

Taxes and Capital Structure: Evidence from Firms Response to the Tax Reform Act of 1986

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While the theoretical relation between taxes and capital structure has been extensively analyzed the empirical evidence on this issue has thus far been inconclusive. One of the main difficulties confronting previous empirical studies of the cross-sectional relationship between taxes and leverage was the control of intervening variables. The Tax Reform Act of 1986 (TRA), which drastically changed the tax regime, provides a unique opportunity to assess the interaction between taxes and leverage decisions in a controlled environment. We test the relationship between leverage and certain tax-related variables for a large sample of companies in the years surrounding the enact-

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ment of the TRA. The results support the tax-based theories of capital structure. The findings indicate that there exists a substitution effect between debt and nondebt tax shields, and that both corporate and personal tax rates affect leverage decisions.

A fundamental question in financial economics is, What are the determinants of the firm's capital structure? While theoretical analysis has suggested that taxes, the cost of financial distress, agency costs, and the firm's product and input market strategies all potentially affect the choice of capital structure, a complete characterization of this corporate decision has yet to be developed.

The relation between capital structure and taxes has been the subject of extensive theoretical analysis, which has led to testable hypotheses.¹ These hypotheses specify particular relations among the optimal capital structure, corporate tax rates, nondebt tax shields, and personal tax rates.

Previous empirical tests concerning the relation between leverage and corporate tax attributes have produced inconclusive results. Some recent tests [see, e.g., Auerbach (1985), Bradley, Jarrell, and Kim (1984), Chaplinsky (1987), and Titman and Wessels (1988)] find no evidence to support theoretical predictions that leverage levels are related to firms' nondebt tax shields. Scholes, Wilson, and Wolfson (1990), however, find that there is a relation between marginal tax rates and financing decisions for commercial banks. Haugen and Senbet (1986), in a survey article, conclude that the empirical evidence "is only partially supportive of the Miller Hypothesis" (p. 13) and that the refinement of the hypothesis by DeAngelo and Masulis (1980) "is not upheld empirically" (p. 13). Typically, these tests use a cross-sectional analysis to investigate the association between the firm's leverage level and its tax attributes.

Cross-sectional tests of leverage levels have several limitations. First, as Myers (1977) points out, changes in capital structure are costly to implement. Hence, the observed capital structure at any point in time may substantially differ from its optimal level. Furthermore, "pecking order" theories of new financing [e.g., Myers and Majluf (1984)] suggest that the capital structure may differ from the optimal level predicted by a static trade-off of the costs and benefits of debt. Both effects may make it difficult for a study focusing on a cross section of capital structures to affirm the predictions of the static trade-off theories. Second, as argued by Dotan and Ravid (1985) and

¹ See, for example, Barnea, Haugen, and Senbet (1981), Brennan and Schwartz (1978), Dammon and Senbet (1988), DeAngelo and Masulis (1980), Green and Talmor (1985), Kane, Marcus, and McDonald (1984), Kraus and Litzenberger (1973), Miller (1977), Modigliani and Miller (1958, 1963), and Taggart (1980).

Dammon and Senbet (1988), tax considerations may affect other operational decisions of the firm besides leverage (e.g., investment). As a result, the *ceteris paribus* assumption underlying the cross-sectional relation between nondebt tax attributes and leverage does not necessarily hold.

The Tax Reform Act of 1986 (henceforth, TRA) changes the tax regime in which firms and investors operate. The new tax code abolishes some nondebt tax shields available to firms, which, *ceteris paribus*, makes the tax shield provided by interest more attractive. At the same time, the TRA lowers the corporate tax rate, reducing the value of tax shields to firms. At the investor level, the TRA reduces the preferential treatment of capital gains and cuts personal tax rates, decreasing the relative attractiveness of equity over debt. These changes provide a unique opportunity to test directly the interaction between firms' leverage decisions and taxes.

In this study, we conduct a cross-sectional analysis of firms' reactions to the TRA to assess the tax-based theories of capital structure. Methodologically, our approach, which focuses on leverage changes, represents a possible improvement over the cross-sectional tests employed by previous researchers that consider *levels* of leverage. In essence, we analyze the derivative of the optimal capital structure decision instead of its level. Also, since the same firm is observed before and after the change in the tax code, control is obtained for firm-specific, nontax factors affecting leverage.² Furthermore, the TRA affects companies differentially, depending on their particular tax attributes. These differences provide a sample rich in cross-sectional variability, thus allowing for a powerful test of tax-related theories of leverage.

In addition to its impact on corporate taxes, the TRA might also affect firms' leverage decisions through its impact on personal taxes. While previous empirical examinations of capital structure have focused mostly on the role of corporate taxes, theory suggests that personal taxes are potentially relevant in leverage decisions [e.g., Miller (1977) and DeAngelo and Masulis (1980)]. Results of tests that have included personal taxes have been inconclusive [see, e.g., Rim, Lewellen, and McConnell (1979)]. However, because the TRA alters the individual tax structure, an examination of the leverage changes before and after this act also enables us to test the impact of personal taxes on capital structure.

We find a positive association between changes in leverage and changes in corporate tax rates, thus supporting the tax-based theories

² Note, however, that the use of leverage changes rather than leverage levels does not resolve the problem of omitted non-firm-specific variables (such as macro factors) that are correlated with the explanatory variables.

of capital structure. We also document a substitution effect between debt and nondebt tax shields. Finally, the findings are consistent with the hypothesis that personal tax rates affect the leverage choice of firms.

The article is organized as follows. In Section 1, the primary objectives underlying the TRA and the impact of its main provisions are discussed. The tax-based theories of capital structure are reviewed in Section 2, and the hypotheses to be tested are presented. In Section 3, the methodology is introduced, and in Section 4, the time period examined, the sample, the variables, and the data sources are described. In Section 5, the results are presented and discussed. Concluding remarks are provided in the last section.

1. The Tax Reform Act of 1986 (TRA)

1.1 Background

The TRA represents one of the most comprehensive revisions of the U.S. tax system since its inception. The act is far-reaching in its consequences and affects all individuals and corporations in the United States. The TRA was designed to have distributional effects—that is, to shift the tax burden from individuals to the corporate sector. Within the corporate sector, the TRA shifts the tax burden from high-effective-tax-rate industries and companies to industries and companies that have enjoyed considerable tax breaks and preferences in the past. The added corporate tax revenues expected to be raised by the TRA are the net result of numerous offsetting changes in the tax code, each affecting individual industries and companies differently.³ The more prominent of these changes are the tax rate reduction (a decrease of \$116 billion in revenues) and the repeal of the investment tax credit (an increase of \$119 billion in revenues).

The TRA also reduces personal tax rates on ordinary income. The 15-bracket schedule in place prior to the act, which had a maximum rate of 50 percent, was eliminated. In 1987, a transition schedule consisting of five brackets with a maximum rate of 38.5 percent was implemented. The schedule, effective for 1988 and subsequent years, consists of two brackets of 15 percent and 28 percent. A surcharge of 5 percent is applied to higher income taxpayers, resulting in a maximum tax rate of 33 percent on income subject to this tax.⁴ If the

³ For a discussion of how these changes may influence corporate financial behavior, see Scholes and Wolfson (1989,1990).

⁴ The TRA phases out the benefits of both the 15 percent bracket and the personal exemptions for individuals in certain ranges of income, producing an effective marginal rate of 33 percent on income in these ranges. Income above these ranges is taxed at a marginal rate of 28 percent.

probability of being in a given tax bracket varies across individuals between zero and unity, there will be a continuum of effective personal tax rates. Thus, even after the elimination of most of the brackets in the tax schedule, there is still progressivity in the effective personal tax rates. In addition to the change in the personal income tax rate, the TRA changes the tax on capital gains at the individual level, abolishing the 60 percent deduction for long-term capital gains (which resulted in a maximum capital gains tax of 20 percent) and thus reducing the preferential treatment of these gains.

1.2 Identification of the relevant tax provisions

A complete assessment of the impact of the TRA on firms' leverage decisions would require a separate evaluation of the effect of each of the hundreds of provisions contained in the act. This is a formidable and, indeed, an impractical task. Thus, it is necessary to concentrate on specific provisions that are more likely to influence corporations' tax payments and, as a result, their leverage.

Our research design considers the effect of three of the more prominent corporate provisions—the elimination of the investment tax credit, the reduction in the statutory tax rate, and the change in depreciation allowances. Other items such as the changes in inventory capitalization were not incorporated into the analysis since their effect on individual firms could not be determined based on publicly available information. At the individual level, our research design considers the reduction of the preferential treatment of capital gains.

2. Hypotheses

Firms' leverage levels may be affected by changes in the corporate and the personal tax structures. The TRA introduced changes in both tax structures. Since firms differ with respect to their corporate tax attributes and because they may also differ with respect to the tax attributes of their security holders, a test of the tax-based theories of capital structure should account for both effects. In this section, we first present hypotheses relating to the potential impact of the changes in the corporate tax structure on leverage. We then develop a hypothesis relating changes made in the personal tax structure to leverage changes. The test designed to examine these hypotheses simultaneously considers both of these effects.

The corporate tax structure favors the issuance of debt over equity since interest is deductible. Consequently, some of the theoretical analyses suggest that firms' leverage increases with an increase in the corporate tax rate. This prediction is difficult to test since, at any given point in time, all corporations face the same statutory tax rate. How-

ever, leverage decisions are not based on the statutory tax rate, but rather on the marginal effective tax rate. The marginal effective tax rate, which is the present value of future tax payments arising from an additional dollar of taxable income per year, varies across firms. This variation enables us to analyze the relation between leverage and corporate tax rates, as discussed below.

Cross-sectional differences in marginal effective tax rates result from different opportunities for tax deferral or tax reduction among firms, as well as from imperfect interperiod transfers of tax losses.⁵ A given change in the statutory tax rate brings about a greater change in the marginal effective tax rate of firms that initially have a higher marginal effective tax rate. Therefore, firms with a higher marginal effective tax rate will change their capital structure more than firms with a lower marginal effective tax rate in response to a given change in the statutory tax rate. Accordingly, we test the following hypothesis regarding the effect of the TRA's reduction in the corporate tax rate.

Hypothesis 1. *Firms with a high marginal effective corporate tax rate will decrease their leverage more than firms with a low marginal effective corporate tax rate in response to the decrease in the statutory corporate tax rate.*

Next we consider the effect of nondebt tax shields on the choice of leverage. DeAngelo and Masulis (1980) suggest that there is substitution between debt and other deductions in shielding corporate income from taxes. Because the TRA reduced the amount of some nondebt tax shields, the enactment of this legislation enables us to examine the trade-off between debt and nondebt tax shields.

Accordingly, we examine the following hypothesis.

Hypothesis 2. *Firms that lose a greater amount of nondebt taxshields will increase their leverage more than firms that lose a smaller amount of these tax shields in response to the reduction in the available nondebt tax shields.*

Another factor affecting leverage choice is taxes on individuals. Because of the lower tax rate on capital gains prior to the TRA, the tax structure for individuals was biased in favor of equity income over debt income.⁶ The TRA reduces the preferential tax treatment of capital gains, diminishing the advantage to the individual of receiving

⁵Scholes and Wolfson (1990) discuss the *effect* of opportunities for tax deferrals and tax reduction. The effect of imperfect interperiod transfers of tax losses on the marginal effective tax rate is discussed in Kane, Marcus, and McDonald (1984) and Green and Talmor (1985).

⁶For a formal exposition of this argument, see Modigliani and Miller (1963), Miller (1977), DeAngel and Masulis (1980), and Barnes, Haugen, and Senbet (1981).

equity income relative to debt income.⁷ If differential personal taxes on debt and equity are reflected in their relative cost to the firm [see, e.g., Miller (1977)], this tax change, by itself, should bring about an overall increase in leverage, since debt is now relatively more attractive to investors than it was before the TRA.

The ability to test the above prediction in a cross-sectional setting is predicated upon the existence and observability of cross-sectional differences in the personal tax advantage of equity income relative to debt income of the marginal investor (henceforth γ). While the tax rates of the marginal investors in the firm's securities are not observable, a proxy for γ exists in the form of the firm's dividend yield. As Long (1977) and subsequent analyses show, when dividends and capital gains are taxed differentially, investors in different tax brackets may choose different portfolios.⁸ Specifically, high-tax-bracket investors tilt their holdings toward low-dividend-yield portfolios and vice versa. Assuming that high-tax-bracket investors predominantly hold low-dividend-yield stocks, then γ is a decreasing function of the dividend yield.

A reduction in the personal tax advantage of capital gains would be more pronounced for high-tax-bracket investors than for low-tax-bracket investors. If dividend clienteles exist, this implies that the TRA's reduction in the personal tax advantage of equity income would be greater for low-dividend-yield stocks than for high-dividend-yield stocks. Leverage changes would then be expected to be negatively correlated with dividend yields.⁹ Formally, assuming that personal taxes affect capital structure decisions and that the impact of the TRA on the equilibrium value of γ is correlated with the dividend yield, we hypothesize the following.

Hypothesis 3. *Firms with a high dividend yield will increase their leverage less than firms with a low dividend yield in response to the decrease in the personal tax advantage of equity income.*

Note that a test of this hypothesis is a joint test of several assertions. An insignificant correlation between dividend yield and leverage changes may result from the absence of dividend clienteles, a zero

⁷ As noted, the TRA also reduces the level of personal tax rates; this too diminishes the advantage of equity income relative to debt income.

⁸ The question of whether such clienteles leave their mark on stock prices is still under debate [see Miller and Scholes (1978) and Litzenberger and Ramaswamy (1979)]. Yet, as Dybvig and Ross (1986) show, clienteles can exist independently of the existence of price effects. In fact, a stronger statement can be made: the lack of price effects, possibly driven by arbitrageurs, induces clienteles.

⁹ This prediction assumes that the equilibrium amount of corporate debt does not increase as a result of the TRA, such that a supply-driven increase in γ more than offsets the effect of the personal-tax changes on γ . Note that, indeed, we find only a small average change in leverage (see Table 1).

net effect of the TRA on the equilibrium value of γ , or the fact that personal tax considerations do not affect firms' leverage decisions. A significant negative correlation, on the other hand, is consistent with the notion that personal tax rates do affect the choice of capital structure. Such a finding also lends support to the dividend clientele theory.

In addition to the tax effects of leverage, the issuance of debt has been shown to have many nontax implications. Leverage affects the costs of financial distress [Durand (1959)], agency costs [Fama and Miller (1972) and Jensen and Meckling (1976)], product market strategies [Bradner and Lewis (1986)], input market strategies [Sarig (1988)], liquidation decisions [Titman (1984)], and choice of scale of operations [Hite (1977), Dotan and Ravid (1985), and Dammon and Senbet (1988)].¹⁰ Our tests control for nontax effects as described in the following section.

3. Methodology

The main analysis in this study is based on a cross-sectional regression in which the firm's change in leverage, the dependent variable, is regressed on the changes in tax-related firm attributes hypothesized to affect the leverage decision. Specifically, the explanatory variables are (i) an estimate of the firm's marginal effective tax rate, which proxies for the change in this rate; (ii) an estimate of the amount of nondebt tax shields lost as a result of the TRA, which captures the substitution effect; and (iii) the firm's dividend yield, which proxies for the change in its γ . These variables are discussed briefly below; their computation is provided in the following section.

The firm's marginal effective tax rate cannot be observed. We estimate this rate by finding the firm's average tax rate over the most recent lo-year period.¹¹ The two nondebt tax shields most affected by the act were depreciation and the investment tax credit. We estimate the amount of tax shields lost from these two sources based on the average amount of depreciation and investment tax credits used over the five years preceding the act. We use the same period to measure the firm's average dividend yield.

Another nondebt tax shield affected by the TRA and considered in this study is the amount of net operating losses and unused investment

¹⁰ In addition, it has been proposed that firms tinge their leverage to signal new information. Results reported by Ofer and Natarajan (19137) and Israel, Ofer, and Siegel (1989) support this hypothesis.

¹¹ There could be a relation between the average tax rate and prior levels of nondebt tax shields. We use, however, the anticipated loss in nondebt tax shields in future years resulting from the TRA. As we report later, there is no significant correlation between our proxy for the effective tax rate and our estimate for the loss in nondebt tax shields.

tax credits carried forward (NOLCC). However, unlike depreciation and the investment tax credit, the relation between leverage changes and NOLCC cannot be unambiguously predicted. On one hand, we would expect the additional restrictions on the use of NOLCC imposed by the TRA to result in a substitution effect as specified in Hypothesis 2.¹² That is, we would expect a negative relation between the amount of NOLCC and leverage changes in 1987, since the effect of the restrictions is proportional to the amount of NOLCC. However, note that firms with NOLCC have had losses for tax purposes, indicating that their marginal effective tax rate, at least in the most recent year, was zero. According to Hypothesis 1, to the extent that the presence of NOLCC is correlated with the firm's marginal effective tax rate, we would expect a positive relation between the amount of NOLCC and leverage changes in 1987. Thus, the direction of the relation between NOLCC and leverage changes in 1987 cannot be predicted based on our hypotheses.

Additional independent variables are introduced to control for non-tax factors potentially affecting leverage. They represent firm size, business risk, and bankruptcy cost or collateral value. (These variables are discussed further in Section 4.3.2.)

The cross-sectional regression has the following form:

$$\Delta \text{LEV} = \alpha + \beta_1 \text{ETR} + \beta_2 \Delta \text{DEP} + \beta_3 \Delta \text{ITC} + \beta_4 \text{NOLCC} + \beta_5 \text{DYLD} + \beta_6 \text{SIZE} + \beta_7 \text{BRISK} + \beta_8 \text{TBQ} + \epsilon, \quad (1)$$

where ΔLEV is the change in leverage, ETR is the effective tax rate, ΔDEP is the average annual amount of depreciation lost as a result of the TRA, ΔITC is the average annual amount of investment tax credit lost as a result of the TRA, NOLCC is the amount of nondebt shields available to the firm from net operating losses and investment tax credits carried forward, DYLD is the dividend yield, SIZE is the firm's size, BRISK is the firm's business risk, TBQ is the Tobin's Q ratio for the firm, proxying for bankruptcy costs and collateral value, and ϵ is an error term.

In line with Hypothesis 1, we expect β_1 to be negative: the higher the effective tax rate, the larger the reduction in leverage caused by the cut in the statutory tax rate. Based on Hypothesis 2, we expect β_2 and β_3 to be negative, reflecting the substitution effect resulting from the reduction of nondebt tax shields. Given the potentially offsetting effects represented by NOLCC , no directional hypothesis is made with

¹² The TRA does not reduce the amount of these carryforwards. Rather, it imposes an annual limit (the "Section 382 limitation") on the extent to which net operating losses carried forward as well as other credits (e.g., business, research, foreign tax) and capital losses carried forward can be used upon an "ownership change."

respect to β_4 . According to Hypothesis 3, we expect β_5 to be negative, reflecting the impact of the reduction in the personal tax advantage of equity income over debt income.

No formal hypotheses are offered for the signs of the control variables. Since we examine leverage changes surrounding the enactment of the TRA, control for nontax determinants of capital structure is obtained by virtue of examining the same firm before and after the act. Hence, the control variables control only for the “cross derivatives” (i.e., the effect that these variables have on the firm’s response to the new tax code).

4. Time Period Examined, Sample, Variables, and Data Sources

4.1 Time period examined

The TRA was passed by the U.S. Congress in September 1986 and signed into law by President Reagan the following month. It governs all tax years after 1986, with various transitional provisions applying in 1987.¹³ Our hypotheses pertain to the changes in leverage made in 1987. Leverage changes in this year are examined not only because this was the first year the TRA was in effect,¹⁴ but also because until the Senate’s passage of its version of a tax reform bill in May 1986, there was still a great deal of uncertainty about whether a tax reform bill would pass both houses of Congress.¹⁵ Further, given the differences in the provisions incorporated in the House and Senate bills, it was not at all clear what provisions would be contained in the final legislation should it eventually be approved by both Congressional bodies.

¹³ Most of the TRA provisions became effective on January 1, 1987 (e.g., the provisions governing net operating loss carryforwards and depreciation schedules). Some became effective earlier (e.g., the retroactive repeal of the investment tax credit effective January 1, 1966). Other provisions were phased in during 1987, becoming fully effective in 1988. Specifically, the corporate tax rate reduction became effective July 1, 1987, resulting in a blended rate (of approximately 40 percent) for 1987; the new rate of 34 percent became effective January 1, 1988. For individuals, the highest tax bracket was reduced from 50 to 38.5 percent and the number of brackets was cut from 15 to 5 in 1987. In 1988, the new maximum rate of 28 percent was implemented (with an additional tax of 5 percent on a specified range of income for high-income taxpayers) and the two-bracket system became effective.

¹⁴ All of the provisions of the TRA became effective in 1987, although (as previously noted) a couple of them were phased in over the course of the year. Thus, it is likely that firms that elected to change their capital structure in reaction to the TRA would have done so as early as possible after the implementation of the act in order to maximize the benefits (or minimize the costs) resulting from the act. Therefore, we analyze leverage changes up through 1987.

¹⁵ See, for example, the *Wall Street Journal* article under the heading “Tax Overhaul Runs into Trouble” (April 18, 1986, page 1) and the assessment by Senator Robert Dole, Senate Majority Leader, that the tax-overhaul legislation is “hanging by a thread” and “might not pass in 1986” (*Wall Street Journal*, April 29, 1986, page 3). In fact, press releases just prior to the Senate vote indicated that the likelihood of the act’s passage was low.

While it is unlikely that most firms would have taken all of the proposed changes into account in making their capital structure decisions prior to 1987, some firms may have taken various provisions into account as early as 1986 if they believed that the likelihood of their eventual passage was high. In particular, both the House and Senate Committee bills contained a provision repealing the investment tax credit retroactive to the beginning of 1986. Leverage changes made in 1986 may thus be related to the loss of this nondebt tax shield. To the extent that other provisions appeared likely to pass, firms may have considered their effects in making their 1986 leverage decisions.

Since the issue of tax reform was not introduced to the Congressional agenda until 1985, it is unlikely that leverage changes in that year or prior years would be related to the provisions of the TRA.¹⁶ Accordingly, we introduce 1985 and 1984 as control years.

We expect the coefficients of ETR, Δ DEP, Δ ITC, NOLCC, and DYLD (β_1 to β_5 , respectively) to be zero in the control years. The coefficients of these variables may be significant in 1986, depending on the extent to which firms anticipated passage of the TRA and acted accordingly. In particular, the coefficient of the investment tax credit variable (β_3) may be significant in 1986 as a result of its retroactive effect.

4.2 Sample

The sample consists of all firms that meet the following criteria: (1) availability of accounting data (on Compustat) for 11 years prior to and including the year for which the leverage change is examined;¹⁷ (2) availability of financial statements for the years 1983-1986; (3) fiscal year-ends between October 1 and December 31; and (4) not in the utilities (SIC 4911-4940), financial (SIC 6022-6200), insurance (SIC 6312-6400), or real estate (SIC 6500-6799) industries.

The first criterion is necessary to compute variables whose computation requires 10 years of data. The second criterion is required for the computation of the ITC and NOLCC variables. The third criterion is introduced to maintain a uniform time framework in analyzing the response of firms to the TRA. The fourth criterion eliminates firms in certain industries, since they are affected by the TRA differently than manufacturers and retailers because of industry-specific provisions included in the act.

¹⁶ See Givoly and Hayn (1991) for a chronological review of the events leading to the Tax Reform Act of 1986.

¹⁷ Firms that were delisted from the Compustat Annual Industrial file because of mergers, acquisitions, liquidation, bankruptcy, etc., are not included in the sample. Although the sample selection criteria does not appear to have introduced a "survivorship bias" in that the omitted firms would have responded differently to the TRA as regards the relation between their leverage decisions and tax attributes, the possibility of such a bias cannot be ruled out.

4.3 Operationalization of the variables

4.3.1 Dependent variable. Leverage is defined in this article as the ratio of the value of debt to the sum of the value of debt and equity. Some studies have used the market value of equity and the book value of debt (as a proxy for the market value of debt) to compute this ratio. While use of the market value of equity is justified theoretically, changes in leverage under this definition are registered whenever share prices change and do not necessarily reflect intentional changes by management. Over the long run, management may adjust the amount of securities outstanding to restore the optimal leverage level. Over any given sample period, however, some of the changes in stock price result in an unintentional change in the measured leverage and may disappear over a longer period.

Since we are interested in intentional changes, we analyze initiated leverage changes brought about by such activities as new issues of equity or bonds, stock repurchases, and recalls of previously issued debt, using a book-based leverage measure. We also examine leverage changes using a market-based leverage measure.¹⁸ The dependent variable is computed as the change in the level of leverage (defined using either the initiated or market-based measure) at year-end t minus the level of leverage at year-end $t - 1$:

$$\Delta \text{LEV}_t = \text{LEV}_t - \text{LEV}_{t-1}.$$

The initiated leverage measure in year t is computed as¹⁹

$$\text{LEV(Init)}_t = \text{BVLTD}_t / (\text{BVLTD}_t + \text{BVE}_t),$$

where BVLTD_t is the book value of long-term debt and BVE_t is the book value of shareholders' equity.

The market-based leverage measure in year t is computed as

$$\text{LEV(Mkt)}_t = (\text{MVLTD}_t + \text{MVSTD}_t) / (\text{MVLTD}_t + \text{MVSTD}_t + \text{MVE}_t),$$

where MVLTD_t is an estimate of market value of long-term debt, MVSTD_t is an estimate of market value of short-term debt, and MVE_t is the market value of equity. The market value of long-term debt is

¹⁸ In addition to the two leverage measures reported in this study, we calculate seven other measures of leverage that differ with respect to whether (1) short-term debt is included, (2) the market value or the book value of equity is used, and (3) an estimated market value or the book value of long-term debt is used. In addition, a principal component technique was employed to produce a composite measure of leverage changes. Detailed definitions of the various leverage measures are available upon request. All leverage measures produced essentially the same results.

¹⁹ To avoid situations with negative BVE arising from the valuation of treasury stock at the purchase cost, the balance of treasury stock was adjusted so that the value of each share would be equal to the book value per share of the outstanding shares. Also, in computing $\Delta \text{LEV(Init)}_t$, the denominator of the leverage measure computed for year t excluded the earnings of year t that were retained.

proxied by the book value of long-term debt, adjusted for changes in interest rates during the year.²⁰ The market value and book value of short-term debt were assumed to be equal. The market value of equity was determined using the closing price at year-end t . As discussed later, the regression coefficients are not sensitive to the measure of leverage used to calculate leverage changes.

4.3.2 Independent variables.

Effective tax rate. In line with the approach described in Scholes and Wolfson (1992), we proxy for the marginal effective tax rate by the following measure:

$$ETR = \frac{\left(\frac{\text{Actual taxes paid}}{\text{over period}} + \frac{\text{Discounted deferred taxes}}{\text{accumulated over period}} \right)}{(\text{Pretax income over period})}.$$

The first term in the numerator measures the amount of taxes actually paid (as opposed to the tax expense reported in the firm's financial statements). The second term captures the present value of deferred taxes to be paid in the future, when the timing differences that gave rise to them reverse. To find the tax rate, the sum of these two terms is divided by pretax income. We use the effective tax rate computed over the 10-year period preceding the test year to estimate the firm's actual effective tax rate.

Alternative effective tax rate measures were also computed by (a) excluding the discounted deferred tax amount from the numerator; (b) finding the average annual effective tax rate over the 10 yearly rates; and (c) calculating the above measure, but weighting the various years so that more recent experience has a higher weight. The various measures were highly correlated and produced similar results.

Annual amount of depreciation lost (D DEP). The expected amount of depreciation lost as a result of the TRA depends on the expected level of capital expenditures. To estimate the former amount, we assume that future asset acquisitions are correlated with past asset acquisitions and thus base the estimate on the balance and compo-

²⁰ Specifically, if the book value of long-term debt at year-end t is less than the book value of long-term debt at year-end $t - 1$, long-term debt at year-end t is multiplied by the ratio of the interest rate in year $t - 1$ divided by the interest rate in year t to estimate the market value of long-term debt at year-end t . If the book-value of long-term debt at year-end t is greater than the book value of long-term debt at year-end $t - 1$, long-term debt at year-end $t - 1$ is multiplied by the ratio of the interest rate in year $t - 1$ divided by the interest rate in year t ; the amount of increase in long-term debt is added to this product to estimate the market value of long-term debt at year-end t . The prevailing rate on five-year Treasury notes is used to estimate interest rates.

sition of the assets in place. Since the TRA affected depreciation schedules for short- and long-lived assets differently, the firms' assets were divided into two categories: short-lived assets, consisting of machinery and equipment, and long-lived assets, consisting of plant and depreciable real property.²¹ Depreciation taken over the past five years was then allocated to these two asset categories based on the percentage of assets in each category. The amount of depreciation associated with short-lived assets was multiplied by 5 percent and the amount of depreciation associated with long-lived assets was multiplied by 17 percent.²² The sum of the two resulting amounts comprises the estimated reduction in the depreciation allowances resulting from the TRA. This amount is multiplied by -1 to indicate that these tax shields are no longer available to the firm.

The result is deflated by total firm value, as calculated in the denominator of the dependent variable. This deflation allows an intuitive interpretation of the regression coefficient (i.e., the change in total debt induced by a one dollar change in the amount of the depreciation tax shield). The Δ DEP variable is thus computed as

$$\Delta \text{DEP} = \frac{(\text{Average annual amount of depreciation lost due to TRA})}{(\text{Total firm value})}.$$

Annual amount of investment tax credits lost (D ITC). The annual amount of the investment tax credit lost as a result of the TRA is estimated based on the firm's average annual use of such credits over the most recent five years. This approach is based on the assumption that future asset acquisitions are correlated with past asset acquisitions. We convert the average credit lost to a deduction, comparable with the depreciation and interest deductions, by dividing the amount of the credit taken by the expected statutory tax rate; the investment tax credit is thus restated to its before-tax equivalent. Similar to the Δ DEP variable, the average annual amount of the investment tax credit

²¹ Prior to the TRA, a 150 percent declining balance method was used to compute depreciation for assets with depreciable lives from 3 to 15 years; real property was depreciated using a rate of 175 percent. The TRA adopted a rate of 200 percent for assets with depreciable lives from 3 to 10 years and 150 percent for assets with longer lives. In addition, the TRA lengthened the depreciable life of most assets, effectively reducing the present value of the depreciation tax shield. Thus, for shorter-lived assets, a slightly greater amount of depreciation can be taken in a given year, effectively increasing the present value of the depreciation. For longer-lived assets, a smaller amount of depreciation is allowed in a given year.

²² The amount of lost depreciation for shorter-lived assets, such as machinery and equipment, depends on the extent to which lengthening the asset lives outweighs the increase in the depreciation rate. Various estimates [i.e., see Coopers and Lybrand (1986) and Arthur Andersen and Co. (1986)] indicate that for short-lived assets, the TRA will result in a 5 percent loss in the present value of the tax shield provided by depreciation. For longer-lived assets and, in particular, plant and depreciable real property, estimates indicate that the effect of the two changes will be to reduce the present value of the depreciation tax shield by 17 percent.

lost is multiplied by -1 and then deflated by total firm value. The Δ ITC variable is thus computed as

$$\Delta \text{ITC} = \frac{\left(\frac{\text{Average annual amount ITC lost}}{\text{(on before-tax basis)}} \right)}{\text{(Total firm value)}}.$$

Net operating losses and tax credits carried forward (NOLCC).

The loss to the firm represented by the restrictions imposed on the use of NOLCC depends on many parameters that cannot be precisely estimated.²³ However, the reduction in the value of these nondebt tax shields is cross-sectionally correlated with the amount of NOLCC. We proxy for the reduction by the balance of NOLCC at the time of the act's passage as follows:

$$\text{NOLCC} = \frac{\left(\frac{\text{Net operating losses carried forward}}{\text{(Total firm value)}} + \frac{\text{Investment tax credits carried forward (on before-tax basis)}}{\text{(Total firm value)}} \right)}{\text{(Total firm value)}}.$$

Again, the investment tax credit is converted to a tax deduction by restating it on a before-tax equivalent basis. Since the net operating losses carried forward are a tax deduction, these two terms are added to get the existing amount of nondebt tax shields. As is done for the Δ DEP and Δ ITC variables, the amount of these tax shields is deflated by the denominator of the dependent variable, total firm value, to provide a more intuitive interpretation of the regression coefficient.

Dividend yield (DYLD). The dividend yield variable is calculated as the weighted average dividend yield over the recent five-year period as follows:

$$\text{DYLD} = \text{Weighted average of } \left(\frac{\text{(Dividends per share)}}{\text{(Price per share)}} \right).$$

An average yield is used because it is likely to be more representative of the firm's long-term dividend yield, and thus the dividend clientele, as compared with only the most recent dividend. A weighted average based on the dividend yields in the last five years is used. The weighting scheme gives more weight to recent years. The weight assigned to the most recent year is .35; a constant decay rate is used to deter-

²³ For instance, it might be the case that the value of NOLCC was reduced more for firms that had a higher probability of being taken over since the TRA restrictions on the use of net operating losses carried forward apply when there is a change in ownership.

mine the weights for the earlier years (yielding a decay rate of 28 percent). Admittedly, this is an arbitrary weighting scheme. However, alternative weights yielded essentially the same results.

Size (SIZE). If there are returns to scale in the costs of issuing securities, larger firms might change their leverage more readily than smaller firms. The size variable is introduced to control for this potential effect. It is computed as the natural logarithm of the total firm value as calculated in the denominator of the dependent variable.

$$SIZE = \ln(\text{Total firm value}).$$

Business risk (BRISK). The firm's business risk is proxied by the coefficient of variation of its operating income after depreciation over the most recent 10-year period, as follows:

$$BRISK = \frac{\left(\frac{\text{Std. dev. of operating income after depreciation over 10 years}}{\left| \text{Mean of operating income after depreciation over 10 years} \right|} \right)}{\left| \text{Mean of operating income after depreciation over 10 years} \right|}.$$

Bankruptcy cost and collateral value (TBQ). It has been suggested that the liquidation or collateral value of the firm's assets is a determinant of the optimal capital structure [see, e.g., Scott (1976) and Myers (1977)]. We use the book value of tangible net assets, normalized by the market value of equity, as a proxy for these determinants. This ratio corresponds to the inverse of Tobin's Q ratio. As such, it also measures the potential loss of growth opportunities in the case of bankruptcy (i.e., it also proxies for bankruptcy costs). This point is highlighted in Brealey and Myers (1988), who state that "the costs of distress are likely to be greater for firms whose value depends on growth opportunities or intangible assets. These firms are more likely to forgo profitable investment opportunities and, if default occurs, their assets may erode rapidly" (p. 435). The ratio is computed as

$$TBQ = \frac{(\text{Book value of equity}) - (\text{Intangible assets})}{(\text{Market value of equity})}.$$

4.4 Data sources

Data used to compute most of the variables were obtained from the Compustat Annual Industrial and the Center for Research on Security Prices (CRSP) databases. Information on net operating losses and investment tax credits carried forward for tax purposes as of the end

of 1983-1986 was collected from firms' 10-K reports.²⁴ Further, if Compustat contained most of the data needed for a firm to participate in the analysis, the missing data items were collected from its 10-K reports.

5. Results

The final sample consists of 995, 892, 873, and 860 firms for the analysis of leverage changes in 1987, 1986, 1985, and 1984, respectively. Table 1 shows descriptive statistics of the variables for 1987. The average change in leverage as measured by $\Delta \text{LEV(Init)}$ in 1987 is slightly positive (0.007), with a fairly symmetric distribution around this mean. The mean of $\Delta \text{LEV(Mkt)}$ is slightly negative (-0.013). The correlation between these leverage measures in 1987 is .51. The cross-sectional dispersion for both measures is quite pronounced. Leverage changes in the earlier years for $\Delta \text{LEV(Init)}$ range from 0.006 to 0.020 and from 0.006 to 0.031 for $\Delta \text{LEV(Mkt)}$.

Regarding the independent variables, the mean effective tax rate is .432, lower than the prevailing statutory rates of .46 and .48 over the 10-year period in which the effective tax rate is computed. The average values of ΔITC (-0.014) and ΔDEP (-0.010) indicate that firms lost a greater amount of nondebt tax shields from the elimination of the investment tax credit than they did from the change in depreciation schedules.²⁵ The average value of the NOLCC variable is 9.8 percent of the book value of the firm [computed as the denominator of the $\Delta \text{LEV(Init)}$ measure], although less than one fourth of the firms have these tax shields. Approximately 80 percent of NOLCC is due to the presence of net operating losses carried forward; the remaining 20 percent stems from investment tax credits carried forward.

The regression results are presented in Table 2. Panel A of Table 2 shows the regression results for leverage changes measured by $\Delta \text{LEV(Init)}$; panel B shows the results for leverage changes measured by $\Delta \text{LEV(Mkt)}$. The results for the two measures are similar, although the explanatory power of the initiated changes measure is higher. The direction of the coefficients of the main explanatory variables—ETR, ΔDEP , ΔITC , and DYLD—are consistent with the hypothesized signs. These coefficients are different from zero at the 50 percent level of confidence or higher.

²⁴ Compustat generally reports the amount of net operating losses carried forward for financial reporting purposes (the "book" amount) as opposed to the amount available for tax purposes. Compustat does not report the amount of investment tax credits carried forward.

²⁵ Revenue estimates prepared by the U.S. Congress Joint Committee on Taxation (1987) indicate that the repeal of the investment tax credit was expected to raise about \$24 billion a year over the 1987-1991 period, whereas the change in the depreciation schedule was expected to raise roughly \$2 billion per year.

Table 1
Distribution statistics of regression variables for the 1987 sample (995 firms)

	ΔLEV		ETR	ΔDEP^1	ΔITC^1	NOLCC ¹	DYLD	SIZE ¹	BRISK	TBQ
	Init	Mkt								
Mean	0.007	-0.013	0.432	-0.010	-0.014	0.098	0.022	5.382	1.824	0.677
SD	0.135	0.136	0.137	0.016	0.026	0.503	0.028	1.873	1.164	0.504
1st quarter	-0.031	-0.086	0.354	-0.005	0.000	0.000	0.005	3.978	1.020	0.368
Median	-0.001	-0.014	0.430	-0.007	-0.009	0.000	0.020	5.263	1.480	0.596
3rd quarter	0.035	0.045	0.482	-0.011	-0.019	0.006	0.033	6.691	2.348	0.867

Sample firms consist of firms on Compustat (excluding those in the utilities, financial, insurance, and real estate industries) over the 11-year period ending December 1987 for which financial statement data is available and which have fiscal year-ends from October–December. $\Delta\text{LEV}(\text{Init})$, change in firm's leverage from year-end $t - 1$ to year-end t , using the measure of initiated leverage change; $\Delta\text{LEV}(\text{Mkt})$, change in firm's leverage from year-end $t - 1$ to year-end t , using the market-based measure of leverage change; ETR, effective tax rate; ΔDEP , average depreciation lost, divided by total firm value; ΔITC , average investment tax credits lost, divided by total firm value; NOLCC, net operating losses and investment tax credits carried forward, divided by total firm value; DYLD, weighted average dividend yield; SIZE, natural log of total firm value; BRISK, business risk (adjusted coefficient of variation of operating income); TBQ, bankruptcy cost and collateral value (reciprocal of Tobin's Q ratio).

¹ Total firm value used in computing variable is that used in the $\Delta\text{LEV}(\text{Init})$ measure.

Table 2
Results of cross-sectional regression (1)

Regression coefficients (numbers in parentheses are <i>t</i> -statistics)										
Year	Intercept	ETR	ΔDEP	ΔITC	NOLCC	DYLD	SIZE	BRISK	TBQ	Adj. <i>R</i> ² (<i>F</i>)
A: ΔLEV(Init)										
1987	.191	-.115	-.501	-.299	-.052	-.417	-.015	-.024	-.021	.12
(995) ¹	(9.11)*	(-3.85)*	(-2.96)*	(-1.79)**	(-5.53)*	(-2.70)*	(-6.37)*	(-6.11)*	(-2.67)*	(18.27)*
1986	.121	-.026	-.306	-.600	-.017	-.100	-.008	-.016	-.030	.05
(892)	(5.23)*	(-0.84)	(-1.21)	(-2.43)*	(-1.43)	(-0.85)	(-3.30)*	(-3.37)*	(-5.05)*	(7.12)*
1985	.106	.003	-.039	-.190	-.025	.215	-.010	-.018	-.022	.04
(873)	(3.76)*	(0.10)	(-1.15)	(-1.08)	(-1.51)	(0.87)	(-3.61)*	(-3.28)*	(-3.32)*	(4.84)*
1984	.134	-.039	-.272	-.087	-.035	-.238	-.009	-.017	-.016	.03
(860)	(5.09)*	(-1.17)	(-0.74)	(-0.49)	(-2.08)*	(-1.40)	(-3.49)*	(-3.50)*	(-1.69)**	(4.04)*
B: ΔLEV(Mkt)										
1987	.169	-.097	-.749	-.452	-.048	-.395	-.016	-.010	-.052	.08
(995) ¹	(7.00)*	(-3.47)*	(-2.38)*	(-1.86)**	(-4.25)*	(-1.88)**	(-6.18)*	(-2.52)*	(-6.00)*	(11.75)*
1986	.108	-.028	-.455	-.526	-.046	-.259	-.006	-.013	-.021	.05
(892)	(4.64)*	(-0.93)	(-1.41)	(-2.43)*	(-3.72)*	(-1.12)	(-2.43)*	(-2.81)*	(-3.42)*	(6.66)*
1985	.066	.024	.231	-.154	-.016	.186	-.007	-.013	-.009	.03
(873)	(2.85)*	(0.78)	(0.58)	(-0.95)	(-1.17)	(0.89)	(-2.93)*	(-2.98)*	(-1.55)	(4.26)*
1984	.148	-.022	-.336	-.253	-.024	-.124	-.010	-.011	-.016	.03
(860)	(6.53)*	(-0.76)	(-1.08)	(-1.32)	(-1.53)	(-1.13)	(-4.88)*	(-2.52)*	(-1.75)**	(4.72)*

Sample firms consist of firms on Compustat (excluding those in the utilities, financial, insurance, and real estate industries) over the 11-year period ending in the year of the analysis, for which financial statement data is available and which have fiscal year-ends from October–December. ΔLEV(Init), change in firm's leverage from year-end $t - 1$ to year-end t , using the initiated measure of leverage change; ΔLEV(Mkt), change in firm's leverage from year-end $t - 1$ to year-end t , using the market-based measure of leverage change; ETR, effective tax rate; ΔDEP, average depreciation lost, divided by total firm value; ΔITC, average investment tax credits lost, divided by total firm value; NOLCC, net operating losses and investment tax credits carried forward, divided by total firm value; DYLD, weighted average dividend yield; SIZE, natural log of total firm value; BRISK, business risk (adjusted coefficient of variation of operating income); TBQ, bankruptcy cost and collateral value (reciprocal of Tobin's Q ratio).

¹ Number of firms in analysis.

* Significant at .01 level; **, significant at .05 level. All significance levels are for two-sided tests except for those relating to the coefficients of ETR, ΔDEP, ΔITC, and DYLD in 1987, the test year.

The coefficient of the ETR variable, which is negative and significant, is consistent with the notion that the corporate tax rate is a determinant of capital structure. Specifically, the propensity of firms to decrease leverage as a result of the drop in the statutory tax rate is greater the higher the firms' effective tax rates.

The negative signs on Δ DEP and Δ ITC suggest that firms that lose more from the reductions in the depreciation allowance and the repeal of the investment tax credit increase their leverage more than firms that were less dependent on these nondebt tax shields. Considered together, the negative signs on these two variables support the hypothesis that there is substitution between debt and nondebt tax shields. Note that Δ DEP and Δ ITC might proxy for the firm's debt capacity. As such, they might be positively correlated with leverage changes and thus offset the substitution effect. However, the significant negative coefficients for these variables suggest that the substitution effect is the dominant one.

The coefficient of NOLCC is negative and significant. This suggests that the substitution effect between debt and nondebt tax shields triggered by the new restrictions imposed on the use of the NOLCC dominates the tax effect (i.e., the extent to which the NOLCC proxies for the firm's marginal effective tax rate).²⁶

Finally, the coefficient of the DYLD variable is negative and significant. This finding may indicate that personal taxes are a determinant of capital structure. Furthermore, this result provides indirect support for the dividend clientele theory.

For 1986, the coefficient of Δ ITC is negative and significant. This is consistent with the notion that the retroactive repeal of this credit (to January 1, 1986) did affect leverage decisions as early as 1986. None of the other main explanatory variables is significant, with the exception of the NOLCC variable.

The results of the regression equation using either leverage measure are not significant in the hypothesized direction in the control years 1985 and 1984.

To test formally whether the results obtained for 1987 are significantly different from those obtained for the control years, we employ the Chow test [see Chow (1960)], comparing 1987 with the control

²⁶ This result is further borne out by the fact that there is a relatively low correlation (-0.05) between ETR and NOLCC. This appears to result from the way the two variables are measured; ETR is calculated over a 10-year period, whereas NOLCC is measured only in the last year of this period. To further explore whether NOLCC proxies for the firm's effective marginal tax rate and thus influences our estimation of the coefficients of the two variables, we reestimated Equation (1) once without the NOLCC variable, and then without the ETR variable. When the NOLCC variable is omitted, the coefficient of ETR changes from -0.118 to -0.123 (*t*-statistic of -4.07). When ETR is dropped from the regression, the coefficient of NOLCC changes from -0.048 to -0.049 (*t*-statistic of -5.16). The small change in the estimated coefficients indicates that the correlation between these two variables does not affect the estimated coefficients.

period, defined as 1985 and 1984 combined. Specifically, we pool the data for 1987, 1985, and 1984, and reestimate Equation (1). The F -statistic comparing the residual sum of squares for the pooled regression to that obtained from the separate regressions for the individual periods (the control period and the test period) is 14.85, which is significant at the 1 percent level. This indicates that there is a significant difference in the estimated regression between the test period and the control period. We repeat this test, comparing 1987 with 1986, obtaining an F -statistic that is lower (7.94) but still significant.

Even though the Chow test results indicate that the regression estimates for 1987 are different from those of the control period, individual coefficients of the main explanatory variables might still be equal. We compare the individual coefficient estimates to determine if those in the test period are significantly different from those in the control period. For the pooled data (1987, 1985, and 1984), we estimate a modified version of regression Equation (1), using the dummy variable approach [see Kennedy (1986), pp. 180-188]. Specifically, we estimate the following regression:

$$y = \sum_{i=1}^n (B_i x_i + \lambda_i D x_i) + \epsilon, \quad (2)$$

where x_i ($i = 1, \dots, n$) are the independent variables (including the intercept), and D takes on a value of 1.0 in 1987 and 0.0 in other years.

This regression is estimated for a pooled sample consisting of observations for 1987 and the comparison year(s). The test of equality in the coefficient of variable x_i between 1987 and the comparison year(s) is based on the t -values of the coefficients of the Dx_i 's, the λ_i 's. We expect the coefficients of the main explanatory variables in the control period to be closer to zero than in the test period. That is, we expect the λ_i 's to be negative, indicating that the coefficients of the x_i 's are lower in 1987 than in the comparison year(s).

Table 3 reports the f -statistics for the λ_i 's relating to the main explanatory variables. The test results show that the differences in the coefficients of the main explanatory variables between 1987 and the control period are generally significant and in the expected directions. These findings highlight the importance of the control problem inherent in cross-sectional studies of capital structure in periods in which the tax regime remains stable. More importantly, in the context of this study, the results of the Chow and t -tests, and the absence of significant coefficients for the main explanatory variables in the control period (with the exception of NOLCC), indicate that the 1987

Table 3
Results of test on equality of coefficients of main explanatory variables, based on regression (2)

	t-statistics for coefficients corresponding to:				
	ETR	Δ DEP	Δ ITC	NOLCC	DYLD
A: ΔLEV(Init)					
1987 vs. 1984 and 1985	-6.04*	-3.68*	-1.82**	-1.52	-4.56*
1987 vs. 1984	-3.05*	-2.98*	-2.08**	-1.36	-3.34*
1987 vs. 1985	-7.98*	-4.43*	-1.81**	-1.87**	-7.02*
1987 vs. 1986	-6.82*	-2.95*	2.32*	-2.08**	-4.34*
B: ΔLEV(Mkt)					
1987 vs. 1984 and 1985	-4.02*	-4.42*	-1.79**	-2.41*	-5.22*
1987 vs. 1984	-2.87*	-2.86*	-1.66**	-2.01**	-4.64*
1987 vs. 1985	-6.19*	-5.84*	-1.81**	-2.88*	-5.47*
1987 vs. 1986	-3.83*	-2.25*	0.81	-0.93	-2.87*

Sample firms consist of firms on Compustat (excluding those in the utilities, financial, insurance, and real estate industries) over the 11-year period ending in the year of the analysis, for which financial statement data is available and which have fiscal year-ends from October–December. Δ LEV(Init), change in firm's leverage from year-end $t - 1$ to year-end t , using measure of initiated leverage change; Δ LEV(Mkt), change in firm's leverage from year-end $t - 1$ to year-end t , using market-based measure of leverage change; ETR, effective tax rate; Δ DEP, average depreciation lost, divided by total firm value; Δ ITC, average investment tax credits lost, divided by total firm value; NOLCC, net operating losses and investment tax credits carried forward, divided by total firm value; DYLD, weighted average dividend yield.

* Significant at .01 level; **, significant at .05 level. All significance levels are for one-sided tests.

results are robust and unlikely to be due to a misspecification of the regression equation.

The correlation of the main explanatory variables used to examine the change in leverage is generally low, indicating that multicollinearity is not a serious problem in our analysis. Δ DEP and Δ ITC have the highest correlation (.36) and NOLCC is positively correlated with both of these variables (.21 with Δ DEP and .33 with Δ ITC). We further test for heteroskedasticity using the White test [see White (1980)]. That is, we regressed the residuals from Equation (1) on all the explanatory variables, their squares, and their cross-products for each of the four years. The resulting R^2 were very low (ranging from 0.5 percent to 1.8 percent), suggesting that the assumption of a constant variance cannot be rejected.

6. Concluding Remarks

While theory has provided testable predictions about the relation between taxes and capital structure, the empirical evidence to date has been inconclusive in refuting or supporting these predictions. The Tax Reform Act of 1986, by materially affecting the tax regime in which both corporations and individuals operate, provides a rich testing ground for the impact of taxes on leverage. In this article, we

examine the determinants of leverage changes surrounding the enactment of this act. The controlled experiment provided by a “before” and “after” comparison of the leverage of the same firm enables us to hold constant contemporaneous nontax factors that might affect capital structure. This increases the power of our tests, leading to more conclusive results.

Specifically, our findings indicate that both corporate taxes and nondebt tax shields are determinants of capital structure. Furthermore, we provide indirect evidence that personal taxes play a role in the capital structure decision and that dividend clienteles exist.

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