduce the well-known fact that tax effects are relatively hard to clearly identify in the data. Even if taxes are not the full story, they matter at least to some extent (see Graham, 2003). In addition, Hennessy and Whited (2005) show that due to transactions costs, it is possible that tax effects will be hard to identify empirically even when they are an element of the firm's problem. For these reasons, we think that distinguishing the relative importance of the agency costs versus the tax-bankruptcy costs trade-offs deserves further work.

The pecking order theory is often used to explain financing decisions of firms. A significant merit of the pecking order theory is that it predicts the effect of profits correctly (Shyam-Sunder and Myers, 1999). However, as shown by Fama and French (2002) and Frank and Goyal (2003), the theory has other problems.[6] In its current form, the pecking order theory is not helpful in organizing many of the features we see in the way firms finance themselves.

The market timing theory makes correct predictions for the market-to-book assets ratio and the effect of expected inflation. However, by itself market timing does not make any predictions for many of the patterns in the data that are accounted for by the trade-off theory. The market timing theory needs considerable theoretical development to explain all of empirical regularities we observe in the data.

There is no unified model of leverage currently available that can directly account for the six reliable factors. However, the main elements that might be used to create such a theory are present in the literature already. The theory will have to be explicitly intertemporal to reflect the effects of market-to-book and expected inflation. To reflect profits, the theory is likely to have a friction such as significant fixed costs of adjustment or time-to-build. To capture the role of tangibility, it will need to have some role for repossession of assets by the suppliers of debt. The theory might well have a role for financial constraints of some type to explain the effect of firm size.

The rest of this paper is organized as follows. We provide a brief overview of the main prediction of leading capital structure theories in Section I. The data are described in Section II. The factor selection process and results are presented in Section III. This leads to the core model of leverage that is presented in Section IV. The conclusions are presented in Section V.

I. Capital Structure Theories and Their Predictions

This section provides a brief review of the prominent theories of capital structure followed by a summary of predictions on how the theories relate to observable leverage factors. A more detailed review of the capital structure literature is provided by Frank and Goyal (2008).

A. Capital Structure Theories

1. Trade-Off Theory

According to the trade-off theory, capital structure is determined by a trade-off between the benefits of debt and the costs of debt. The benefits and costs can be obtained in a variety of ways. The "tax-bankruptcy trade-off" perspective is that firms balance the tax benefits of debt against the deadweight costs of bankruptcy. The "agency" perspective is that debt disciplines managers and mitigates agency problems of free cash flow since debt must be repaid to avoid

[6] Furthermore, Frank and Goyal (2003) show that the pecking order theory works much better in the 1970s and the 1980s and it performed progressively worse in the 1990s. Huang and Ritter (2007) show that the poor performance of the pecking order in the more recent period coincided with a decline in the equity risk premium.

bankruptcy (Jensen and Meckling, 1976; Jensen, 1986). Although debt mitigates shareholder-manager conflicts, it exacerbates shareholder-debtholder conflicts (Stulz, 1990).

Product and factor market interactions suggest that in some firms, efficiency requires a firm's stakeholders to make significant firm-specific investments. Capital structures that make these firm-specific investments insecure will generate few such investments. Theory suggests that capital structure could either enhance or impede productive interactions among the stakeholders. Titman (1984) argues that firms making unique products will lose customers if they appear likely to fail. Maksimovic and Titman (1991) consider how leverage affects a firm's incentives to offer a high quality product. Jaggia and Thakor (1994) and Hart and Moore (1994) consider the importance of managerial investments in human capital. These perspectives differ from the tax-bankruptcy trade-off in that the costs of debt are from disruption to normal business operations and thus do not depend on the arguably small direct costs of bankruptcy. In other words, the product and factor market interaction based trade-off theories can be viewed as trading off the advantages of debt with liquidation costs rather than bankruptcy costs.

2. Pecking Order Theory

While the pecking order theory has long roots in the descriptive literature, it was clearly articulated by Myers (1984). Consider three sources of funds available to firms—retained earnings, debt, and equity. Equity has serious adverse selection, debt has only minor adverse selection, and retained earnings avoid the problem. From the point of view of an outside investor, equity is strictly riskier than debt. Rational investors will thus revalue a firm's securities when it announces a security issue. For all but the lowest quality firm, the drop in valuation of equity makes equity look undervalued, conditional on issuing equity. From the perspective of those inside the firm, retained earnings are a better source of funds than outside financing. Retained earnings are thus used when possible. If retained earnings are inadequate, debt financing will be used. Equity is used only as a last resort. This is a theory of leverage in which there is no notion of an optimal leverage ratio. Although the pecking order theory is almost always framed in terms of asymmetric information, it can also be generated from tax, agency, or behavioral considerations.[7]

3. Market Timing Theory

Market timing, a relatively old idea (see Myers, 1984), is having a renewed surge of popularity in the academic literature. In surveys, such as those by Graham and Harvey (2001), managers continue to offer at least some support for the idea. Consistent with market timing behavior, firms tend to issue equity following a stock price run-up. In addition, studies that analyze long-run stock returns following corporate financing events find evidence consistent with market timing.[8] Lucas and McDonald (1990) analyze a dynamic adverse selection model that combines elements of the pecking order with the market timing idea, which can explain preissue run-ups but not postissue underperformance. Baker and Wurgler (2002) argue that capital structure is best understood as the cumulative effect of past attempts to time the market.

The basic idea is that managers look at current conditions in both debt and equity markets. If they need financing, they use whichever market currently looks more favorable. If neither market

[7]See, Frank and Goyal (2008) for a discussion of how tax and agency considerations can lead to a hierarchy of financing. Heaton (2002) generates the pecking order using a simple model of optimistic managers.

[8]The evidence that equity issuers have low subsequent abnormal returns shows up in a number of studies (see, e.g., Loughan and Ritter, 1995; Jegadeesh, 2000). Furthermore, Baker and Wurgler (2000) find low returns on the stock market following heavy aggregate stock issuance.

looks favorable, they may defer issuances. Alternatively, if current conditions look unusually favorable, funds may be raised even if the firm has no need for funds currently.

While this idea seems plausible, it has nothing to say about most of the factors traditionally considered in studies of corporate leverage. However, it does suggest that stock returns and debt market conditions will play an important role in capital structure decisions.

B. Predictions

From the existing literature, we extract a long list of factors claimed to have some influence on corporate leverage. This list includes measures of profitability, size, growth, industry, nature of assets, taxation, risk, supply-side constraints, stock market conditions, debt market conditions, and macroeconomic conditions.[9] The Appendix provides a description of these factors. The theories are not developed in terms of standard accounting definitions. To test the theories, it is therefore necessary to make judgments about the connection between the observable data and theory. While many of these judgments seem uncontroversial, there is room for significant disagreement in some cases.

1. Leverage and Profitability

Profitable firms face lower expected costs of financial distress and find interest tax shields more valuable. Thus, the tax and the bankruptcy costs perspective predicts that profitable firms use more debt. In addition, the agency costs perspective predicts that the discipline provided by debt is more valuable for profitable firms as these firms are likely to have severe free cash flow problems (Jensen, 1986).

Recent papers, however, suggest that the trade-off theory predictions on profitability are more complex than those based on static models (see Strebulaev, 2007). In a dynamic trade-off model, leverage can appear to be negatively related to profitability in the data due to various frictions. Empirically, the response has been to argue that leverage and profitability are negatively related because firms passively accumulate profits (see Kayhan and Titman, 2007).[10]

The pecking order theory argues that firms prefer internal finance over external funds. If investments and dividends are fixed, then more profitable firms will become less levered over time.

Measure: Profitability

2. Leverage and Firm Size

Large, more diversified, firms face lower default risk. In addition, older firms with better reputations in debt markets face lower debt-related agency costs. Thus, the trade-off theory predicts larger, more mature firms to have relatively more debt.

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[9] We do not include "derived" factors included in several previous papers. Thus, we do not consider the Titman and Wessels (1988) version of nondebt tax shields, the Graham (1996) version of trichotomous tax variable, the *Z*-score factor, and the Korajczyk and Levy (2003) measure of financial constraints. These factors are constructed from factors that are already in our list and are consequently highly correlated with the factors that we consider. In general, we do not consider alternative choices, which are highly correlated with the factors we include in the study. For example, we measure firm size using log of assets. An alternative is log of sales. The two are highly correlated ($\rho = 0.92$). Similarly, high correlations exist between profitability and a loss-making indicator variable ($\rho = -0.63$), change in assets and change in sales ($\rho = 0.51$), tangibility and collateral value ($\rho = 0.75$), term spread and quality spread ($\rho = -0.82$), T-bill rate and expected inflation ($\rho = 0.76$), and purchasing manager's sentiment index and macrogrowth ($\rho = 0.78$).

[10] However, Chen and Zhao (2005) conclude that neither transaction costs nor taxes can properly explain the negative relation between leverage and profitability.

The pecking order theory is usually interpreted as predicting an inverse relation between leverage and firm size and between leverage and firm age. Large firms are better known, as they have been around longer. In addition, older firms have had an opportunity to retain earnings.

Measures: 1) Log of assets and 2) Mature firms

3. Leverage and Growth

Growth increases costs of financial distress, reduces free cash flow problems, and exacerbates debt-related agency problems.[11] Growing firms place a greater value on stakeholder coinvestment. Thus, the trade-off theory predicts that growth reduces leverage.

By contrast, the pecking order theory implies that firms with more investments—holding profitability fixed—should accumulate more debt over time. Thus, growth opportunities and leverage are positively related under the pecking order theory.

The market-to-book asset ratio is the most commonly used proxy for growth opportunities. Adam and Goyal (2008) show that it is also the most reliable. A higher market-to-book ratio, however, may also be influenced by stock mispricing. If market timing drives capital structure decisions, a higher market-to-book ratio should reduce leverage as firms exploit equity mispricing through equity issuances. Furthermore, a mechanical negative relation may exist between a market-based definition of leverage and the market-to book assets ratio.

Capital expenditures and the change in log assets, which are also proxies for growth, represent outflows. They directly increase the financing deficit as discussed in Shyam-Sunder and Myers (1999). These variables should therefore be positively related to debt under the pecking order theory.

Measures: 1) Market-to-book ratio, 2) Change in log assets, and 3) Capital-expenditure-to-assets ratio

4. Leverage and Industry Conditions

It is well known that leverage ratios exhibit significant variation across industries. Textbooks in corporate finance such as Ross, Westerfield, and Jaffe (2008) routinely point to interindustry differences in debt ratios. More formal tests are presented in Lemmon, Roberts, and Zender (2008). Industry differences in leverage ratios have several possible meanings. One interpretation is that managers perhaps use industry median leverage as a benchmark as they contemplate their own firm's leverage. Thus, industry median leverage is often used as a proxy for target capital structure (see, e.g., Gilson, 1997; Hull, 1999; Hovakimian, Opler, and Titman, 2001; Faccio and Masulis, 2005; Flannery and Rangan, 2006). Hovakimian, Opler, and Titman (2001) provide evidence consistent with firms actively adjusting their debt ratios towards the industry average.

Another interpretation is that industry effects reflect a set of correlated, but otherwise omitted, factors.[12] Firms in an industry face common forces that affect their financing decisions. These could reflect product market interactions or the nature of competition.[13] These could also reflect industry heterogeneity in the types of assets, business risk, technology, or regulation. Industry factors do not have a unique interpretation.

We consider two industry variables—industry median growth and industry median leverage. Trade-off theory predicts that higher industry median growth should result in less debt, while

[11] Growth could also be a manifestation of free cash flow, which can be used by managers to build empires.

[12] Hovakimian, Hovakimian, and Tehranian (2004) follow this interpretation and include industry leverage to control for omitted factors. It is also possible to give industry a more structural interpretation. Almazan and Molina (2005) and Mackay and Phillips (2005) interpret industry in terms of relatively specialized industry equilibrium models.

[13] See Brander and Lewis (1986) and Chevalier (1995).

higher industry median leverage should result in more debt. Finally, we consider if firms are regulated. Regulated firms have stable cash flows and lower expected costs of financial distress. Thus, regulated firms should have more debt. But, at the same time, managers have less discretion in regulated firms, which reduces the severity of shareholder-manager conflicts and makes debt less desirable from a control perspective. Trade-off theory makes an ambiguous prediction on the effect of regulation on leverage.

Under a pure pecking order perspective, the industry should only matter to the extent that it serves as a proxy for the firm's financing deficit—a rather indirect link. Under the market timing theory, the industry should matter only if valuations are correlated across firms in an industry.

Measures: 1) Median industry leverage, 2) Median industry growth, and 3) Regulated dummy

5. Leverage and Nature of Assets

Tangible assets, such as property, plant, and equipment, are easier for outsiders to value than intangibles, such as the value of goodwill from an acquisition—this lowers expected distress costs. In addition, tangibility makes it difficult for shareholders to substitute high-risk assets for low-risk ones. The lower expected costs of distress and fewer debt-related agency problems predict a positive relation between tangibility and leverage. An analogous prediction is that firms making large discretionary expenditures such as SG&A expenses and R&D expenses have more intangible assets and consequently less debt.

Stakeholder coinvestment theory suggests that firms producing unique products (such as durable goods) should have less debt in their capital structure (Titman, 1984). Firms in unique industries have more specialized labor, which results in higher financial distress costs and consequently less debt. To protect unique assets that result from large expenditures on SG&A and R&D, these firms will have less debt.

The pecking order theory makes opposite predictions. Low information asymmetry associated with tangible assets makes equity issuances less costly. Thus, leverage ratios should be lower for firms with higher tangibility. However, if adverse selection is about assets in place, tangibility increases adverse selection and results in higher debt. This ambiguity under the pecking order theory stems from the fact that tangibility can be viewed as a proxy for different economic forces. Furthermore, R&D expenditures increase the financing deficit. R&D expenditures are particularly prone to adverse selection problems and affect debt positively under the pecking order theory.

Measures: 1) Tangibility, 2) R&D expense/sales, 3) Uniqueness dummy, and 4) Selling, general, and administrative expense/sales ratio

6. Leverage and Taxes

High tax rates increase the interest tax benefits of debt. The trade-off theory predicts that to take advantage of higher interest tax shields, firms will issue more debt when tax rates are higher. DeAngelo and Masulis (1980) show that nondebt tax shields are a substitute for the tax benefits of debt financing. Nondebt tax shield proxies—that is, net operating loss carryforwards, depreciation expense, and investment tax credits—should be negatively related to leverage.

Measures: 1) Top tax rate, 2) NOL carryforwards/assets, 3) Depreciation/assets, and 4) Investment tax credit/assets

7. Leverage and Risk

Firms with more volatile cash flows face higher expected costs of financial distress and should use less debt. More volatile cash flows reduce the probability that tax shields will be fully utilized.

Risk is detrimental for stakeholder coinvestment. Thus higher risk should result in less debt under the trade-off theory.

We might expect firms with volatile stocks to be those about which beliefs are quite volatile. It seems plausible that such firms suffer more from adverse selection. If so, then the pecking order theory would predict that riskier firms have higher leverage. Also, firms with volatile cash flows might need to periodically access the external capital markets.

Measure: Variance of stock returns

8. Leverage and Supply-Side Factors

Faulkender and Petersen (2006) argue that supply-side factors are important in explaining the variation in capital structure. When firms have restricted access to debt markets, all else equal, financing takes place through equity markets. Less debt is issued because of restricted debt market access. The proxy they use for access to debt markets is whether the firm has rated debt. Firms with a debt rating are expected to have more debt, ceteris paribus.

From a pecking order perspective, however, possessing a credit rating involves a process of information revelation by the rating agency. Thus, firms with higher ratings have less of an adverse selection problem. Accordingly, firms with such ratings should use less debt and more equity. But this is ambiguous since less adverse selection risk increases the frequency with which the external capital market is accessed, which would result in more debt.

Measure: Debt rating dummy

9. Leverage and Stock Market Conditions

Welch (2004) argues that firms do not rebalance capital structure changes caused by stock price shocks and therefore stock returns are "considerably more important in explaining debt–equity ratios than all previously identified proxies together." Market timing theories make similar predictions, but the effects come from managers actively timing equity markets to take advantage of mispricing. Time-varying adverse selection could also result in a negative relation between stock prices and leverage. Choe, Masulis, and Nanda (1993) show that at the aggregate level, seasoned equity issues are procyclical while debt issues are countercyclical. Korajczyk, Lucas, and McDonald (1990), Bayless and Chaplinsky (1991), and many other authors show that firms issue equity following price run-ups. In summary, the effect of stock prices on leverage could reflect 1) growth (as discussed previously), 2) changes in the relative prices of asset classes (reflecting changes in aggregate conditions), 3) market timing (reflecting changes in firm-specific conditions), and 4) changes in adverse selection costs. The prediction that strong market performance results in a reduction in market leverage could be derived from any of the leading capital structure theories. Static trade-off models would predict that low market debt ratios ought to encourage a company to issue debt in an attempt to move towards the optimum, which would have the effect of raising book debt ratios following high stock returns. The market timing theory, on the other hand, makes the contrary prediction that book debt ratios should fall following high stock returns as firms issue equity.

Measures: 1) Cumulative raw returns and 2) Cumulative market returns

10. Leverage and Debt Market Conditions

According to Taggart (1985), the real value of tax deductions on debt is higher when inflation is expected to be high. Thus, the trade-off theory predicts leverage to be positively related to expected inflation. Market timing in debt markets also results in a positive relation between

expected inflation and leverage if managers issue debt when expected inflation is high relative to current interest rates.[14] Barry et al. (2008) find that firms issue more debt when current interest rates are low relative to historical levels.

The term spread is considered a credible signal of economic performance and expected growth opportunities. If a higher term spread implies higher growth, then term spread should negatively affect leverage.

Measures: 1) Expected inflation rates, and 2) Term spread

11. Leverage and Macroeconomic Conditions

Gertler and Gilchrist (1993) show that subsequent to recessions induced by monetary contractions, aggregate net debt issues increase for large firms but remain stable for small firms. During expansions, stock prices go up, expected bankruptcy costs go down, taxable income goes up, and cash increases. Thus, firms borrow more during expansions. Collateral values are likely to be procyclical too. If firms borrow against collateral, leverage should again be procyclical.

However, agency problems are likely to be more severe during downturns as manager's wealth is reduced relative to that of shareholders. If debt aligns managers incentives with those of shareholders, leverage should be countercyclical.

If pecking order theory holds, leverage should decline during expansions since internal funds increase during expansions, all else equal. If corporate profits have shown an increase in the recent past, agency problems between shareholders and managers are less severe. Consequently, firms should issue less debt.

Measures: 1) Growth in profit after tax and 2) Growth in GDP

II. Data Description

The sample consists of US firms on Compustat for the period from 1950 to 2003. The data are annual and are converted to 1992 dollars using the GDP deflator. The stock return data are from the Center for Research in Security Prices (CRSP) database. The macroeconomic data are from various public databases. These sources are described in the Appendix. Financial firms and firms involved in major mergers (Compustat footnote code AB) are excluded. Also excluded are firms with missing book value of assets. The ratios used in the analysis are winsorized at the 0.50% level in both tails of the distribution. This serves to replace outliers and the most extremely misrecorded data.[15]

A. Defining Leverage

Several alternative definitions of leverage have been used in the literature. Most studies consider some form of a debt ratio. These differ according to whether book measures or market values are used. They also differ in whether total debt or only long-term debt is considered. One can also

[14] See Ritter and Warr (2002) for a discussion of how inflation can induce valuation errors in equity markets, resulting in undervaluation of equity when inflation is high.

[15] Prior to trimming, several balance sheet and cash flow statement items are recoded as zero if they were reported missing or combined with other data items in Compustat. The data are often coded as missing when a firm does not report a particular item or combines it with other data items. Table 8 of Frank and Goyal (2003) identifies variables coded as zero when reported missing or combined with other items. Winsorizing is the procedure of replacing extreme values with the value of the observations at the cutoffs. Only variables constructed as ratios are winsorized.

consider the interest coverage ratio as a measure of leverage (see Welch, 2004).[16] Finally, firms have many kinds of assets and liabilities and a range of more detailed adjustments can be made.

In the empirical work, we study four alternative definitions of leverage: 1) the ratio of total debt to market value of assets (TDM), 2) the ratio of total debt to book value of assets (TDA), 3) the ratio of long term debt to market value of assets (LDM), and 4) the ratio of long-term debt to book value of assets (LDA).[17] Most studies focus on a single measure of leverage.

We take TDM to be the main focus. In the literature, it is common to find claims that the crucial results are robust to alternative leverage definitions. Having reviewed many such robustness claims, we expected the results to be largely robust to the choice among the four measures. In most regards, this is reassuring. But the robustness of many results to large differences between alternative measures is sometimes troublesome. Cross-sectional tests may be more robust to the measure used than time-series tests if macro variation can be netted out. For example, the ratio of the market value of equity to the book value of equity soared between 1974-1982 and 1999-2000 for the median firm.

B. Descriptive Statistics

Table I provides descriptive statistics. The median leverage is below the mean leverage. There is a large cross-sectional difference so that the 10th percentile of TDM is 0 while the 90th percentile is 0.67. Several factors have mean values that diverge sharply from the medians.

To explore changes in US corporate balance sheets and cash flow statements over time, median balance sheets normalized by total assets for US firms from 1950 to 2003 are presented in Appendix Table AI and median corporate cash flow statements normalized by end-of-year total assets are presented in Appendix Table AII. These tables reveal significant time-series variation in the structure of balance sheets and cash flow statements of US firms.[18] Cash levels fell until the 1970s and then built back up. Inventories declined by almost half while net property, plant, and equipment had a more modest decline. Intangibles have become increasingly important in recent periods. Current liabilities, especially "current liabilities–other," have also increased. This category has risen from being trivial to accounting for about 8% of the average firm's liabilities. Long-term debt rose early in the period but has been fairly stable over the period 1970-2003. The net effect of the various changes is that total liabilities rose from about 35% of assets to more than 53% of assets while common book equity had a correspondingly large decline.

The changes to the cash flows are also fairly remarkable. Both sales and the cost of goods as a fraction of assets fell dramatically. The selling, general, and administrative expenses more than doubled over the period. As a result, the median firm has negative pretax income by the end of the period. Increasingly, it seems that public firms include currently unprofitable firms with

[16]The interest coverage ratio is normally defined as operating income before depreciation divided by interest expense. A high interest coverage ratio means less leverage since earnings are large relative to debt payments. We find that the interest coverage ratio has a highly skewed distribution and it did poorly in most of the tests we examined. We do not report these results. A drawback to interest coverage is that corporate earnings are reportedly smoothed by managers who may attempt to portray a positive picture of health while it remains feasible to do so. Periodically, they take a "big bath" and may even exaggerate the losses. This may help to explain why the measure performs so poorly.

[17]Beyond the four measures we consider, many other leverage definitions can be considered. Some scholars regard corporate cash holdings as negative debt and hence subtract cash from the debt measure. Similarly, corrections can also be made for a range of other assets and liabilities such as deferred taxes, accounts payable, pension liabilities, and others. It is important to understand that we have not carried out a full comparison of all treatments of all candidate leverage definitions.

[18]Some of the variation could be attributed to the exclusion of most small firms from the Compustat universe in the 1960s and, especially, the 1950s.

Table I. Data Description for Publicly Traded, Nonfinancial US Companies, 1950-2003

The leverage measures and factors (other than assets, indicator variables and macrovariables) are winsorized at the 0.50% level in both tails of the distribution before the summary statistics are calculated. The cutoffs are determined for the aggregate sample. The sample period is 1950-2003. Financial firms and firms involved in major mergers (Compustat footnote code AB) are excluded. The variables are defined in the Appendix.

Variable	*N*	Mean	*SD*	Distribution		
				10th	50th	90th
Leverage measures						
TDM	203,211	0.28	0.26	0.00	0.22	0.67
TDA	246,187	0.29	0.35	0.00	0.24	0.59
LDM	203,211	0.20	0.21	0.00	0.13	0.52
LDA	250,785	0.20	0.22	0.00	0.14	0.46
Factors						
Profitability						
Profit	247,348	0.02	0.47	−0.19	0.12	0.25
Firm size						
Assets	251,073	4.58	2.43	1.48	4.57	7.80
Mature	272,537	0.64	0.48	0.00	1.00	1.00
Growth						
Mktbk	203,207	1.76	2.87	0.51	1.00	3.23
ChgAsset	228,313	0.05	0.43	−0.26	0.00	0.41
Capex	251,073	0.07	0.09	0.00	0.05	0.17
Industry						
IndustLev	18,514	0.25	0.20	0.08	0.24	0.43
IndustGr	18,223	0.02	0.15	−0.10	0.00	0.14
Regultd	272,537	0.05	0.21	0.00	0.00	0.00
Nature of assets						
Tang	249,482	0.34	0.25	0.06	0.28	0.74
RnD	246,472	0.14	0.95	0.00	0.00	0.11
Unique	272,537	0.27	0.44	0.00	0.00	1.00
SGA	246,472	0.38	1.10	0.00	0.18	0.57
Taxes						
TaxRate	54	0.45	0.07	0.35	0.48	0.52
NOLCF	190,914	0.49	2.41	0.00	0.00	0.70
Depr	251,073	0.05	0.06	0.00	0.04	0.09
InvTaxCr	240,099	0.00	0.01	0.00	0.00	0.00
Risk						
StockVar	160,436	0.27	0.40	0.03	0.13	0.62
Supply-side factors						
Rating	272,537	0.05	0.22	0.00	0.00	0.00
Stock market conditions						
StockRet	169,891	0.14	0.66	−0.51	0.04	0.81
CrspRet	173,218	0.12	0.17	−0.11	0.14	0.33
Debt market conditions						
TermSprd	54	0.01	0.01	0.00	0.01	0.03
Macroeconomic conditions						
Inflation	54	0.03	0.02	0.01	0.03	0.06
MacroProf	54	−0.02	0.17	−0.25	−0.02	0.17
MacroGr	54	0.03	0.02	0.00	0.04	0.06

expectations of future profitability, a pattern also noted by Fama and French (2001) and DeAngelo, DeAngelo, and Skinner (2004). We also find that corporate income taxes have declined over time. This is not surprising, since the statutory tax rates have dropped and the average includes more unprofitable firms. The median firm both issues and reduces a significant amount of debt each year.

III. Empirical Evidence on Factor Selection

We begin by reporting the correlations between the factors and each of the leverage measures in Table II. Beneath each correlation, the pluses and minuses indicate the fraction of the time the correlation was of a particular sign and statistically significant at the 1% level. The sample period from 1950 to 2003 is divided into six periods—the five decades and the last period consisting of the period 2000-2003. A single + means that the correlation was positive and significant in at least two out of six periods. A ++ means that the correlation was positive and significant in four out of six periods. A +++ means that the correlation was positive and significant in every period. The −, −−, and −−− are analogously defined for the negative and significant cases. A −+ indicates that the correlations are negative and significant for at least two out of six periods and positive and significant for at least another two periods. A −−+ indicates that the correlations are negative and significant in four periods and positive and significant for the other two periods. Similarly, a ++− indicates that the correlations are positive and significant for four periods and negative and significant for the other two periods.

In every period, positive and significant correlations with leverage (TDM) are found for: log of assets, median industry leverage, the dummy for being regulated, and tangibility. Similarly, powerful negative correlations are found for: the market-to-book ratio; R&D expenses; uniqueness; selling, general, and administration expenses; the variance of stock returns; cumulative stock returns; and term spread. With some exceptions, the factors identified here exhibit similar correlations with the alternative leverage definitions.

Unconditional correlations are interesting, but more important are the effects of a factor when other factors are also present in the analysis. Linear regressions are used to study the effects of the factors. Let $L_{i,t}$ denote the leverage of firm i on date t. The set of factors observed at firm i at date $t-1$ is denoted $F_{i,t-1}$, The constant α and the vector β are the parameters to be estimated. The factors are lagged one year so that they are in the information set. To remove the effects of clustering on the estimated standard errors, we use t-statistics corrected for clustering at both the firm and the year level in our tests, as suggested by Petersen (2009).[19] The basic model is:

$$L_{i,t} = \alpha + \beta F_{i,t-1} + \varepsilon_{i,t}. \tag{1}$$

We have a long list of factors. In the interest of parsimony, it is desirable to remove inessential factors. Hastie, Tibshirani, and Friedman (2001) describe many methods that can be used to decide which factors to keep and which to drop. The Akaike information criterion (AIC) and the Bayesian information criterion (BIC) are the two most commonly used model selection criteria and we have tried both.[20] Let P be the number of parameters and let N be the number of

[19]We thank Petersen for the Stata ado file for two-dimensional clustering. This file can be obtained from: http://www.kellogg.northwestern.edu/faculty/petersen/htm/papers/se/se_programming.htm.

[20]An alternative would be to examine the underlying correlations among factors in a principal components (or factors analysis) framework as in Titman and Wessels (1988). These methods have both strengths and weaknesses relative to regression analysis. Although we have carried out such tests, we prefer the regressions approach since the regression coefficients are more familiar and easier to interpret. The basic patterns in the data show up rather similarly under either approach.

Table II. Correlations between Leverage Ratios and Factors

This table presents correlation coefficients between leverage measures and various leverage factors. The variables are defined in the Appendix. In square brackets below the correlation coefficients, we present a summary of the period-by-period correlations. The sample period from 1950 to 2003 is broken up into six periods—five decades and the last period consisting of 2000-2003. A + indicates that the correlation was positive and significant in at least two out of six periods. A ++ indicates that the correlation was positive and significant in at least four out of six periods. A +++ indicates that it was significant and positive in every period. The −, −−, and −−− are analogously defined for the negative and significant cases. A −+ indicates that the correlations are negative and significant in at least two out of six periods and positive and significant in at least two other periods. A −−+ indicates that the correlations are negative and significant in four out of six periods and positive and significant in the other two periods. Similarly, a ++− indicates that the correlations are positive and significant in four out of six periods and negative and significant in the other two periods.

	Total Debt/Market Assets (TDM)	Total Debt/Book Assets (TDA)	Long-Term Debt/Market Assets (LDM)	Long-Term Debt/Book Assets (LDA)
Profit	0.055***	−0.334***	0.116***	−0.001
	[−+]	[−−−]	[−+]	[−+]
Assets	0.204***	−0.098***	0.311***	0.179***
	[+++]	[−−+]	[+++]	[+++]
Mature	0.125***	−0.014***	0.139***	0.031***
	[++]	[−+]	[++]	[+]
Mktbk	−0.282***	0.196***	−0.264***	−0.060***
	[−−−]	[−+]	[−−−]	[−−]
ChgAsset	−0.144***	−0.159***	−0.076***	−0.046***
	[−−]	[−−+]	[−−]	[−−+]
Capex	−0.022***	0.032***	0.029***	0.071***
	[−−]	[+++]	[++]	[++]
IndustLev	0.436***	0.267***	0.426***	0.360***
	[+++]	[+++]	[+++]	[+++]
IndustGr	−0.137***	−0.059***	−0.106***	−0.035***
	[−−]	[−−+]	[−−]	[−+]
Regultd	0.192***	0.069***	0.242***	0.171***
	[+++]	[+++]	[+++]	[+++]
Tang	0.261***	0.142***	0.345***	0.286***
	[+++]	[+++]	[+++]	[+++]
RnD	−0.127***	−0.009***	−0.116***	−0.057***
	[−−−]	[−]	[−−−]	[−−−]
Unique	−0.106***	−0.059***	−0.138***	−0.112***
	[−−−]	[−−−]	[−−−]	[−−−]
SGA	−0.136***	0.055***	−0.148***	−0.064***
	[−−−]	[++]	[−−]	[−−−]
TaxRate	0.081***	−0.049***	0.092***	−0.003
	[−]	[−]	[−+]	[−]
NOLCF	−0.049***	0.356***	−0.101***	0.036***
	[−+]	[+++]	[−]	[++]
Depr	0.040***	0.231***	−0.001	0.088***
	[++]	[++]	[+]	[++]
InvTaxCr	0.142***	0.025***	0.186***	0.089***
	[++]	[++]	[++]	[++]

(*Continued*)

Table II. Correlations between Leverage Ratios and Factors (*Continued*)

	Total Debt/Market Assets (TDM)	Total Debt/Book Assets (TDA)	Long-term Debt/Market Assets (LDM)	Long-term Debt/Book Assets (LDA)
StockVar	−0.253***	−0.144***	−0.263***	−0.193***
	[−−−]	[−−]	[−−−]	[−−−]
Rating	0.029***	0.002	0.064***	0.055***
	[+]	[−]	[+]	[+]
StockRet	−0.180***	−0.090***	−0.114***	−0.033***
	[−−−]	[−−]	[−−−]	[−−]
CrspRet	−0.058***	−0.005**	−0.035***	0.011***
	[−−]	[−]	[−−]	[+]
TermSprd	−0.047***	0.020***	−0.043***	−0.004**
	[−−−]	[0]	[−−−]	[−]
Inflation	0.187***	0.025***	0.170***	0.035***
	[++]	[−+]	[++]	[+]
MacroProf	−0.009***	−0.014***	0.001	−0.009***
	[−−]	[−−]	[−]	[−]
MacroGr	−0.062***	−0.032***	−0.042***	−0.017***
	[−−]	[−−]	[−−]	[−]

***Significant at the 0.01 level.

**Significant at the 0.05 level.

observations in a fitted model. The BIC is defined as follows,

$$\text{BIC} = -2 \times \text{log-likelihood} + P \times \log(N). \tag{2}$$

The AIC is measured similarly, but with the number 2 replacing $\log(N)$ in the definition. Both the BIC and AIC have a sensible structure. In each case, smaller is better. As the log-likelihood increases, both measures fall. As the number of parameters increases, both measures increase. As the number of observations increases, so does the BIC.

The BIC is asymptotically consistent. In other words, suppose that you have a family of possible models that includes the true model. Then as the sample size grows to infinity, the probability that the BIC will pick the true model approaches one. In small samples it is not clear whether the AIC or BIC is better. Since $\log(N) > 2$, the BIC tends to select a more parsimonious model. In our analysis, they routinely produce the same answers. Thus, we only report the BIC. For a useful discussion of the relative merits of many approaches to model selection, including both the AIC and BIC, see Hastie, Tibshirani, and Friedman (2001).

Robustness of conclusions is extremely important. For this reason, in addition to overall results, we systematically consider the results for subsamples. Reliably important results should be robust across subsamples. We therefore generate 10 random subsamples of the data and repeat the analysis on each of these groups. We also consider annual cross-sections.

Table III presents the results of this selection process. Columns (1) to (5) illustrate the method that generates the minimum BIC specification for the overall sample. To understand these columns, start at the bottom of the table and estimate Equation (1) with all the factors. Report the adjusted R^2 in Column (4) and the BIC in Column (5). Then remove the factor with the

Table III. Core Factor Selection Using Market Leverage as the Dependent Variable

The table reports the variation in leverage explained by various factors. The factors are defined in the Appendix and are lagged by one year. Leverage is defined as TDM. We begin with the regression that includes all factors and report the R^2 (in the cumulative R^2 column) and the Bayesian information criterion (in the BIC column) at the bottom of the table. The standard errors are corrected for clustering at both the firm level and the year level. The coefficient estimate and the *t*-statistic of the factor that has performed worst (the lowest *t*-statistic) are also reported at the bottom of the table. "Own" reports the R^2 from simple univariate regressions of the leverage measure on this factor. We then delete the worst-performing variable, run the regression with the remaining variables, and report the R^2 and the BIC in the second to the bottom cell in the table. Thus, "Cumulative" reports R^2 from a regression that includes the variable listed, along with all variables listed above it. We then continue in this manner all the way up the table. The variables are listed in the order of the amount of additional variation explained. "Group Positive%" reports the percentage of instances for which the given factor has a positive sign and is included in the minimum BIC specification in 10 equally sized random subsamples. "Group Negative%" reports the percentage of instances for which the given factor has a negative sign and is included in the minimum BIC specification in 10 equally sized random sub-samples. The data are also run on each of the 54 years independently. These results are summarized in columns labeled "Year Positive%" and "Year Negative%," which report the percentage of instances for which the given factor was included in the minimum BIC specification and for which the coefficient had the indicated sign.

Factor	Coefficient Estimate	*t*-stat	Own R^2	Cumulative R^2	BIC	Group Positive%	Group Negative%	Year Positive%	Year Negative%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IndustLev	0.849	32.7	0.19	0.19	−17,288.4	100.0	0.0	100.0	0.0
Tang	0.124	11.7	0.06	0.20	−20,243.7	100.0	0.0	55.8	0.0
Mktbk	0.018	−6.6	0.07	0.23	−27,101.4	0.0	100.0	0.0	82.7
SGA	0.003	−2.7	0.02	0.24	−27,750.5	0.0	80.0	0.0	40.4
RnD	0.002	−1.6	0.02	0.24	−27,751.8	0.0	20.0	0.0	17.3
Profit	−0.135	−7.8	0.00	0.26	−32,588.1	0.0	100.0	0.0	100.0
Assets	0.009	6.6	0.05	0.27	−33,616.5	90.0	0.0	57.7	0.0
Rating	−0.056	−5.0	0.00	0.27	−34,145.6	0.0	50.0	0.0	32.7
Capex	−0.135	−3.6	0.00	0.28	−34,478.0	0.0	40.0	9.6	25.0
Inflation	1.325	4.7	0.03	0.26	−36,925.7	100.0	0.0	NA	NA
NOLCF	0.003	−1.2	0.00	0.28	−32,956.7	0.0	0.0	1.9	7.7
StockRet	0.030	−4.6	0.02	0.28	−31,178.9	0.0	80.0	1.9	38.5
Regultd	0.059	3.7	0.03	0.29	−31,275.9	0.0	0.0	21.2	0.0
StockVar	0.030	−3.5	0.05	0.29	−31,176.4	0.0	30.0	0.0	32.7
InvTaxCr	−1.692	−3.4	0.02	0.29	−28,240.5	0.0	0.0	3.8	3.8
ChgAsset	0.026	3.2	0.01	0.29	−27,990.0	10.0	0.0	23.1	7.7
Unique	0.010	−2.2	0.01	0.29	−28,027.8	0.0	10.0	1.9	19.2
MacroGr	0.656	1.9	0.00	0.29	−28,416.0	50.0	0.0	NA	NA
TermSprd	−0.703	−1.2	0.00	0.29	−28,536.5	0.0	10.0	NA	NA
IndustGr	0.024	1.0	0.01	0.29	−28,537.3	0.0	0.0	0.0	0.0
Depr	0.039	0.7	0.00	0.29	−28,530.9	0.0	0.0	3.8	5.8
Mature	0.004	0.6	0.02	0.29	−28,524.5	0.0	0.0	11.5	11.5
MacroProf	0.015	−0.5	0.00	0.29	−28,523.9	0.0	0.0	NA	NA
TaxRate	0.032	−0.3	0.01	0.29	−28,518.5	0.0	0.0	NA	NA
CrspRet	0.000	0.0	0.00	0.29	−28,506.9	0.0	0.0	7.7	0.0

lowest *t*-statistic (in this case, it is the cumulative market return or CrspRet). Report the coefficient estimate and the *t*-statistic in columns (1) and (2) for the one-variable regression using this variable. Reestimate a regression of leverage on cumulative market return and report the R^2 from this regression in Column (3). Next, recalculate all statistics on the reduced sample that includes all factors except the cumulative market return. This improves the model slightly as the BIC drops from −28,507 to −28,519. Next, remove the factor with the lowest *t*-statistic and recalculate. This time it is the top tax rate (TaxRate). This process continues removing one factor at a time until at the top of the table only a single factor remains—the median industry leverage.[21]

[21] One concern with the industry median leverage variable is the possibility that some industries may have very few firms. This may bias the coefficient estimates. We examine this possibility in two ways. First, in unreported tests, we redefine

In columns (6) and (7), we randomly partition the data into 10 equal groups. The exercise to identify the minimum BIC specification is repeated on each group separately. The heading "Group Positive %" lists the percentage of groups for which the given factor was included in the minimum BIC specification and had the indicated sign. Similarly, "Group Negative %" lists the percentage of groups for which the given factor was included in the minimum BIC specification and had the indicated sign. In columns (8) and (9), we repeat the minimum BIC selection process for each year of data run separately. Since the macro factors have only a single observation in each year, they are excluded from the year-specific tests.

The selection of core factors is based on how often a factor is included in the minimum BIC specification in repeated runs of the sample. To be considered, as a rule of thumb, we require a factor to be included in at least 50% of the minimum BIC specifications. The core factors that result from this process include 1) Industry median leverage, 2) Tangibility, 3) Market-to-book assets ratio, 4) Profitability, 5) Log of assets, and 6) Expected inflation.[22] These six factors account for about 29% of the variation in the data. We have also examined the performance of the variables one at a time to ensure that major variables are not being excluded from the final model due to a quirk of path dependence in the selection process. We find no evidence of a path-dependence problem.

Much of the focus so far has been on a market-based definition of leverage (TDM). As indicated earlier, this definition is frequently used in the literature, but a range of alternative definitions have been used in other studies. The six main factors are fairly, but not perfectly, robust. In unreported results, we find that for LDM, the robust factors would be industry median leverage, tangibility, profitability, log of assets, and the selling, general, and administrative expenses-to-sales ratio. If we consider TDA, the list includes industry median leverage, tangibility, profitability, and net operating loss carryforwards. If we consider LDA, the list includes industry median leverage, tangibility, assets, profitability, and stock return variance. Overall, we can conclude that industry median leverage, tangibility, and profitability appear as robust factors in various definitions of leverage.

We are not aware of any theory that satisfactorily accounts for the differences that are observed between those factors that influence the alternative definitions of leverage. It is possible that the market-to-book assets ratio appears as a robust factor in TDM because the effect of the market-to-book ratio may be operating through an effect on the value of equity more than through the effect on the value of debt. There is a mechanical negative relation when market leverage is used, but not when book leverage is used. Inflation may similarly be affecting stock prices, thus affecting market leverage ratios more than the book leverage ratios. Ritter and Warr (2002) argue that investors misinterpret the effects of inflation, which results in inflation-induced valuation errors in equity markets.

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industry at the three-digit level and estimate the factor selection exercise. This yielded coefficient estimates that are virtually identical to those reported in Table III. Second we also tried excluding industries that have fewer than four firms. This resulted in exclusion of roughly 1/10th of 1% of our sample. Again, the results did not change materially.

[22] Appendix Table AIII presents results from the core model selection exercise when industry variables are excluded from the analysis. The results show that the remaining five core factors continue to be included. In addition, three other factors appear important. These are 1) indicator variable for regulated firms, 2) selling general and administrative expenses, and 3) macroeconomic growth. The result that industry median leverage replaces regulated firm dummy is consistent with the survey findings of Graham and Harvey (2001) in which managers of regulated firms report that they consider industry debt ratios as important in determining their own firm leverage. Bradley, Jarrell, and Kim (1984) also find that a large part of the cross-industry variation in leverage can be explained by regulated firms. It is not clear what industry effects are picked up by SG&A expense-to-sales ratio and macroeconomic growth.

A. Financially Constrained versus Unconstrained Firms

Myers (2003) has argued that "the theories are conditional, not general." They work better in some conditions than in others. The recent literature has focused on financial constraints as having a significant effect on how firms finance themselves (see, e.g., Lemmon and Zender, 2004). We therefore examine if the factors affect leverage differently for firms that are relatively more financially constrained. To classify firms into those that are constrained and those that are not, we rely on dividend paying status, firm size, and the market-to-book assets ratio. Firms that pay dividends, those that are larger, and those with low growth opportunities should find it relatively easy to raise external financing. Table IV presents results for subsamples of firms classified based on these three criteria. For each subsample, we repeat the Table III exercise and then report how often the factor is included for that class of firms in annual cross-sections. For simplicity we use a 50% cutoff rule of thumb for inclusion.

Table IV shows that none of the excluded factors should be added back to the set of six core factors. On the other hand, some of the six included factors do not perform as well for certain types of firms. The most important point about Table IV is the remarkable similarity of effects across the classes of firms. Clearly, there are some differences. However, the basic patterns are very similar for different types of firms. It seems that financing constraints at least as measured in this manner do not have a big effect on our interpretation of the evidence.

IV. Parameter Estimates for the Core Leverage Model

The analysis in Section III has provided a set of factors that are reliably important for leverage.[23] The next task is to estimate Equation (1) using the factors. Table V provides parameter estimates from the core model along with t-statistics computed using standard errors corrected for clustering both by firm and by year.[24]

In Column (1) of Table V, an overall regression model is reported that makes use of the available data for "All Years." In columns (2) to (7) of Table V, estimates are presented on a decade-by-decade basis and for the four years in the 2000-2003 period. Over the decades there is a worsening in the ability of the set of factors to explain leverage. In the 1950s, these factors account for 42% of the variation in leverage. In the early 2000s, they account for only about 24% of the variation.[25]

The impact of profits declines sharply. Panel A of Table V reports that, in the 1950s, the estimated coefficient on profitability was -0.54, while in the early 2000s, it had declined to -0.05. This is a truly remarkable decline in the importance of profits. At the same time, the effects of firm size and dividend paying status have both increased in economic importance.

[23] In the working paper version of this paper we show that the dividend paying dummy works empirically. Whether to include that factor or not is an issue on which we have found that different scholars have different opinions. For those wishing to see the versions of the tables that include the dividend-paying dummy factor, see http://ssrn.com/abstract=567650. The coefficient estimates for the dividend dummy are also reported in Column (9) of Table V.

[24] Using panel regressions with either fixed effects or random effects leads to the same conclusions. This means that the factors help us to understand both the differences between firms as well as the differences for a given firm across time.

[25] By way of comparison Rajan and Zingales (1995) suggest a basic model with four factors: tangibility, sales, market-to-book assets ratio, and profits. Their model has often been used as benchmark model (e.g., Frank and Goyal, 2003). Their four-factor model does not provide as satisfactory an account of the data as these six factors. Estimates of that model account for 17.5% of the variation in the data. The biggest single missing factor is the industry effect.

Table IV. Do Different Factors Matter for Firms in Different Circumstances?

This table presents a summary of the results from the robustness checks for various classes of firms. All factors are lagged by one year and are defined in the Appendix. Leverage is defined as TDM. The classes we examine include 1) dividend- and nondividend-paying firms, 2) large and small firms (assets larger than the 67th percentile and smaller than the 33rd percentile in annual Compustat cross-sections), and 3) low- and high-growth firms (market-to-book assets ratio smaller than the 33rd percentile and larger than the 67th percentile in annual Compustat cross-sections). The columns headed "+%" and "%" are generated by running the data for each of the 54 years independently. They list the instances in which the particular factor was included in the minimum BIC specification and for which the regression coefficient had the indicated sign. Standard errors used in this exercise are corrected for two-dimensional clustering both at the firm level and the year level.

	Dividend-Paying Firms		Nondividend-Paying Firms		Large Firms		Small Firms		Low Growth		High Growth	
	+% (1)	−% (2)	+% (3)	−% (4)	+% (5)	−% (6)	+% (7)	−% (8)	+% (9)	−% (10)	+% (11)	−% (12)
IndustLev	100.0	0.0	84.0	0.0	100.0	0.0	92.3	0.0	100.0	0.0	98.1	0.0
Tang	55.8	0.0	50.0	0.0	44.2	0.0	38.5	0.0	50.0	0.0	26.9	1.9
Mktbk	0.0	63.5	0.0	88.0	0.0	69.2	0.0	53.8	13.5	17.3	0.0	28.8
Profit	0.0	100.0	0.0	66.0	0.0	98.1	0.0	55.8	0.0	71.2	0.0	61.5
Assets	48.1	1.9	88.0	0.0	7.7	9.6	61.5	0.0	50.0	0.0	7.7	0.0
Inflation	← Macroeconomic Variable →											
SGA	0.0	25.0	0.0	20.0	0.0	13.5	0.0	5.8	0.0	17.3	0.0	7.7
RnD	0.0	34.6	0.0	16.0	0.0	21.2	1.9	5.8	1.9	21.2	0.0	9.6
Rating	0.0	5.8	0.0	18.0	0.0	17.3	0.0	0.0	0.0	25.0	0.0	1.9
Capex	7.7	1.9	0.0	32.0	17.3	3.8	0.0	9.6	5.8	11.5	7.7	5.8
NOLCF	0.0	0.0	4.0	8.0	0.0	0.0	0.0	1.9	1.9	1.9	1.9	0.0
StockRet	1.9	5.8	0.0	38.0	0.0	17.3	0.0	17.3	1.9	36.5	0.0	11.5
Regultd	30.8	0.0	4.0	0.0	9.6	0.0	3.8	0.0	3.8	3.8	5.8	0.0
StockVar	0.0	9.6	0.0	36.0	0.0	11.5	0.0	13.5	1.9	30.8	0.0	5.8
InvTaxCr	3.8	0.0	2.0	2.0	0.0	0.0	0.0	1.9	0.0	1.9	0.0	0.0
ChgAsset	26.9	0.0	2.0	16.0	19.2	0.0	1.9	5.8	34.6	1.9	5.8	1.9
Unique	1.9	0.0	2.0	22.0	0.0	7.7	0.0	1.9	1.9	13.5	1.9	0.0
MacroGr	← Macroeconomic Variable →											
TermSprd												
IndustGr	3.8	0.0	2.0	12.0	5.8	1.9	0.0	3.8	3.8	3.8	3.8	0.0
Depr	5.8	0.0	2.0	8.0	0.0	0.0	3.8	0.0	1.9	7.7	7.7	0.0
Mature	0.0	5.8	26.0	6.0	0.0	7.7	7.7	3.8	7.7	5.8	1.9	3.8
MacroProf	← Macroeconomic Variable →											
TaxRate	← Macroeconomic Variable →											
CrspRet	0.0	0.0	8.0	0.0	1.9	0.0	1.9	1.9	3.8	1.9	1.9	1.9

Table V. A Core Model of Leverage

This table reports estimates from regressions of leverage on the core model. The factors are defined in the Appendix and are lagged by one year. Leverage is defined as TDM in Panel A and as TDA in Panel B. Columns (1) to (7) report the estimated coefficients from OLS regressions with clustered standard errors. Column (8), titled "Impute Missing," reports estimates based on the use of multiple imputation by chained equations for imputing missing values. The imputation is done by using a switching regression, an iterative multivariate regression technique. The technique assumes that missing observations are missing at random. The procedure is implemented using ICE in Stata. We impute 5 times. The number of observations, AIC, BIC, and adjusted R^2 in Column (8) are averages from an analysis of 5 data sets.

Panel A. Total Debt to Market Assets (TDM)

	All Years	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2003	Impute Missing	All Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IndustLev	0.684***	0.681***	0.466***	0.671***	0.715***	0.647***	0.639***	0.665***	0.674***
	(51.8)	(14.2)	(9.3)	(27.5)	(35.9)	(37.7)	(20.8)	(54.1)	(51.8)
Tang	0.092***	−0.006	0.086***	0.061***	0.137***	0.106***	0.134***	0.090***	0.105***
	(14.8)	(−0.2)	(5.0)	(4.7)	(13.8)	(12.8)	(12.0)	(15.2)	(17.0)
Mktbk	−0.024***	−0.039***	−0.022***	−0.058***	−0.032***	−0.022***	−0.011***	−0.022***	−0.023***
	(−43.3)	(−6.1)	(−9.9)	(−19.0)	(−25.1)	(−27.0)	(−21.1)	(−44.3)	(−42.7)
Profit	−0.120***	−0.542***	−0.628***	−0.687***	−0.156***	−0.090***	−0.049***	−0.011***	−0.114***
	(−34.9)	(−11.9)	(−18.8)	(−22.9)	(−17.5)	(−19.3)	(−12.3)	(−37.2)	(−34.9)
Assets	0.011***	−0.002	0.001	0.012***	0.012***	0.011***	0.009***	0.014***	0.023***
	(15.4)	(−0.6)	(0.9)	(7.8)	(11.3)	(11.4)	(8.2)	(19.6)	(29.5)
Inflation	1.328***	1.037***	0.832***	1.030***	0.688***	0.221	8.886***	1.338***	1.586***
	(25.7)	(10.2)	(3.0)	(10.8)	(11.4)	(0.9)	(12.9)	(26.9)	(31.5)
Dividend									−0.102***
									(−34.1)
Constant	0.039***	0.234***	0.202***	0.220***	0.048***	0.066***	−0.131***	0.025***	0.012***
	(8.9)	(9.6)	(17.2)	(16.6)	(6.2)	(7.8)	(−8.0)	(6.2)	(2.7)
AIC	−34,579.0	−5,832.0	−16,334.7	−8,588.8	−8,413.1	−11,419.5	−212.3	−36,781.0	−41,111.0
BIC	−34,508.3	−5,787.1	−16,281.1	−8,529.8	−8,352.2	−11,356.8	−155.2	−36,707.0	−41,030.2
Adjusted R^2	0.266	0.415	0.408	0.324	0.251	0.254	0.240	0.262	0.292
Observations	180,552	4,483	15,618	3,3542	43,834	57,313	25,762	272, 537	180, 552

(*Continued*)

Table V. A Core Model of Leverage (*Continued*)

Panel B. Total Debt to Book Assets

	All Years	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2003	Impute Missing	All Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IndustLev	0.668***	0.685***	0.685***	0.592***	0.610***	0.662***	0.695***	0.694***	0.661***
	(43.1)	(15.3)	(21.7)	(27.5)	(15.7)	(32.0)	(16.2)	(48.6)	(43.2)
Tang	0.126***	0.044*	0.088***	0.120***	0.150***	0.121***	0.146***	0.111***	0.136***
	(17.5)	(1.8)	(6.4)	(11.0)	(11.9)	(11.4)	(8.4)	(16.1)	(19.1)
Mktbk	0.002*	0.000	0.001	0.000	−0.002	−0.003**	0.009***	0.002	0.002**
	(1.7)	(0.0)	(1.0)	(−0.2)	(−1.0)	(−2.0)	(5.4)	(2.4)	(2.0)
Profit	−0.252***	−0.350***	−0.546***	−0.547***	−0.257***	−0.207***	−0.233***	−0.212***	−0.250***
	(−28.9)	(−8.2)	(−17.8)	(−20.7)	(−12.5)	(−14.9)	(−16.8)	(−28.5)	(−28.5)
Assets	0.001	0.001	−0.002	0.004***	0.001	0.003***	−0.007***	−0.003***	0.010***
	(0.8)	(0.5)	(−1.5)	(3.6)	(0.5)	(2.8)	(−3.5)	(−4.0)	−11.3
Inflation	0.052	0.699***	1.014***	0.108	−0.148**	−1.917***	1.215	0.063	0.230***
	(1.1)	(7.9)	(4.8)	(1.1)	(−2.4)	(−6.4)	(0.8)	(1.1)	(4.8)
Dividend									−0.077***
									(−26.2)
Constant	0.083***	0.096***	0.136***	0.127***	0.111***	0.139***	0.071**	0.107***	0.064***
	(15.4)	(4.7)	(11.8)	(12.0)	(10.2)	(11.5)	(2.0)	(20.9)	(11.9)
AIC	55,485	−7,192	−18,311	−26,857	6,515	23,850	31,202	123,496	53,156
BIC	55,556	−7,147	−18,257	−26,798	6,576	23,912	31,260	123,570	53,237
Adjusted R^2-	0.185	0.382	0.465	0.297	0.142	0.138	0.212	0.148	0.195
Observations	183,962	4,537	15,652	33,908	44,650	58,088	27,127	272,537	183,962

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

A. Adjusting for Missing Data

We have so far followed standard practice in treating missing data.[26] This means we have left out the records of firms for which necessary data items are not available. Depending on what determines which data are missing and which data are reported, biases that arise from dropping observations with incomplete records may be important.[27]

The missing data problem has been well studied and it has been found that procedures, known as "multiple imputation" work relatively well.[28] The idea of multiple imputation is to use the facts that you can observe about a firm in a given year to predict the data that have not been recorded. The predicted data are less certain than are the observed data. There is a distribution of possible values. Accordingly, the standard approach is to stochastically impute the missing values several times. In this way several data sets are created. Each data set is analyzed as if it were a complete data set. Then the results are aggregated in order to see how sensitive the results are to the imputed values.

The results of imputing the missing values are found in Column (8) headed "Impute Missing" in Table V.[29] Imputing missing data has the effect of dramatically increasing the number of firm-years from 180,552 to 272,537.

Even with this large increase in data, for the set of factors that form the core model, it is remarkable how little change is observed. None of the conclusions about the reliable factors are affected. We have done some experimentation and found, not surprisingly, that the minor factors are more sensitive to multiple imputation. Since we do not stress the minor factors, we have not explored this issue systematically.

B. Reintroducing the Minor Factors

The minor factors are of interest for some purposes. There are several reasons that justify adding them to the core model of leverage. If a new factor materially affects the sign and significance of one of the core factors, then it is interesting. If a new factor accounts for significant additional variation that the factors leave unexplained, then it is interesting. If a new factor is a variable that is policy relevant, then it is interesting to add it to the model for some purposes.

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[26]In fact, we have gone further by recoding certain missing values to zero where it can be reasonably ascertained that the values are close to zero based on standard accounting identities. We have also recoded missing R&D expenses to zero. Huang and Ritter (2007) point out that a majority of firms with missing R&D are firms in industries where R&D expenditures are likely to be zero (e.g., clothing retailers). Dropping these observations systematically removes many firms with nonrandom characteristics. These replacements still leave many instances where a variable cannot (and should not) be recoded to zero.

[27]To understand why this is potentially so important consider a simple example. We let x and y be two independent accounting measures that are each normally distributed with a mean of 100 and a standard deviation of 10. We generate 500 of each variable and then regress x on y. The intercept is 105 ($SE = 4.6$), the slope is –0.05 ($SE = 0.05$), and the $R^2 = 0.002$. This is as it should be. Next suppose that we only include observations for which $x > 100$, or $y > 100$ or both. Now the intercept is 139.9 ($SE = 5.1$), the slope is –0.37 ($SE = 0.05$), and the $R^2 = 0.12$. Finally, suppose that we require that $x + y > 200$. Now the intercept is 159.9 ($SE = 5.5$), the slope is –0.52 ($SE = 0.05$), and the $R^2 = 0.27$. Obviously, when there are requirements that must be satisfied in order for the data to be observed, regressions reflect both the underlying data and the data-recording process.

[28]The missing data problem is related to, but distinct from, the familiar survivorship bias. Compustat includes data only on firms in year t that continue to exist long enough to file an annual financial statement for year t in year $t + 1$. This leads to the well-known problem of survivorship bias. Early studies such as Titman and Wessels (1988) examined balanced panels of data. Only firms that existed over the full time period were included. In recent years this practice has been replaced by the now common use of unbalanced panels of firms. We use unbalanced panel methods.

[29]To implement the imputation procedure, we use the program called "ICE" in Stata and generate five imputed data sets. We use the full set of factors as the basis for the imputation.

Accordingly in Table VI, we reintroduce these factors one at a time. We consider their effect when added to the core factor model, to the five factors that exclude industry, and to the eight factors that are found robust when industry is omitted.[30] We do not report coefficient estimates on the control factors. The coefficients on the core factors are extremely stable no matter which of the minor factors is added back in. In these regressions, the reported *t*-statistics use standard errors corrected for clustering both by firm and by year.

Note that if we use conventional levels of "statistically significant," Table VI suggests that many of these factors are significant. This is despite the earlier evidence that these effects are weak. This shows that it is easy to add a factor to our list and find that "it matters empirically." In essence, Table VI provides a lengthy list of such factors. Despite their significance, some minor factors have signs that are unreliable. The choice of a leverage definition is important in several cases. These cases may reflect either lack of robustness, or cases in which a forward-looking measure simply provides a different perspective than a backward-looking measure. Theoretically, disentangling such cases might be interesting in future work.

Table VI also presents cases where it matters whether one includes the industry factor or not. The impact of the stock market returns, uniqueness variable, and regulated variable are reversed depending on whether industry is included or not. The effect of stock market return on leverage is negative and significant when industry is included, but positive and significant when it is excluded.

Several other variables are insignificant when industry median leverage is included but become statistically significant when it is excluded. This is important. It implies that a great deal of robustness checking is needed to properly establish empirical results as being reliable.

As an example, consider the effect of investment tax credits. In Table II, it is positively correlated with leverage. In Table III, it is dropped at the point where it has a coefficient of -1.692 and a *t*-statistic of -3.4. What is much more interesting is seen in Table VI. Depending on the set of factors used as controls and the definition of leverage, this factor can have either a positive sign or a negative sign. In the market leverage regression, the *t*-statistic is 3.3 when included with the core factors, but it becomes -1.2 with eight control variables: five core factors (without industry median leverage) and three additional variables: dummy for regulated firm; selling, general, and administrative expense/sales ratio; and macro growth. If we measure leverage using book values, the coefficient is significantly negative regardless of the set of core factors used.

Adding or dropping a factor that is itself minor typically has little effect. Yet there are cases in which one can provide "robust" evidence that a given factor has a positive sign on leverage and by using a slightly different set of control factors it can also be established that the same factor also has a robust negative effect on leverage. What this means is that using exactly the same data, but different control factors or with different definitions of leverage, different papers might reach different conclusions about how a particular factor relates to leverage. This is why it is important for the literature to make use of a standardized set of control factors, such as the robust factors.

C. Caveats

The current paper documents reliable patterns in the leverage data. We do not provide structural tests of the theories. That is a job for another day. To mitigate concern about endogeneity we use factors from the previous year, not contemporaneous factors. This neither resolve the endogeneity problem nor the lack of a structural model. But at least it has the merit of ensuring that the factors

[30] As described earlier, these eight factors include the five core factors (without the industry median leverage) and three additional factors: 1) dummy for regulated firms (+); 2) selling, general, and administrative expense to sales ratio (–); and 3) macroeconomic growth (+).

Table VI. Reintroducing Minor Factors

This table presents regression coefficients and the associated *t*-statistics (in parentheses) on the minor factors when included one at a time with the core leverage factors. The standard errors are corrected for clustering at both the firm level and the year level. The factors are defined in the Appendix and are lagged by one year. Columns (1) and (4) present the estimated coefficients and *t*-statistics on each of the minor factors when included one at a time together with IndustLev, Mktbk, Tang, Profit, Assets, and Inflation. Columns (2) and (5) repeat this exercise after controlling for Mktbk, Tang, Profit, Assets, and Inflation. Columns (3) and (6) control for Mktbk, Tang, Inflation, Profit, MacroGr, SGA, Regultd, and Assets. The coefficient estimates on these core factors are suppressed in the table.

	Total Debt to Market Assets (TDM)			Total Debt to Book Assets (TDA)		
Minor Factors	**Included 6 Core Factors**	**Included 5 Core Factors w/o IndustLev**	**Included 8 Factors Min BIC w/o Ind.**	**Included 6 Core Factors**	**Included 5 Core Factors w/o IndustLev**	**Included 8 Factors Min BIC w/o Ind.**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Mature	0.014***	0.014***	0.010***	0.014***	0.015***	0.010***
	(6.7)	(6.7)	(4.8)	(5.0)	(5.2)	(3.6)
ChgAsset	−0.008***	−0.010***	0.002	−0.012***	−0.015***	−0.007**
	(−4.4)	(−5.2)	(1.0)	(−3.5)	(−4.1)	(−2.0)
MacroGr	0.557***	0.470***		0.286***	0.205***	
	(25.4)	(20.6)		(10.2)	(7.1)	
MacroProf	−0.009***	−0.022***	−0.053***	−0.008**	−0.019***	−0.035***
	(−3.2)	(−7.1)	(−15.4)	(−2.1)	(−5.2)	(−8.3)
TermSprd	−0.660***	−0.547***	−0.539***	−0.227***	−0.118	−0.152**
	(−11.2)	(−8.6)	(−8.5)	(−3.1)	(−1.5)	(−2.0)
CrspRet	−0.013***	−0.015***	−0.017***	0.013***	0.011***	0.010***
	(−4.3)	(−4.7)	(−5.6)	(3.9)	(3.2)	(3.0)
StockRet	−0.030***	−0.030***	−0.029***	−0.013***	−0.013***	−0.013***
	(−29.7)	(−27.6)	(−27.8)	(−10.9)	(−10.5)	(−10.3)
StockVar	−0.047***	−0.072***	−0.067***	−0.034***	−0.058***	−0.057***
	(−20.4)	(−29.4)	(−27.1)	(−11.9)	(−19.5)	(−19.0)
Rating	−0.047***	−0.032***	−0.033***	−0.004	0.011***	0.011**
	(−10.0)	(−6.1)	(−6.8)	(−0.9)	(2.7)	(2.5)
InvTaxCr	0.852***	2.028***	−0.374	−1.820***	−0.667***	−2.429***
	(3.3)	(7.1)	(−1.2)	(−10.6)	(−3.5)	(−12.0)
Depr	0.073***	0.023	−0.002	0.578***	0.531***	0.442***
	(3.3)	(1.0)	(−0.1)	(13.5)	(12.0)	(10.0)
NOLCF	< 0.001	< 0.001	−0.003**	0.027***	0.027***	0.028***
	(0.3)	(0.1)	(−2.3)	(8.9)	(8.6)	(8.1)
TaxRate	−0.016	−0.061***	−0.115***	−0.039**	−0.083***	−0.125***
	(−0.9)	(−3.1)	(−6.0)	(−2.3)	(−4.3)	(−6.6)
SGA	−0.017***	−0.021***		−0.011***	−0.016***	
	(−18.1)	(−21.0)		(−4.8)	(−6.5)	
RnD	−0.014***	−0.022***	−0.019***	−0.025***	−0.032***	−0.031***
	(−18.7)	(−26.7)	(−22.9)	(−13.4)	(−17.3)	(−16.3)
Unique	−0.008**	−0.026***	−0.026***	0.007**	−0.010***	−0.012***
	(−2.4)	(−7.1)	(−7.2)	(2.1)	(−2.8)	(−3.3)
Regultd	0.037***	0.112***		−0.021***	0.053***	
	(5.6)	(16.5)		(−4.1)	(10.0)	
IndustGr	< 0.001	−0.034***	−0.032***	0.039***	0.007	0.015
	(0.1)	(−4.9)	(−4.4)	(3.6)	(0.6)	(1.4)
Capex	−0.180***	−0.251***	−0.197***	−0.066***	−0.137***	−0.100***
	(−14.1)	(−17.4)	(−13.0)	(−3.5)	(−7.0)	(−5.0)
IndustLev		0.684***	0.660***		0.669***	0.652***
		(51.8)	(48.5)		(43.1)	(40.9)

***Significant at the 0.01 level.

**Significant at the 0.05 level.

are in the firm's information set. To go further would require imposing extra structure and then testing whether that structure fits the data. Such studies are worth doing, but they are well outside the scope of the current paper. We hope that our results may be a useful precursor to studies that impose more structure.

There are a number of other things that we have not studied in this paper. We have not allowed for alternative functional forms and general nonlinearities. We have not allowed for general interaction effects, although some minor interaction effects can be found in Table IV. We have not measured underwriting costs and their impacts. We have not studied dynamic effects in this paper.[31] We have intentionally excluded firm fixed effects. Firm fixed effects are statistically important. However, the interpretation is unclear. Their inclusion would not be appropriate for our purposes. Including them would have its largest effect on the industry median leverage variable. All of these are potentially interesting, and we hope to explore many of them in the future.

V. Conclusion

This paper studies publicly traded American firms over the period 1950 to 2003 to determine which factors have a reliable relation to market-based leverage. Starting from a large set of factors that have been used in previous studies, we find that a set of six factors provides a solid basic account of the patterns in the data:

- Firms that compete in industries in which the median firm has high leverage tend to have high leverage.
- Firms that have a high market-to-book ratio tend to have low levels of leverage.
- Firms that have more tangible assets tend to have more leverage.
- Firms that have more profits tend to have less leverage.
- Larger firms (as measured by book assets) tend to have high leverage.
- When inflation is expected to be high firms tend to have high leverage.

In addition to these six factors, a previous version of this paper finds that an indicator variable indicating whether the firm pays a dividend is also reliably associated with leverage. Firms that pay dividends have less leverage than nonpayers. The existing capital structure theories have ambiguous predictions on the relation between dividend paying status and firm leverage. In our view, the interpretation of dividends needs further development beyond that contained in the literature.

Many studies report that whatever their results are, they are robust to the use of market or book leverage. Given these past studies, we expected that the main factors would also be robust to the choice of market or book leverage. This turns out not to be correct.

When studying book leverage, the effects of market-to-book, firm size, and expected inflation factors all lose the reliable impact that they have when studying market-based leverage. The industry median leverage, tangibility, and profitability remain reliable and statistically significant.

How do we interpret this surprising finding? Recall that Barclay, Morellec, and Smith (2006) argue book-leverage is backward looking while market leverage is forward looking. From this perspective, we see that the effects of the market-to-book assets ratio, firm size (as measured

[31] These are addressed in many other papers including Hovakimian, Opler, and Titman (2001), Welch (2004), Frank and Goyal (2004), Leary and Roberts (2005), Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), Huang and Ritter (2007), and Tsyplakov (2008).

by book assets), and expected inflation are apparently operating through their ability to capture aspects of the firm's anticipated future. Industry median leverage, tangibility, and profitability appear to reflect the impact of the firm's past. We believe that this distinction merits future attention from corporate finance theorists.

How good an account do these major theories provide for the main patterns we see in the data? We study publicly traded American firms over the past half century. For these firms, the evidence points to weaknesses in each theory—some more damaging than others. The nature of the weaknesses differs.

Market timing is frequently pointed to by advocates of behavioral finance. But market timing could also result from rational optimizing by managers (e.g., Baker and Wurgler, 2002). Almost any realistic optimizing model of corporate leverage is likely to have time-varying costs and benefits. This will lead to time-varying optimal choices. More importantly, market timing provides very few refutable cross-sectional implications within this empirical framework and no direct explanation for the main patterns that we observe. Furthermore, the idea provides no natural explanation for most of the observed cross-sectional capital structure regularities independent of the broader trade-off framework.[32]

The pecking order theory provides an intuitively pleasing explanation for the fact that more profitable firms tend to have lower leverage. However, the most important single empirical factor is industry leverage. The pecking order does not directly predict the importance of industry. The roles of tangibility and firm size also do not easily and directly flow from the basic logic of the pecking order theory. Thus, considerable theoretical development would be needed if a model within the basic pecking order approach is to completely account for the main robust evidence.

The trade-off theory provides accounts for many of the factors such as industry leverage, firm size, tangibility, and market-to-book. The main empirical weakness of the trade-off theory is commonly thought to be the fact that more profitable firms generally have lower leverage. In dynamic trade-off models, however, leverage and profits can be negatively related. Tsyplakov (2008), for example, argues that when productive capacity takes time to build and is lumpy, firms tend to stock pile retained earnings (i.e., build up internal equity) before spending the money to build capacity. The process of retaining earnings would show up empirically as profits reducing leverage. Buying the physical capital involves spending money, which thus increases leverage.

According to the well-known statistician Box (1979), "All models are wrong, but some are useful." We hope that the six core factors will provide a useful basis for further studies of leverage. The core factors are quite robust. The fact that the same factors have generally similar effects across classes of firms is particularly encouraging. It suggests that a unified theory of leverage might not be beyond reach. When such a theory emerges it seems fairly clear that it will have important elements in common with what is currently known as the trade-off theory. It also seems likely that some friction such as time-to-build or transaction costs will be important. ■

Appendix: Variable Definitions

A. Leverage Measures

Total debt/market value of assets (TDM) is the ratio of total debt (Compustat item 34, debt in current liabilities + item 9, long-term debt) to market value of assets (MVA). MVA is the sum

[32]Market timing does however seem to be a natural way to think about things like waves of IPOs, as in Loughan and Ritter (1995).

of the market value of equity (item 199, price-close × item 54, shares outstanding) + item 34, debt in current liabilities + item 9, long-term debt + item 10, preferred-liquidation value − item 35, deferred taxes and investment tax credit.

Total debt/assets (TDA) is the ratio of total debt (item 34, debt in current liabilities + item 9, long-term debt) to item 6, assets.

Long-term debt/market value of assets (LDM) is the ratio of item 9, long-term debt, to MVA.

Long term debt/assets (LDA) is the ratio of item 9, long-term debt, to item 6, assets.

B. Factors

1. Profitability

Profitability—operating income before depreciation (Profit) is the ratio of Compustat item 13, operating income before depreciation, to item 6, assets.

2. Firm Size

Log of assets (Assets) is the log of Compustat item 6, assets deflated to 1992 dollars using the GDP deflator.

Mature firms (Mature) is a dummy variable that takes a value of one if the firm has been listed on the Compustat database for more than five years.

3. Growth

Market-to-book ratio (Mktbk) is the ratio of MVA to Compustat item 6, assets. MVA is obtained as the sum of the market value of equity (item 199, price-close × item 54, shares outstanding) + item 34, short-term debt + item 9, long-term debt + item 10, preferred-liquidation value − item 35, deferred taxes and investment tax credit.

Change in log assets (ChgAsset) is change in log of Compustat item 6, assets.

Capital expenditure/assets (Capex) is the ratio of Compustat item 128, capital expenditure, to item 6, assets.

4. Industry

Median industry leverage (IndustLev) is the median of total debt to market value of assets by SIC code and by year. Industry is defined at the four-digit SIC code level in the main results. Robustness is examined by redefining industry at the three-digit SIC level.

Median industry growth (IndustGr) is the median of change in the log of Compustat item 6, assets, by SIC code and by year.

Regulated dummy (Regultd) is a dummy variable equal to one for firms in regulated industries and zero otherwise. Regulated industries include railroads (SIC code 4011) through 1980, trucking (between 4210 and 4213) through 1980, airlines (4512) through 1978, telecommunications (4812 and 4813) through 1982, and gas and electric utilities (between 4900 and 4939).

5. Nature of Assets

Tangibility (Tang) is the ratio of Compustat item 8, net property, plant, and equipment, to item 6, assets.

Table AI. Balance Sheet Items as a Fraction of Total Assets, 1950-2003

The table presents the median balance sheet items as a fraction of total assets for the period from 1950 to 2003. The data are from Compustat. Financial firms and firms involved in major mergers (Compustat footnote code AB) are excluded.

	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2003
N	7,708	22,782	46,101	60,763	80,411	33,308
Assets						
Cash and short-term investments (#1)	0.144	0.077	0.054	0.059	0.069	0.084
+ Receivables − total (#2)	0.136	0.181	0.197	0.173	0.150	0.113
+ Inventories − total (#3)	0.257	0.257	0.234	0.147	0.082	0.039
+ Current assets − other (#68)	0.005	0.008	0.012	0.013	0.020	0.023
= Current assets − total (#4)	0.619	0.587	0.590	0.562	0.533	0.478
+ Net property, plant and equipment − total (#8)	0.327	0.326	0.312	0.305	0.245	0.214
+ Investments and advances − equity method (#31)	0.000	0.000	0.000	0.000	0.000	0.000
+ Investment and advances − other (#32)	0.001	0.000	0.000	0.000	0.000	0.000
+ Intangibles (#33)	0.000	0.000	0.000	0.000	0.003	0.033
+ Assets − other (#69)	0.008	0.011	0.012	0.016	0.026	0.027
= Total assets (#6)	1.000	1.000	1.000	1.000	1.000	1.000
Liabilities and shareholders equity						
+ Debt in current liabilities (#34)	0.008	0.028	0.044	0.035	0.025	0.019
+ Accounts payable (#70)			0.087	0.082	0.077	0.070
+ Income taxes payable (#71)			0.012	0.002	0.000	0.000
+ Current liabilities − other (#72)			0.057	0.067	0.076	0.078
= Current liabilities − total (#5)	0.213	0.212	0.250	0.248	0.237	0.230
+ Long-term debt – total (#9)	0.129	0.152	0.180	0.156	0.116	0.095
+ Liabilities − other (#75)	0.001	0.000	0.000	0.000	0.004	0.008
+ Deferred taxes and ITC (#35)	0.000	0.000	0.009	0.004	0.000	0.000
+ Minority interest (#38)	0.000	0.000	0.000	0.000	0.000	0.000
= Total liabilities (#181)	0.359	0.442	0.526	0.551	0.534	0.535
+ Preferred stock − carrying value (#130)		0.000	0.000	0.000	0.000	0.000
+ Common equity − total (#60)		0.522	0.465	0.439	0.446	0.447
= Stockholders equity − total (#216)		0.530	0.473	0.449	0.466	0.466
= Total liabilities and SE (#6)	1.000	1.000	1.000	1.000	1.000	1.000

Table AII. Statement of Cash Flow Items as Fraction of End-of-Year Assets, 1950-2003

The table presents the median cash flow statement items as a fraction of end-of-year total assets for the period from 1950 to 2003. The data are from Compustat. Financial firms and firms involved in major mergers (Compustat footnote code AB) are excluded. For years up to and including 1985, Compustat format codes 1, 2, and 3 are used. Starting in year 1990, format code 7 is used. The variables are winsorized at the 0.50% level in both tails of the distribution. We recode certain cash flow items as zero if they were either missing or combined with other data items (for details, see table 8 of Frank and Goyal, 2003).

	Median Statement of Cash Flow Item as a Fraction of End-of-Year Assets					
	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2003
N	7,708	22,782	46,101	60,763	80,411	33,308
Income						
+ Sales (#12)	1.292	1.349	1.375	1.131	0.992	0.798
− Cost of goods sold (#41)	0.981	0.931	0.948	0.739	0.624	0.505
− Selling, general and admin. expenses (#189)	0.090	0.178	0.222	0.227	0.229	0.213
= Operating income before depreciation (#13)	0.182	0.149	0.141	0.112	0.100	0.072
− Depreciation (#14)	0.030	0.034	0.033	0.039	0.042	0.045
= Operating income after depreciation (#14)	0.141	0.110	0.101	0.070	0.055	0.026
− Interest expense (#15)	0.006	0.011	0.021	0.026	0.018	0.015
+ Nonoperating income and special items (# 61 + # 17)	0.005	0.005	0.007	0.011	0.004	0.001
= Pre tax income (#170)	0.131	0.103	0.086	0.052	0.031	−0.001
− Income taxes − total (#16)	0.063	0.046	0.036	0.016	0.007	0.002
− Minority interests (#49)	0.000	0.000	0.000	0.000	0.000	0.000
= Income before extraordinary items (#18)	0.065	0.057	0.049	0.033	0.020	−0.003
− Dividend preferred (#19)	0.000	0.000	0.000	0.000	0.000	0.000
+ Common stock equivalents − savings (#191)		0.000	0.000	0.000	0.000	0.000
+ Extraordinary items and discontinued operations (#48)	0.000	0.000	0.000	0.000	0.000	0.000
Net income (#172)	0.071	0.059	0.051	0.036	0.020	−0.005
= Income before extraordinary items (#123)	–	–	0.050	0.033	0.020	−0.003
+ Depreciation and amortization (#125)	–	–	0.032	0.040	0.045	0.048
+ Other funds from operations[a] (#124 + 125 + 106 + 213 + 217)	–	–	0.002	0.004	0.005	0.012
= Funds from operations − Total (#110)	–	—	0.098	0.083	0.072	0.052
+ Accounts receivable dec. (inc.) (#302)	–	–	–	–	−0.006	0.000
+ Inventory dec. (inc.) (#303)	–	–	–	–	0.000	0.000
+ Accounts payable and accr liabilities − inc. (dec.) (#304)	–	–	–	–	0.000	0.000

(*Continued*)

Table AII. Statement of Cash Flow Items as Fraction of End-of-Year Assets, 1950-2003 (*Continued*)

	Median Statement of Cash Flow Item as a Fraction of End-of-Year Assets					
	1950-1959	**1960-1969**	**1970-1979**	**1980-1989**	**1990-1999**	**2000-2003**
+ Income taxes − accrued − inc. (dec.) (#305)	–	–	–	–	0.000	0.000
+ Asset and liabilities other (net change) (#307)	–	–	–	–	0.000	0.000
= Operating activities − net cash flow (#308)	–	–	–	–	0.051	0.044
− Increase in investment (#313)	–	–	0.000	0.000	0.000	0.000
+ Sale of investment (#109)	–	–	0.000	0.000	0.000	0.000
− Capital expenditure (#128)	0.041	0.042	0.056	0.058	0.047	0.034
+ Sale of property, plant, and eqpt. (#107)	–	–	0.000	0.000	0.000	0.000
− Acquisitions (#129)	–	–	0.000	0.000	0.000	0.000
+ ST inv. change and inv act – other (#309 + 310)	–	–	–	–	0.000	0.000
= Investing activities − net cash flow (#311)	–	–	–	–	−0.069	−0.049
Financing activities						
+ Sale of common and preferred stock (#108)	–	–	0.000	0.001	0.003	0.004
− Purchase of common and pfd. stock (#115)	–	–	0.000	0.000	0.000	0.000
− Cash dividends (#127)	–	–	0.002	0.000	0.000	0.000
+ Long-term debt − issuance (#111)	–	–	0.014	0.013	0.008	0.000
− Long-term debt − reduction (#114)	–	–	0.014	0.018	0.017	0.013
+ Changes in current debt (#301)	–	–	0.000	0.000	0.000	0.000
+ Financing activities − other (#312)	–	–	–	–	0.000	0.000
= Financing activities − net cash flow (#313)	–	–	–	0.001	0.015	0.006
+ Exchange rate effect (#314)	–	–	–	–	0.000	0.000
= Cash and cash eqvt inc. (dec.) (#274)	–	–	0.000	0.000	0.001	0.001
Sources of funds other (#218)	–	–	0.001	0.001	–	–
Uses of funds − other (#219)	–	–	0.002	0.004	–	–
Working capital change other (#236)	–	–	0.019	0.005	–	–

[a]Other funds from operation = Extraordinary items + Deferred taxes + Equity in net loss + Loss (gain) on sale of PPE and Investments + Funds from operations – other.

Table AIII. Core Factor Selection—Without Industry Variables

The table reports the variation in leverage explained by various factors. The factors are defined earlier in this Appendix and are lagged by one year. This table excludes industry median leverage (IndustLev) and the industry median growth (IndustGr) from consideration. Leverage is defined as TDM. We begin with the regression that includes all factors and report the R^2 (in the cumulative R^2 column) and the Bayesian information criterion (in the BIC column) at the bottom of the table. The coefficient estimate and the *t*-statistic of the factor that has performed worst (the lowest *t*-statistic) are also reported at the bottom of the table. The standard errors are clustered at both the firm level and the year level. "Own" reports the R^2 from simple univariate regressions of leverage measure on this factor. We then delete the worst performing variable, run the regression with the remaining variables, and report the R^2 and the BIC in the second to the bottom cell in the table. Thus, "Cumulative" reports R^2 from a regression that includes the variable listed, along with all variables listed above it. We then continue in this manner all the way up the table. The variables are listed in the order of the amount of additional variation explained. "Group Positive%" reports the percentage of instances for which the given factor has a positive sign and is included in the minimum BIC specification in 10 equally sized random subsamples. "Group Negative%" reports the percentage of instances for which the given factor has a negative sign and is included in the minimum BIC specification in 10 equally sized random subsamples. The data are also run on each of the 54 years independently. "Year Positive%" and "Year Negative%" report the percentage of instances for which the given factor was included in the minimum BIC specification and for which the coefficient had the indicated sign.

Factor	Coefficient Estimate (1)	*t*-stat (2)	Own R^2 (3)	Cumulative R^2 (4)	BIC (5)	Group Positive% (6)	Group Negative% (7)	Year Positive% (8)	Year Negative% (9)
Mktbk	−0.026	−44.6	0.07	0.07	8,112.8	0.0	100.0	0.0	84.6
Tang	0.231	34.8	0.06	0.12	−1,391.0	100.0	0.0	71.2	0.0
Inflation	1.794	32.3	0.03	0.14	−5,401.8	100.0	0.0	NA	NA
StockVar	−0.064	−25.6	0.05	0.18	−12,739.6	0.0	100.0	0.0	38.5
Profit	−0.142	−26.7	0.00	0.19	−15,917.9	0.0	100.0	0.0	100.0
RnD	−0.022	−19.8	0.02	0.20	−17,086.1	0.0	100.0	0.0	42.3
MacroGr	0.421	17.3	0.00	0.20	−17,256.1	70.0	0.0	NA	NA
StockRet	−0.019	−16.4	0.02	0.20	−17,568.0	0.0	100.0	3.8	34.6
Capex	−0.261	−15.3	0.00	0.21	−18,409.2	0.0	80.0	21.2	34.6
ChgAsset	0.034	14.2	0.01	0.21	−18,698.1	70.0	0.0	38.5	5.8
SGA	−0.026	−15.0	0.02	0.22	−19,521.4	0.0	100.0	0.0	53.8
TermSprd	−0.851	−12.3	0.00	0.22	−19,738.5	0.0	10.0	NA	NA
NOLCF	−0.017	−8.2	0.00	0.21	−19,031.8	0.0	20.0	1.9	7.7
Regultd	0.121	7.7	0.03	0.21	−19,416.9	100.0	0.0	59.6	0.0
Assets	0.007	6.8	0.05	0.21	−19,746.0	100.0	0.0	55.8	0.0
Unique	−0.026	−6.4	0.01	0.22	−20,026.2	0.0	80.0	0.0	42.3
Rating	−0.035	−6.3	0.00	0.22	−20,143.4	0.0	80.0	0.0	32.7
MacroProf	−0.023	−5.1	0.00	0.22	−20,157.1	0.0	30.0	NA	NA
TaxRate	−0.152	−6.0	0.01	0.22	−20,301.8	0.0	30.0	NA	NA
InvTaxCr	−1.794	−3.4	0.02	0.22	−18,043.9	NA	NA	3.8	1.9
CrspRet	−0.011	−2.9	0.00	0.22	−18,038.8	NA	NA	9.6	0.0
Depr	−0.069	−1.8	0.00	0.22	−18,040.8	NA	NA	5.8	7.7
Mature	−0.002	−0.5	0.02	0.22	−18,029.9	NA	NA	11.5	13.5

RND expense/sales (RnD) is the ratio of Compustat item 45, R&D expense, to item 12, sales.

Uniqueness dummy (Unique) is a dummy variable that takes a value of one if the SIC code of the firm is between 3400 and 4000 (firms producing computers, semiconductors, chemicals, and allied, aircraft, guided missiles, and space vehicles and other sensitive industries), and zero otherwise.

SGA expense/sales (SGA) is the ratio of item 189, selling, general, and administration expenses, to item 12, sales.

6. Taxes

Top tax rate (TaxRate) is the top statutory tax rate. It was 42% in 1950, 51% in 1951, 52% from 1952 to 1963, 50% in 1964, 48% from 1965 to 1967, 52.8% from 1968 to 1969, 49.2% in 1970, 48% from 1971 to 1978, 46% from 1979 to 1986, 40% in 1987, 34% from 1988 to 1992, and 35% from 1993 to 2003.

NOL carryforwards/assets (NOLCF) is the ratio of item 52, net operating loss carryforward, to item 6, assets.

Depreciation/assets (Depr) is the ratio of Compustat item 125, depreciation expense, to item 6, assets.

Investment tax credit/assets (InvTaxCr) is the ratio of Compustat item 208, investment tax credit-balance sheet, to item 6, assets.

7. Risk

Variance of asset returns (StockVar) is the annual variance of asset returns that is obtained by unleveraging the variance of equity returns, with other asset values assumed to be equal to their book values. Return variance is coded as missing if CRSP has less than 100 valid daily return observations in a fiscal year.

8. Supply-Side Factors

Debt rating dummy (Rating) is a dummy variable that takes a value of one if Compustat item 280, senior debt rating, or item 320, subordinated debt rating, has a value of less than 13 (i.e., S&P rates the debt investment grade). Rating takes a value of zero if the debt is not rated or if it is rated less than investment grade. Compustat does not report data on bond ratings before 1985. Thus, the variable is set equal to zero for all firms prior to 1985.

9. Stock Market Conditions

Cumulative raw return (StockRet) is cumulative annual raw stock return obtained by compounding monthly returns from CRSP.

Cumulative market returns (CrspRet) is annual CRSP value-weighted index return.

10. Debt Market Conditions

Term spread (TermSprd) is the difference between the 10-year interest series and the one-year interest series. (Source: Federal Reserve files at http://www.federalreserve.gov/releases/.)

11. Macroeconomic Conditions

Expected inflation rate (Inflation) is the expected change in the consumer price index over the coming year using data from the Livingston Survey available at http://www.phil.frb.org/econ/liv/index.html.

Growth in profit after tax–macro (MacroProf) is differences in log of aggregate annual corporate profits after tax for nonfinancial firms. (Source: US Department of Commerce, Bureau of Economic Analysis.)

Growth in GDP (MacroGr) is differences in log of real gross domestic product in 1996 dollars. (Source: US Department of Commerce, Bureau of Economic Analysis.)

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