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CORPORATE TAXES AND CAPITAL STRUCTURE: A LONG-TERM HISTORICAL PERSPECTIVE

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ABSTRACT

We study the relation between leverage and corporate tax rates using an extensive data set constructed from all corporate income tax returns filed with the IRS from 1926 to 2009. This data set includes financial statement data from millions of private and public corporations of all sizes. We show that corporate leverage has increased significantly over the past century. We find strong evidence that changes in corporate leverage are directly related to changes in corporate tax rates for all but the smallest firms. These results are robust to the inclusion of control variables for the costs of financial distress, corporate liquidity, and capital market and macroeconomic conditions. The adjustment of leverage to changes in corporate tax rates is slower for smaller firms facing financial constraints. We find that the capital structures of the smallest firms are driven much more by external shocks than is the case for larger firms.

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1. INTRODUCTION

The capital structure decisions of corporations have been one of the most important areas of study in financial economics ever since the pioneering studies of Modigliani and Miller (1958, 1963). Corporate theory has identified a number of potential determinants of corporate capital structure such as taxes, bankruptcy costs, information asymmetry, and agency problems.

In particular, the relation between corporate taxes and financial decisions of firms has played a central role in the capital structure literature. This is because the choice of capital structure changes the after-tax value of the firm's cash flows. Thus, if corporate taxes are material, optimizing capital structure should be an important priority for firm managers who wish to maximize the total after-tax value of the company. To date, however, there has not been strong evidence linking changes in corporate income tax rates to corporate capital structure. As Graham (2008) puts it in a review of research on taxation and corporate finance, "there is no known study that documents tax-related time series effects in debt usage." At the same time, recent theoretical research and some empirical estimates suggest that tax benefits are large and that firms may leave money on the table by not leveraging enough (Graham (1996a, 2000)).

The challenges that face empirical researchers are two-fold. First, the time series data are limited. For example, the US Compustat data cover only public firms and goes back only to the early 1950s (adequate coverage starts only in the early 1960s). The biggest US tax reform over that period, in 1986, is small in comparison with changes in tax laws and rates during the first half of the 20th Century. The second challenge is that changes in tax laws and rates do not happen overnight but are typically the result of multi-year policy negotiations between decision makers. As a result, economic agents may sometimes have ample time to prepare and adjust for the eventual tax reform. For example, the overall results on the effect of the 1986 US tax reform on capital structure are inconclusive (Slemrod (1992), Givoly, Hayn, Ofer, and Sarig (1992)), likely because the reform itself was very complicated and firms had time to adjust.

This paper studies the relation between corporate taxes and leverage using an extensive new data set that allows us to resolve both of these challenges. Specifically, the data set is constructed from an Internal Revenue Service (IRS) database of all corporate income tax returns filed in the United States from 1926 to 2009. By using nearly a century of capital structure data, our results provide clear answers about the time series effects of tax rate changes on corporate leverage for firms of all sizes. Further, by spanning almost the entire history of the corporate income tax, the data set allows us to evaluate the effects of a much broader set of policy changes, many of which may not have been fully anticipated.

A number of important results emerge from this analysis. First, we find that there

has been a significant upwards trend in the amount of corporate leverage throughout much of the past century. In particular, the average corporate leverage ratio increased from a low of 51.65 percent in 1931 to a high of 75.15 percent in 1978. Since the 1970s, however, the average corporate leverage ratio has gradually declined and was 63.77 percent in 2009.

Second, we find strong direct evidence that corporate leverage responds to changes in corporate tax rates for all but the smallest firms. In particular, an increase in the marginal corporate tax rate of one percent results in a 0.18 percent increase in corporate leverage, representing roughly a $137 billion increase in aggregate corporate leverage (based on 2009 statistics). In contrast, a one percent increase in the marginal corporate tax rate would raise about $8 billion in additional tax revenue (based on 2009 statistics). The significant positive relation between leverage and corporate tax rates is robust to the inclusion of control variables for the costs of financial distress, corporate liquidity, and capital market and macroeconomic conditions. These results provide direct empirical confirmation of one of the central pillars of standard corporate capital structure tradeoff theory.

Finally, our results provide evidence that financial constraints play a central role in determining corporate capital structure. In particular, we show that large firms adjust their capital structures much more rapidly in response to changes in marginal corporate tax rates than do medium-size firms. In contrast, the capital structure decisions of smaller firms are driven more by liquidity and profitability shocks. Thus, given that small and medium-sized firms likely face greater financial constraints than large firms, these results imply the first-order importance of financial constraints in capital structure decisions.

There is an extensive empirical literature on the determinants of corporate capital structure. Because extensive time series data was previously unavailable, earlier research in this area concentrated primarily on identifying cross-sectional factors influencing capital structure. For example, Mackie-Mason (1990) shows that there could be significant tax effects in incremental financing decisions. Rajan and Zingales (1995) compare corporate financial policies across a number of developed countries and find that cross-sectional variation in tax rates has some predictive power in explaining capital structure decisions. Fama and French (2002) find that leverage is an increasing function of the size of public companies. One challenge with cross-sectional determinants is that they do not establish the causality of the link between taxes and financial constraints. Several recent papers try to control for endogeneity by concentrating on natural experiments. For example, Panier, Perez-Gonzales, and Villanueva (2014) study changes in Belgian tax law and find that firms respond strongly to tax incentives (particularly large firms). Heider and Ljungqvist (2014) find that US firms respond strongly to increases in state level corporate income tax rates.

Recent research has also emphasized that macroeconomic risk has a profound impact on corporate financing decisions (Hackbarth, Miao, Morellec (2006), Bhamra,

Kuehn, Strebulaev (2010)). Empirically, Korajczyk and Levy (2003) observed that financially unconstrained firms follow counter-cyclical leverage strategies, but financially constrained firms exhibit pro-cyclical leverage behavior. They also find that macroeconomic conditions are significant for issue choice for unconstrained firms, but less so for constrained firms. Consistent with this evidence, Gertler and Gilchrist (1993) find aggregate cyclicality of short-term availability in the presence of financial constraints.

An important recent paper by Graham, Leary, and Roberts (2014) is one of few studies that explores long-term trends in corporate capital structure. They concentrate on unregulated public US companies and show that firm characteristics are unlikely to account for the long-term trends, such as an increase in the overall level of debt. They attribute the rise of debt to changes in government borrowing, macroeconomic uncertainty, and financial sector development.

This paper extends the literature in several important dimensions. In particular, by using data for millions of both private and public firms for a timeframe spanning most of a century, we are able to identify the time series effects of corporate tax rate changes on corporate capital structure. Furthermore, by stratifying the data by firm size, we are also able to explore the role that financial constraints may play in determining corporate capital structures.

The rest of the paper is as follows. Section 2 review the history of corporate income taxation in the United States. Section 3 describes the data. Section 4 studies the relation between corporate taxes and leverage. Section 5 summarizes the findings and presents concluding remarks.

2. THE US CORPORATE INCOME TAX

The taxation of corporate income in the United States has a long history. During the Civil War in 1862, President Lincoln signed a revenue act that introduced a three to five percent income tax, which also applied to income from businesses. This income tax was repealed in 1872. In 1894, the Wilson Tariff Act reinstated income taxation on both personal and business income. The Wilson Tariff Act was then ruled unconstitutional a year later in 1895.[1]

The current corporate income tax was initiated in 1909 with the levy of a one-percent tax rate on corporate income in excess of $5,000. Thus, the corporate income tax predates the 1913 introduction of the current personal income tax by four years. The passage of the 16th Amendment in 1913 resolved the issue of the constitutionality of both the personal and corporate income taxes.

[1]For a discussion of the history of the income tax, see www.irs.gov/uac/Historical-Highlight-of-the-IRS as well as Joseph (2004) and Bank (2010).

Table 1 presents summary statistics for the corporate income tax rate schedule throughout its history. As shown, corporate income tax rates have varied significantly over time, ranging from a low of one percent from 1909–1915 to a high of 53 percent from 1942–1949. Table 1 also shows that the number of tax brackets, defined as the number of income ranges with distinct tax rates, has also varied dramatically over time. The number of tax brackets ranges from one during 1913–1918 when all corporate income was taxed at the same rate, to nine in 1940. It is also interesting to observe that the maximum tax rate does not always occur for the highest tax bracket. In other words, the corporate tax rate is not always an increasing function of income. For example, the current corporate income tax schedule taxes corporate income between $100,000 and $335,000 at the rate of 39 percent, while income above the maximum threshold of $18,333,333 is only taxed at a 35 percent rate.

Since the corporate tax rate varies across income levels, we need some measure of the marginal or representative tax rate.[2] In this paper, we will use the simplest definition of the marginal tax rate as the tax rate applied to the highest income tax bracket. Figure 1 plots the time series of this measure of the marginal tax rate over the past century. We observe, however, that all of the results are robust to the definition of the marginal tax rate. In particular, the results are very similar when we use the maximum tax rate or an average tax rate as the measure of the marginal tax rate.

3. THE DATA

The Revenue Act of 1916 mandated the annual publication of statistics associated with the collection of income taxes. From 1916–1925, the total values of some income and deduction items were published, where the values were aggregated across all tax returns. Since 1926, the IRS has published aggregate basic balance sheet and income statement information based on all of the millions of corporate income tax returns filed. This data is reported in the annual IRS Statistics of Income (SOI) publication. Since this data set will likely be new to most researchers, we provide an introduction to the SOI reports in the online Appendix to this paper and describe where this data may be accessed in an effort to facilitate future work by academic researchers. Beginning in 1931, the IRS has also reported aggregate balance sheet and income statement data for all firms within specific size categories. The number of size categories ranges from 8 to 12 during the 1931–2009 period.

To provide an example of the distribution of firms included in the SOI, Table 2 shows the total number of firms and total assets for all firms within each of the nine size categories reported in 2009 by the IRS. The total number of corporate tax returns included is 4,829,756. The distribution of returns, however, is heavily skewed towards smaller firms. In fact, firms with total assets of less than or equal to $500,000 total

[2]For a discussion of this issue, see Graham (1996b).

3,889,921, which represents 80.54 percent of all firms. In contrast, the distribution of assets is heavily skewed toward larger firms. The total assets of all firms in the largest size category is $70,497 billion, which represents 92.80 percent of all corporate assets.

It is interesting to compare the distribution of firms in the SOI universe with those in the Compustat universe for the same year, since Compustat is one of the most widely-used sources of data for historical accounting information for US public companies. Table 3 shows the total number of firms and total assets for all firms within the Compustat universe, where these summary statistics are reported using the same format and size categories as in Table 2.

As shown, the 2009 Compustat universe includes information for 9,735 firms in 2009 (the SOI and Compustat universes include both financial firms and nonfinancial firms). Thus, the SOI universe includes roughly 500 times as many firms as the Compustat universe. This is because the SOI universe includes not only the public firms included in the Compustat universe, but also millions of smaller nonpublic firms which represent the vast majority of all corporations in the US. It is important to observe, however, that the SOI data also includes many large firms that are not included in the Compustat universe. For example, the SOI universe includes 14,110 firms in the $250 million and larger category, while the Compustat universe only include 3,812 firms in the same size category. The reason for the difference is that the SOI data includes many large nonpublic firms (such as Cargill, Levi Strauss, Bechtel, etc.) Thus, the SOI universe is far more comprehensive, and significantly extends Compustat in terms of size, nonpublic firms, as well as the time dimension.

To make the SOI data comparable over time, we use the CPI-U index to convert all balance sheet and income statement totals into constant 2009 dollars. To provide greater consistency over time, we combine the totals for the size categories and form three broader size categories. These three categories are designated small, medium, and large. These three categories map into asset size ranges (in 2009 dollars) of roughly zero to $10 million, $10 million to $100 million, and greater than $100 million, respectively.

The balance sheet and income statement information is self reported by each firm filing a corporate tax return, although all information is subject to audit. While there is undoubtedly variation in accounting policies across firms and also over time, the definitions of most of basic balance sheet and income statement categories (such as cash, accounts receivable, accounts payable, shareholders' equity, etc.) are likely relatively constant over time. Thus, leverage ratios computed using these values should be generally consistent over time.

Although corporate tax returns are for a specific tax year, not all firms have the same year end. For example, based on the 2009 Compustat universe, 60.9 percent of firms have a December year end, 8.3 percent have a June year end, and the remaining firms have year ends that are relatively uniformly distributed throughout the other

months of the year. The SOI uses the convention that the 2009 report is based on the corporate income returns for tax years ending between July 1, 2008 and June 30, 2009, and similarly for reports for other years. As we will show later, this will have little effect on the results, since it simply increases the apparent time required by firms to respond to changes in tax rates and other control variables.

The SOI reports for 1926–1950 are based on actual totals of all corporate tax returns filed. Beginning with 1951, totals for smaller size categories are based on a stratified sampling of returns filed. For example, for the 2009 SOI report, the values for size categories below $50,000,000 are based on stratification. Although this procedure results in extrapolated values for totals, this procedure should have little effect on financial ratios such as the leverage measure.

Table 4 presents summary statistics for common-size balance sheet (expressed as a percent of total assets) and income statement (expressed as a percent of total revenues) items for the small, medium, and large categories, as well as for all firms. As shown, there are some interesting patterns in the average common-sized ratios across the size categories. For example, cash represents a much larger fraction of total assets for smaller firms that it does for the medium-sized and large firms. This finding is clearly consistent with the notion that smaller firms face greater financial constraints and, therefore, hold more liquid portfolios of assets as protection against shocks. This pattern is also reflected in the much smaller fraction of total assets that smaller firms invest in longer term investments.

Not surprisingly, larger firms tend to be more profitable on average. Earnings before taxes represents only 2.45 percent of total revenues for small firms, but represents 7.32 percent for the large firms. Because large firms are historically more successful, and because successful small firms become larger firms with time, path dependency drives this result. Small firms include successful firms that are more likely to migrate to the large category and also include many unprofitable firms that are likely to stay small or disappear from the sample altogether.

The ratio of corporate taxes to earnings before taxes is 33.1 percent for small firms, 42.9 percent for medium-sized firms, and 38.4 percent for large firms. This shows that corporate taxes are a significant fraction of earnings for all size categories even though the corporate tax rate schedule has historically been relatively progressive. Furthermore, the incidence of taxation is not monotonic with firm size, suggesting that larger firms may have more flexibility in structuring their corporate tax liabilities.

A comparison of these financial ratios for the SOI universe with those for Compustat firms indicates that they are fairly similar. In particular, we compute average common size ratios for SOI firms during the 1960–2009 period and compare them with those for Compustat firms during the same period. For example, cash, receivables, inventories, and capital assets represent 5.54, 21.73, 5.37, and 18.83 percent of total assets for SOI firms, respectively. The same ratios for Compustat firms are 4.03, 28.39,

8.17, and 27.70 percent, respectively. Similarly, earnings before taxes and corporate taxes paid are 4.50 and 1.72 percent of total revenues for SOI firms, respectively. The same ratios for Compustat firms are 7.87 and 3.56 percent, respectively.

Turning next to corporate leverage, we compute the leverage ratio by simply taking the ratio of total debt to total assets for each year and size category. In this context, debt includes all liabilities of the firm such as accounts payable and accruals as well as formal indebtedness such as bank loans, mortgages, and corporate bonds. This ratio is also equal to one minus the ratio of shareholders' equity to total assets. Empirical researchers typically prefer to use leverage ratios that are based on book values of debt rather than liabilities, because liabilities include items such as working capital financial needs, which are more indicative of day-to-day operating environment than of voluntary financial decisions. SOI data reports only liabilities. However, because our emphasis is on time-series patterns, this distinction is of less importance, unless the composition of debt and non-debt liabilities changed dramatically over time. Rajan and Zingales (1995) also report ratios based on liabilities, because their aim is to compare leverage ratios across different countries and the definition of debt-like liabilities varies with the accounting regime. It should also be noted that empirical researchers overwhelmingly work with large firms, for which debt-like liabilities can take the form of corporate bonds, commercial paper, and so on – that is, "pure" debt. Most of our data is based on small private firms, where the distinction between debt and non-debt liabilities is moot, because most of these firms do not have access to public debt markets.

Table 5 presents summary statistics for the leverage ratios for each of the three size categories and for all firms. Figure 2 plots the leverage ratio for all firms for the 1926–2009 period. As illustrated, the leverage ratio for all firms also varies significantly over time. The highest corporate leverage ratios occur during 1970s when they reached a level in excess of 75 percent.

As a preliminary to the formal empirical analysis later in the paper, Figure 3 presents a scatterdiagram of the level of the marginal corporate tax rate and the level of aggregate corporate leverage for the 1926–2009 period. As shown, there is a strong positive relation between the two measures.

Figure 4 plots the time series of leverage ratios for the small, medium, and large size categories. These leverage ratios are generally increasing throughout the 1931–2009 period. The leverage ratios for the medium-sized and large firms, however, reach a maximum in 1988 and then begin to decline. In contrast, the leverage ratio for small firms continues to increase. Thus, there is a clear difference between the properties of small firms and the other firms.

Returning to Table 5, the results suggest that average leverage is monotonically increasing in firm size. The average leverage ratio is 60.7 percent for small firms, 64.4 percent for medium-sized firms, and 67.5 percent for large firms. The lower average

leverage for smaller firms is again consistent with the perspective that smaller firms face greater financial constraints and are less able to acquire outside funding.

On the other hand, leverage ratios for smaller firms tend to be more volatile than those for larger firms. Specifically, the leverage ratios for small firms range from 38.0 to 76.6 percent during the sample period. In contrast, the leverage ratios of larger firms ranges 53.2 to 76.3 percent, which is a much tighter range than for small firms. The difference in the volatility of leverage ratios across size categories could reflect that smaller firms are more susceptible to liquidity and funding shocks through the business cycle. Thus, they may have less ability to choose their capital structure than larger firms.

It is important to recognize that there are other ways in which the leverage of a firm can be defined. For example, a number of papers focus on the net leverage ratio, given by subtracting cash from total debt, and then dividing the difference by total assets. To show that our results are robust to this alternative definition of leverage, all of the empirical analyses are repeated using net leverage. These results are included in the online Appendix as Tables A1 through A5. As these tables show, the results using the net leverage ratio are all very similar to those obtained using the leverage ratio.

Finally, we note that the average leverage ratios for the SOI firms are very similar to those for Compustat firms. Specifically, the average leverage ratio for all SOI firms during the 1960–2009 period is 69.90 percent. The ratio of liabilities to total assets for all Compustat firms during the same period is 71.18 percent.

4. HOW DO CORPORATE TAX RATES AFFECT LEVERAGE?

The standard tradeoff theory of capital structure implies that corporate tax rates should be a major determinant of corporate leverage decisions. In this section, we test the empirical implications of this theory by examining how corporate tax rates are related to corporate leverage over time. In doing this, we make use of the extensive time series of corporate capital structure information available from the SOI reports. An important advantage of this data set is that it allows us to study the relation between leverage and tax rates almost from the inception of the corporate income tax.

Specifically, our empirical approach will be to test whether changes in corporate tax rates are related to subsequent changes in corporate leverage. The reason for focusing on subsequent changes in leverage rather than contemporaneous changes is that firms may require time to respond to changes in tax rates because of the effects of financial frictions. Furthermore, this approach helps lessen potential endogeneity issues. The reason for focusing on changes rather than levels is simply that both corporate tax rates and leverage ratios tend to be highly persistent. In contrast, changes in these variables appear more stationary.

In testing whether changes in tax rates are followed by changes in corporate capital structure, we also include a number of other explanatory variables as controls. In the first specification, we include several lags of the change in leverage to control for potential persistence in leverage changes. In the second specification, we add variables that proxy for changes in the cost of financial distress. In the third specification, we include variables controlling for the liquidity and internal cash flows of the corporations. In the final specification, we include variables controlling for the state of debt and equity capital markets.

4.1 The Effects of Tax Rate Changes

As an initial specification, we regress changes in leverage on its lagged values and on lagged changes in the marginal corporate income tax rate. In particular, we use the first two lags of the change in leverage as a control for any persistence in the dependent variable (longer lags are not significant). To test whether changes in tax rates are followed by changes in leverage ratios, we also include the first three lags of the change in the marginal tax rate.

Table 6 presents the results from the regression. As shown, changes in leverage display some degree of persistence. The second lagged change is positive and weakly significant in the regression including all firms. This result, however, is not uniform across the individual size categories. Both the small and medium categories have a significant negative coefficient for a lagged change in leverage. This suggests that the leverage ratios for small and medium-sized firms tend to be mean reverting, in sharp contrast to the persistent behavior of leverage ratios for large firms. This pattern of differences in the behavior of capital structure across size categories will be a recurring theme throughout much of the subsequent empirical analysis in the paper. It is also consistent with previous empirical findings about the differences in capital structure policies of small and large firms (Korajczyk and Levy (2003), Gertler and Gilchrist (1993) and others).

Turning next to the effect of changes in tax rates, the results for the regression including all firms indicate that there is a strong positive relation between changes in marginal tax rates and subsequent changes in corporate leverage. In particular, the first lagged change in the marginal tax rate has a t-statistic of 2.30. The coefficient estimates for the lagged changes in marginal tax rates imply that one percent change in the marginal tax rate cumulates to an increase in the leverage ratio of 0.0018, or 0.18 percent. While this increase may seem modest as a percentage, it represents an increase in aggregate corporate leverage of nearly $137 billion (based on 2009 statistics). This increase is very large relative to the roughly $8 billion of incremental annual corporate income tax revenue that a one percent increase in the marginal tax rate would generate (again based on 2009 statistics). These results are clearly consistent with the hypothesis that tax rates are an important determinant of corporate capital structure.

The results for the regressions for the individual size categories are also very intriguing. As shown in Table 6, lagged changes in the marginal tax rate are not significant in explaining subsequent changes in the leverage of small firms. In contrast, there is a significant positive relation between lagged changes in the marginal tax rate and subsequent changes in leverage for both medium-sized and large firms. This distinction suggests that the capital structure of small firms may be driven by different factors than is the case for larger firms. For example, small firms may face financial constraints that limit their ability to optimize capital structure, while larger firms may have more control over their capital structure. This is consistent with recent dynamic capital structure models that emphasize optimal inaction by firms in the presence of transaction costs (Goldstein, Ju, Leland (2001), Strebulaev (2007)). If transaction costs have a fixed cost component, it gives rise to differences between capital structure determinants of small and large firms (Kurshev and Strebulaev (2007)).

Although there is a significant positive relation between leverage and marginal tax rates for medium-sized firms, the result shows that the nature of that relation is subtly different than for large firms. In particular, changes in leverage occur two to three years after changes in the marginal tax rate for the medium category, but occur during the subsequent year for large firms. This difference is consistent with medium-sized firms facing financial frictions which make changing capital structure a slower process than for larger firms.

4.2 The Costs of Financial Distress

The standard tradeoff theory of capital structure implies that the optimal leverage is determined by balancing the tax advantages of debt against the costs of financial distress. Motivated by this, we next examine the relation between changes in leverage and corporate tax rates while including a number of controls for the cost of financial distress associated with leverage.

Specifically, we include three variables as instruments for the cost of financial distress. The first is the annual value-weighted default rate of nonfinancial corporate bonds in the US. This variable is described in Giesecke, Longstaff, Schaefer, and Strebulaev (2011, 2013), and the time series of default rates is obtained from their online Appendix. As shown in their papers, corporate defaults tend to cluster in time and are persistent. Thus, an increase in the corporate default rate implies an increase in expected default rates in the subsequent year. As shown by Acharya, Bharath, and Srinivasan (2007) and many others, recovery rates tend to be lower during periods characterized by higher default rates. In turn, lower recovery rates map into higher expected costs of financial distress.

The second and third variables are the growth rates in GDP and industrial production, respectively. As shown by Davydenko, Strebulaev, and Zhang (2012), the costs of financial distress are industry related and tend to be weakly counter-cyclical.

Thus, we would expect the expected costs of financial distress to increase during business cycle downturns. Including the growth rate in GDP and industrial production in the analysis should control for business cycle variation in the cost of financial distress.

Table 7 reports the results for the regression in which these three variables are added to the regression reported in Table 6. We include only one lag of these variables since the results are unaffected by the inclusion of additional lags, and additional lagged values of these variables are generally insignificant.

As shown, the implications for the relation between tax rates and leverage are very similar to those reported in Table 6. In particular, lagged changes in the corporate tax rate are significantly positively related to subsequent changes in leverage when all firms are included, and also for the medium and large categories. Changes in corporate tax rates are not significantly related to changes in leverage for small firms.

The lagged value of the corporate default rate is significant in explaining subsequent changes in the leverage of small firms. Surprisingly, the sign of the coefficient is positive, implying that an increase in the risk of defaults and the expected cost of financial distress is associated with higher leverage for these smaller firms. This seemingly counterintuitive result may imply, once again, that the capital structure of smaller firms may be driven more by financial constraints and other external factors than by endogenous choices. For example, a higher expected likelihood of distress is associated with a decline in profitability and lower shareholder equity, which, in turn, leads to higher leverage. This may also apply to firms in the medium category since their leverage is significantly positively related to lagged industrial production growth.

4.3 Firm Liquidity and Internal Capital

Recent literature emphasizes the central role that financial constraints play in determining the capital structure of corporations.[3] Firms that face severe constraints or frictions may find that changes in the leverage ratio over time are heavily influenced by the amount of internal cash flow generated by operations or the liquidity of their assets.

In light of this literature, we extend the analysis by including a number of proxies for firm liquidity and internal cash flow. In particular, we calculate the cash and current ratios for firms in the three size categories as well as for the combined total of all firms. The cash ratio is simply the ratio of cash to total assets. The current ratio is the ratio of current assets to total assets, where current assets include cash, accounts receivable, and inventories. To provide a measure of internal cash flow, we compute

[3]See Almeida, Campello, and Weisbach (2004), Opler, Pinkowitz, Stulz, and Williamson (1999), Gryglewicz (2011), Acharya, Davydenko, and Strebulaev (2012), Anderson and Caverhill (2012), and Pinkowitz, Sturgess, Williamson (2013).

the profitability ratio as the ratio of earnings before taxes to total assets. Table 8 reports the results from the regression in which lagged changes in these three liquidity and internal cash flow measures are added to the baseline specification reported in Table 6.

The results show that the implications for the relation between changes in corporate tax rates and subsequent changes in leverage are essentially the same as in the prior regressions. In particular, changes in tax rates are not significant in explaining changes in leverage for small firms. As before, the leverage of medium-sized firms is significantly affected by changes in tax rates after a two- or three-year delay. The leverage of large firms increases significantly in the year after an increase in tax rates. The results for the regression in which all firms are included are the same as in the previous regressions.

Turning to the results for the liquidity and internal cash flow variables, Table 8 shows that the leverage of small firms is strongly influenced by these variables. Both the lagged change in the current ratio and the lagged profitability ratio are highly significant in explaining the subsequent change in the leverage ratio for small firms. These results are consistent with the view that the capital structure of financially constrained firms or firms facing financial frictions is strongly related to the liquidity of their assets or their internal free cash flows. A similar result holds for the medium category in that lagged changes in the current ratio are significantly related to subsequent leverage changes.

In contrast to these results, Table 8 shows that none of the three liquidity or profitability ratios are significant in explaining subsequent changes in leverage for either the large firm category or for the combined total of all firms. This again demonstrates that the determinants of capital structure for larger and presumably less financially constrained firms differ in important ways from those for smaller firms.

4.4 The Effects of External Capital Markets

As discussed earlier, corporate capital structure could be influenced by events in the external capital markets. To address this, we reexamine the relation between changes in corporate tax rates and subsequent changes in leverage while controlling for a number of measures of market factors.

Specifically, we include three additional variables in the baseline regression reported in Table 6. The first is the lagged return on the Center for Research in Security Prices (CRSP) value-weighted index. This return series serves as a control for the conditions in the equity markets. The second variable is the year-on-year change in the volatility of the CRSP value-weighted index. The volatility of the index is estimated each year by taking the standard deviation of the monthly returns on the index during the year. The third variable is the change in the yield spread between Baa-rated and

Treasury bonds. This index is available from Moody's throughout the sample period. Table 9 reports the results from the regression of changes in corporate leverage on its first two lags, the first three lags of the change in the corporate tax rate, and on the first lag of these capital market variables.

Once again, the implications of the regression for the relation between changes in corporate tax rates and subsequent changes in leverage indicate that there is a strong relation for larger firms, a significant but delayed relation for medium-sized firms, and no apparent relation for small firms. The coefficient estimates for the lagged changes in corporate tax rates and their statistical significance are very similar to those reported in previous regressions.

Table 9 also shows that the lagged stock return is not significant for any of the size categories or for the regression with all firms included. It is also not significant for the lagged change in the corporate bond spread. In contrast, there is a marginally significant relation between changes in volatility and the subsequent change in leverage for the large firm category and in the regression with all firms. The sign of these coefficients is negative, consistent with a scenario in which these firms adjust the leverage downward when facing more volatile financial markets.

5. CONCLUSION

In this paper, we study the relation between corporate taxes and corporate capital structure using long-term historical data from US corporate tax returns. The data is based on all corporate tax returns filed in the US for nearly a century by millions of corporations. This study contributes to the growing empirical literature on capital structure determinants by analyzing a much longer time series for a larger sample of companies than in any previous study. On the other hand, the data we have access to is based on aggregated size categories rather than individual tax returns.

We find a strong relation between taxes and capital structure. Changes in tax rates are related to an increase in corporate leverage. When we explore the differences with respect to firm size, we find that only large firms are responsive to changes in tax rates over a short period of time. Medium-sized firms exhibit higher leverage with a lag, and leverage ratios of small firms are not related to the time series variation in tax rates. This evidence is consistent with the presence of financial constraints with a fixed component that delay the response of medium-sized firms and make it too costly for small firms to vary their leverage in response to tax incentives. These results are robust when we consider time-series proxies for corporate distress costs, corporate profitability, macroeconomic indicators such as GDP growth and stock returns, and changes in volatility.

REFERENCES

Acharya, Viral, Sreedhar Bharath, and Anand Srinivasan, 2007, Does Industry-wide Distress Affect Defaulted Firms? Evidence from Creditor Recoveries, *Journal of Financial Economics* 85, 787-821.

Acharya, Viral, Sergei Davydenko, and Ilya A. Strebulaev, 2012, Cash Holdings and Credit Risk, *Review of Financial Studies* 25, 2959-2999.

Almeida, Heitor, Murillo Campello, and Michael S. Weisbach, 2004, The Cash Flow Sensitivity of Cash, *Journal of Finance* 59, 1777-1804.

Anderson, Ronald W., and Andrew Carverhill, 2012, Corporate Liquidity and Capital Structure, *Review of Financial Studies* 25, 797-837.

Bank, Stephen M., 2010, *From Sword to Shield: The Transformation of the Corporate Income Tax, 1861 to Present*, Oxford University Press.

Bhamra, Harjoat S., Lars-Alexander Kuehn, and Ilya A. Strebulaev, 2010, The Aggregate Dynamics of Capital Structure and Macroeconomic Risk, *Review of Financial Studies* 23, 4187-4241.

Davydenko, Sergei, Ilya A. Strebulaev, and Xiaofei Zhao, 2012, A Market-Based Study of the Cost of Default, 2012, *Review of Financial Studies* 25, 3573-3609.

Fama, Eugene F., and Kenneth R. French, 2002, Testing Tradeoff and Pecking Order Predictions about Dividends and Debt, *Review of Financial Studies* 15, 1-37.

Gertler, Mark, and Simon Gilchrist, 1993, The Role of Credit Market Imperfections in the Monetary Transmission Mechanism: Arguments and Evidence, *The Scandinavian Journal of Economics* 95, 43-64.

Giesecke, Kay, Francis A. Longstaff, Stephen M. Schaefer, and Ilya A. Strebulaev, 2011, Corporate Bond Default Risk: A 150-Year Perspective, *Journal of Financial Economics* 102, 233-250.

Giesecke, Kay, Francis A. Longstaff, Stephen M. Schaefer, and Ilya A. Strebulaev, 2013, Macroeconomic Effects of Corporate Default Crisis: A Long-Term Perspective, *Journal of Financial Economics*, forthcoming.

Givoly, Dan, Carla Hayn, Aharon R. Ofer, and Oded Sarig, 1992, Taxes and Capital Structure: Evidence from Firms' Response to the Tax Reform Act of 1986, *Review of Financial Studies* 5, 331-355.

Goldstein, Robert, Nenqiiu Ju, and Hayne Leland, 2001, An EBIT-Based Model of Dynamic Capital Structure, *Journal of Business* 74, 483-512.

Graham, John R., 1996a, Debt and the Marginal Tax Rate, *Journal of Financial Economics* 41, 41-73.

Graham, John R., 1996b, Proxies for the Corporate Marginal Tax Rate, *Journal of Financial Economics* 42, 187-221.

Graham, John R., 2000, How Big are the Tax Benefits of Debt? *Journal of Finance* 55, 1901-1941.

Graham, John R., 2008, Taxes and Corporate Finance, in B.E. Eckbo (ed.), *Handbook of Corporate Finance; Empirical Corporate Finance*, Elsevier Science, Amsterdam.

Graham, John R., Mark Leary, and Michael Roberts, 2014, A Century of Capital Structure: The Leveraging of Corporate America, *Journal of Financial Economics*, forthcoming.

Gryglewicz, Sebastian, 2011, A Theory of Corporate Financial Decisions with Liquidity and Solvency Concerns, *Journal of Financial Economics* 99, 365-384.

Hackbarth, Dirk, Jianjun Miao, and Erwan Morellec, (2006), Capital Structure, Credit Risk and Macroeconomic Conditions, *Journal of Financial Economics* 82, 519-550.

Heider, Florian, and Alexander Lunhgqvist, 2014, As Certain as Debt and Taxes: Estimating the Tax Sensitivity of Leverage from State Tax Changes, Working paper, New York University.

Joseph, Richard J., 2004, *The Origins of the American Income Tax*, Syracuse University Press.

Korajczyk, Robert, and Amnon Levy, 2003, Capital Structure Choice: Macroeconomic Conditions and Financial Constraints, *Journal of Financial Economics* 68, 75-109.

Kurshev, Alexander, and Ilya A. Strebulaev, 2007, Firm Size and Capital Structure, Working paper, Stanford University.

MacKie-Mason, Jeffrey K., 1990, Do Taxes Affect Corporate Financing Decisions, *Journal of Finance* 45, 1471-1493.

Modigliani, Franco, and Merton H. Miller, 1958, The Cost of Capital, Corporation Finance and the Theory of Investment, *American Economic Review* 48, 261-297.

Modigliani, Franco, and Merton H. Miller, 1963, Corporate Income Taxes and the

Cost of Capital: A Correction, *American Economic Review* 53, 433-443.

Opler, Tim, Lee Pinkowitz, Rene Stulz, and Rohan Williamson, 1999, The Determinants and Implications of Corporate Cash Holdings, *Journal of Finance* 52, 3-46.

Panier, Fred, Francisco Perez-Gonzalez, and Pablo Villanueva, 2014, Capital Structure and Taxes: What Happens When You (Also) Subsidize Equity?, Working paper, Stanford University.

Pinkowitz, Lee, Jason Sturgess, and Rohan Williamson, 2013, Do Cash Stockpiles Fuel Cash Acquisitions? *Journal of Corporate Finance*, forthcoming.

Rajan, Raghuram G., and Luigi Zingales, 1995, What Do We Know about Capital Structure? Some Evidence from International Data, *Journal of Finance* 50 1421-1460.

Slemrod, Joel, 1992, Do Taxes Matter? Lessons from the 1980's, *The American Economic Review* 82, 250-256.

Strebulaev, Ilya A., 2007, Do Tests of Capital Structure Mean What They Say?, *Journal of Finance* 62, 1747-1787.

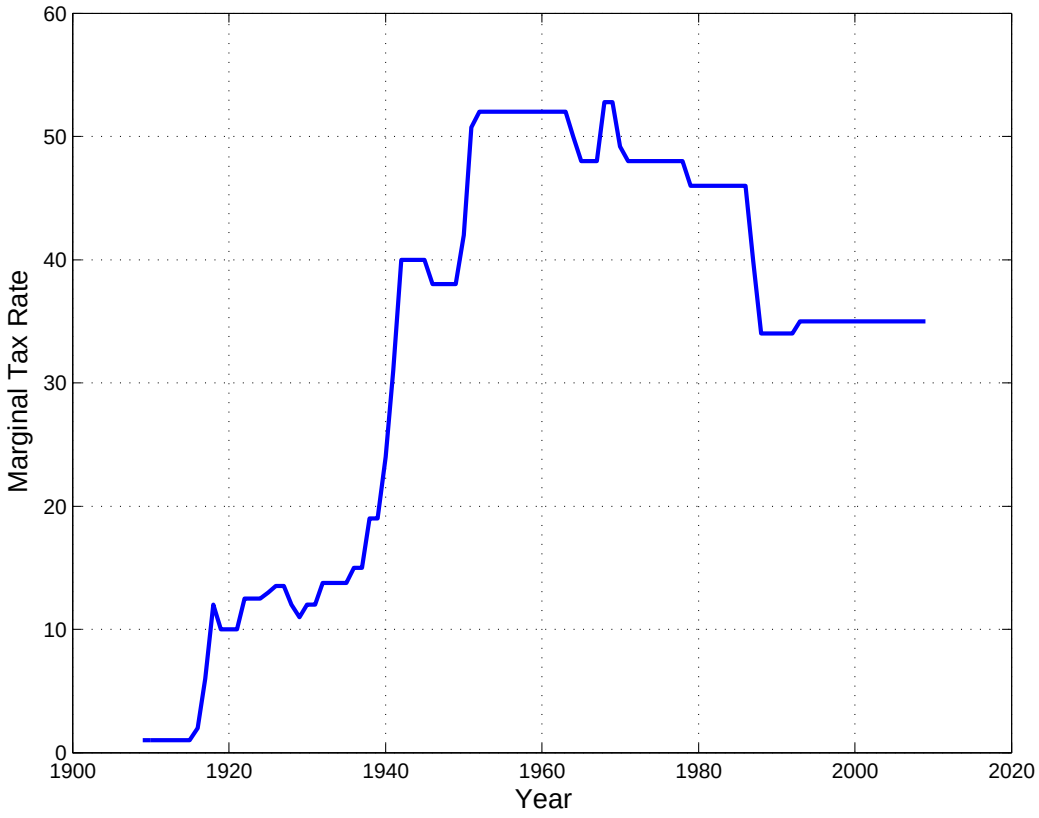

Figure 1. Time Series Plot of the Marginal Corporate Income Tax Rate. This figure plots the marginal corporate income tax rate for the 1909–2009 period. The marginal corporate income tax rate is defined as the rate on the highest bracket of corporate income.

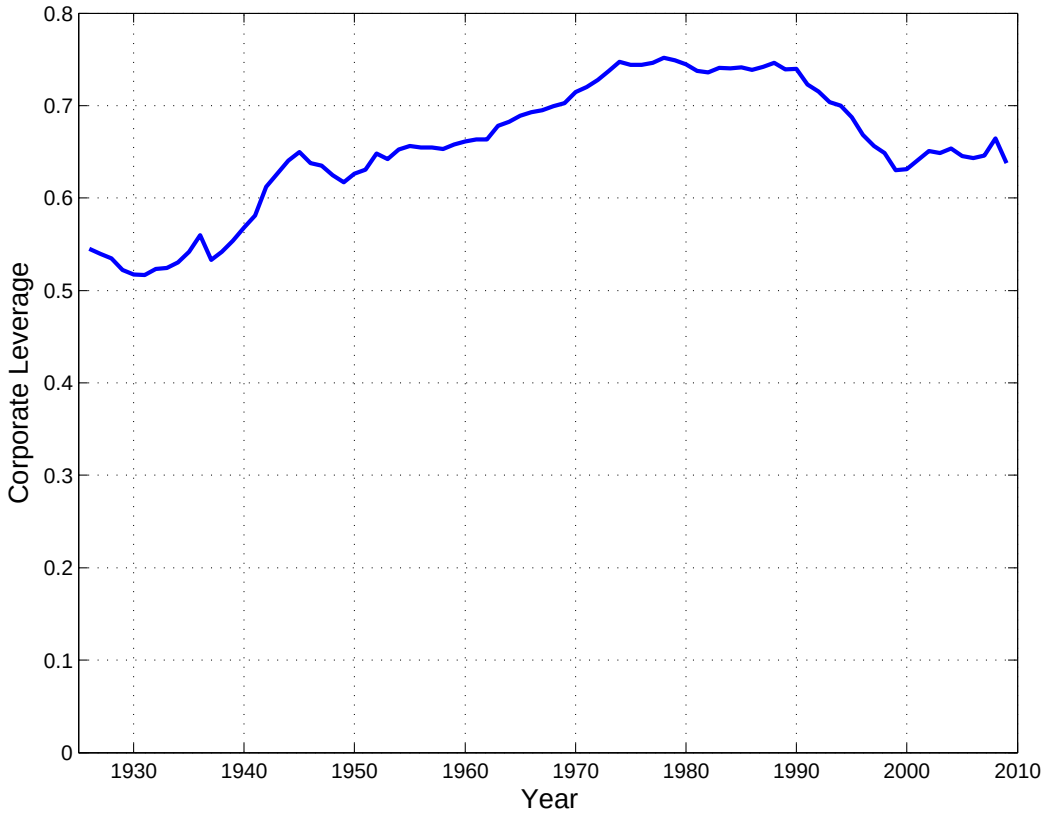

Figure 2. Time Series Plot of Corporate Leverage Ratio for All Firms. This figure plots the corporate leverage ratio for all firms for the 1926–2009 period. The corporate leverage ratio is defined as the ratio of debt to total assets.

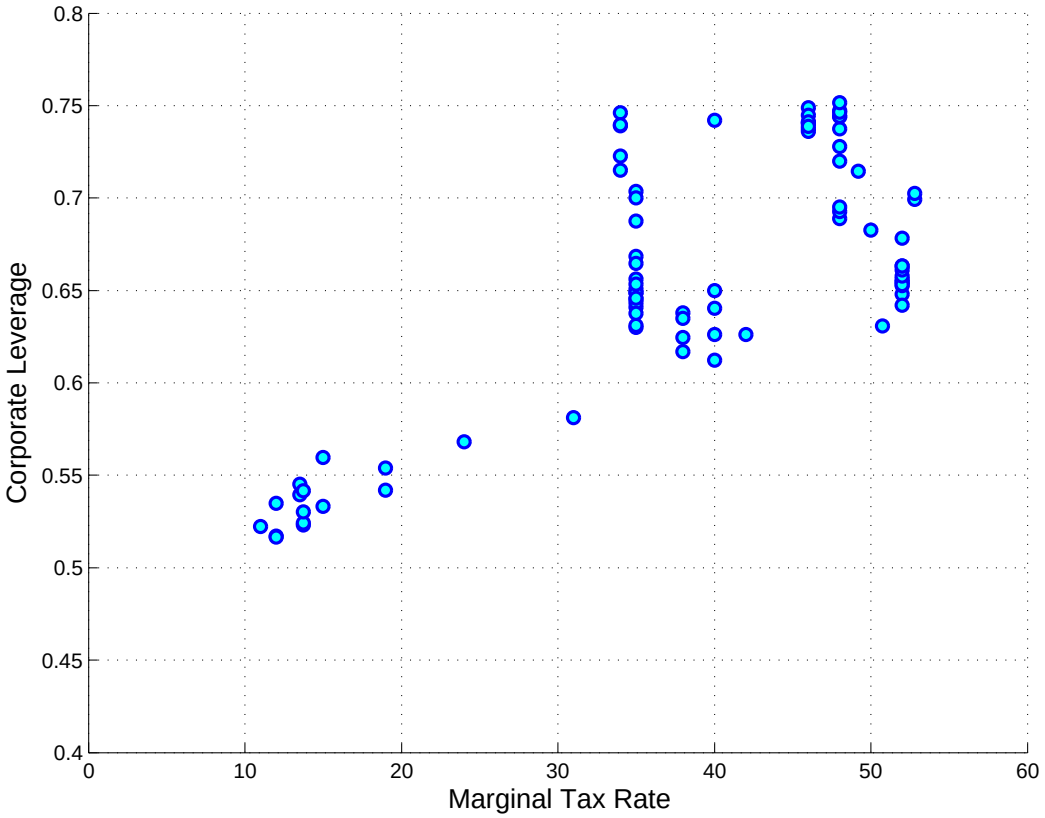

Figure 3. Scatterdiagram of the Corporate Leverage Ratio for All Firms and the Marginal Corporate Income Tax Rate. This figure plots the corporate leverage ratio for all firms against the marginal corporate income tax rate for the 1926–2009 period. The corporate leverage ratio is defined as the ratio of debt to total assets. The marginal corporate income tax rate is defined as the rate on the highest bracket of corporate income.

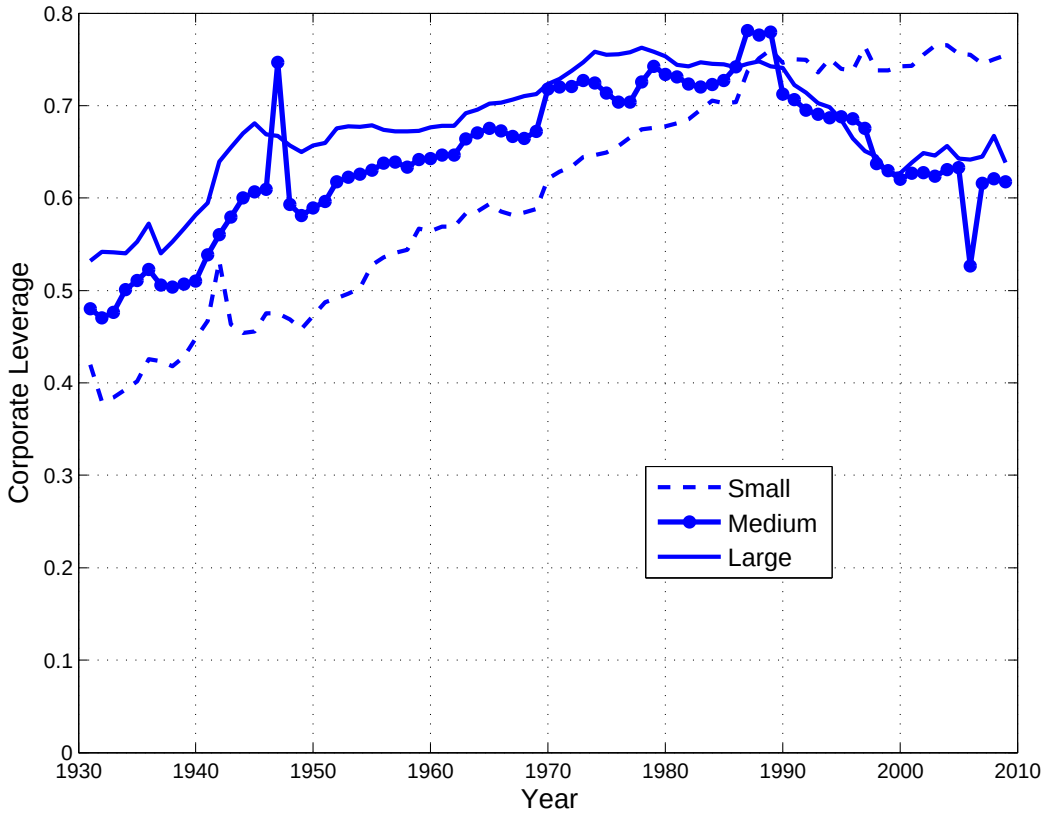

Figure 4. Time Series Plots of Leverage Ratios for Small, Medium-Sized, and Large Corporations. This figure plots the leverage ratios for firms in the small, medium, and large categories for the 1931–2009 period. The leverage ratio is defined as the ratio of debt to total assets for each category of firms.

Online Appendix

Introduction to the IRS Statistics of Income

The IRS provides an extensive introduction to the Statistics of Income Program on its website at http://www.irs.gov/uac/SOI-Tax-Stats-About-SOI. As discussed on this website, the Revenue Act of 1916 requires the IRS to publish an annual report relating to the operations of the internal revenue laws pertaining to the collection of taxes from individuals, and all forms of business including corporations, estates, nonprofit organizations, and trusts. The SOI program fulfills this mandate through its information office, Statistical Information Services.

Beginning in 2009, the IRS began to digitize its library of historical reports, and these are now all available online. In particular, the website http://www.irs.gov/uac/SOI-Tax-Stats-Archive contains links to pdf versions of the annual SOI reports from 1916 to 1933 which contain statistics for both individuals and business returns. Beginning in 1929, the IRS published a separate annual report for businesses, and the above archive website contains links to these reports for the 1929 to 1999 period. The US Bureau of the Census has summarized much of the key information about corporate financial statements from the SOI annual reports for the period from 1926 to 1970 in its publication *Historical Statistics of the United States, Colonial Times to 1970, Part 2*. More recent annual reports for corporate tax statistics can be found at http://www.irs.gov/uac/SOI-Tax-Stats-Corporation-Complete-Report.

Robustness Analysis Using Net Leverage

The empirical results in Tables 5 through 9 of the paper are based on the leverage ratio, which is defined as the ratio of total debt to total assets. As a robustness check, we repeat the analysis in these tables using net leverage, which is defined as the ratio of total debt minus cash to total assets. The results using this alternative measure of leverage are given below as Tables A1 through A5, where Table A1 corresponds to Table 5, Table A2 corresponds to Table 6, etc. As can be seen by comparing the results in Tables A1 through A5 with the corresponding tables in the paper, the empirical results using the net leverage ratio are virtually identical to those in the paper based on the leverage ratio.

Table 1

Summary Statistics for Federal Corporate Income Tax Rates for the 1909–2009 Period. This table provides summary statistics for the Federal Corporate Income Tax Schedule for the indicated periods. Number of Brackets denotes the number of distinct income categories with specifically identified tax rates in the corporate tax schedule. Highest Threshold denotes the income level above which all corporate income is taxed at the same rate. Tax Rate for Highest Bracket denotes the tax rate applied to all corporate income above the highest threshold.

Period	Number of Brackets	Highest Threshold	Minimum Tax Rate	Maximum Tax Rate	Tax Rate for Highest Bracket
1909–1912	2	5,000.00	0.00	1.00	1.00
1913–1915	1	0.00	1.00	1.00	1.00
1916	1	0.00	2.00	2.00	2.00
1917	1	0.00	6.00	6.00	6.00
1918	2	2,000.00	0.00	12.00	12.00
1919–1921	2	2,000.00	0.00	10.00	10.00
1922–1924	2	2,000.00	0.00	12.50	12.50
1925	2	2,000.00	0.00	13.00	13.00
1926–1927	2	2,000.00	0.00	13.50	13.50
1928	2	3,000.00	0.00	12.00	12.00
1929	2	3,000.00	0.00	11.00	11.00
1930–1931	2	3,000.00	0.00	12.00	12.00
1932–1935	1	0.00	13.75	13.75	13.75
1936–1937	4	40,000.00	8.00	15.00	15.00
1938–1939	4	25,000.00	12.50	19.00	19.00
1940	9	38,565.84	14.85	38.30	24.00
1941	5	38,461.54	21.00	44.00	31.00
1942–1945	5	50,000.00	25.00	53.00	40.00
1946–1949	5	50,000.00	21.00	53.00	38.00
1950	2	25,000.00	23.00	42.00	42.00
1951	2	25,000.00	28.75	50.75	50.75
1952–1963	2	25,000.00	30.00	52.00	52.00
1964	2	25,000.00	22.00	50.00	50.00
1965–1967	2	25,000.00	22.00	48.00	48.00
1968–1969	2	25,000.00	24.20	52.80	52.80
1970	2	25,000.00	22.55	49.20	49.20
1971–1974	2	25,000.00	22.00	48.00	48.00
1975–1978	3	50,000.00	20.00	48.00	48.00
1979–1981	5	100,000.00	17.00	46.00	46.00
1982	5	100,000.00	16.00	46.00	46.00
1983	5	100,000.00	15.00	46.00	46.00
1984–1986	7	1,405,000.00	15.00	51.00	46.00
1987	8	1,405,000.00	15.00	42.50	40.00
1988–1992	5	335,000.00	15.00	39.00	34.00
1993–2009	8	18,333,333.00	15.00	39.00	35.00

Table 2

Size Distribution of Corporations in the 2009 IRS Statistics of Income. This table shows the number of firms in each of the size categories reported by the IRS for the year 2009. The range for each size category is based on the total assets for individual firms. The upper and lower bounds for each size category are expressed in dollars. The total assets for all firms in each category are also shown, where these totals are expressed in billions of dollars.

Size Category		Number of Firms	Percentage of Total	Total Assets of All Firms	Percentage of Total
From	To				
1	500,000	3,889,921	80.54	375.36	0.50
500,000	1,000,000	370,940	7.68	260.58	0.34
1,000,000	5,000,000	409,100	8.47	867.43	1.14
5,000,000	10,000,000	67,655	1.40	471.96	0.62
10,000,000	25,000,000	42,016	0.87	647.86	0.85
25,000,000	50,000,000	15,965	0.33	560.42	0.74
50,000,000	100,000,000	10,398	0.22	737.47	0.97
100,000,000	250,000,000	9,651	0.20	1,547.20	2.04
>250,000,000		14,110	0.29	70,496.74	92.80
Total		4,829,756	100.00	75,965.02	100.00

Table 3

Size Distribution of Corporations in the 2009 Compustat Universe. This table shows the number of firms in each of the size categories reported by Compustat for the year 2009. The range for each size category is based on the total assets for individual firms. The upper and lower bounds for each size category are expressed in dollars. The total assets for all firms in each category are also shown, where these totals are expressed in billions of dollars.

Size Category		Number of Firms	Percentage of Total	Total Assets of All Firms	Percentage of Total
From	To				
1	500,000	2,430	24.96	0.07	0.00
500,000	1,000,000	126	1.29	0.09	0.00
1,000,000	5,000,000	493	5.06	1.29	0.00
5,000,000	10,000,000	329	3.38	2.42	0.01
10,000,000	25,000,000	605	6.21	9.98	0.02
25,000,000	50,000,000	537	5.52	19.50	0.05
50,000,000	100,000,000	570	5.86	40.68	0.10
100,000,000	250,000,000	833	8.56	137.72	0.32
>250,000,000		3,812	39.16	42,415.47	99.50
Total		9,735	100.00	42,627.22	100.00

Table 4

Summary Statistics for Corporate Financial Statements. This table reports averages for the indicated common-size balance sheet and income statement items. The balance sheet items are expressed as percentages of total assets. The income statement items are expressed as percentages of total revenues. The averages are taken over all years in the respective sample periods. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). Number of firms denotes the total number of corporate returns in 2009 for the indicated size categories. The sample period for the individual size categories is 1931–2009. The sample period for the category including all firms is 1926–2009.

	Small	Medium	Large	All
Cash	11.07	9.35	6.84	7.14
Receivables	20.49	23.41	18.79	19.12
Inventories	16.80	12.06	4.37	6.05
Investments	9.03	24.69	44.54	36.51
Capital Assets	34.56	24.22	20.39	22.14
Other Assets	8.05	6.27	5.07	9.04
Total Assets	100.00	100.00	100.00	100.00
Expenses	97.55	96.08	92.68	94.83
Earnings before Tax	2.45	3.92	7.32	5.17
Corporate Tax	0.81	1.68	2.81	2.07
Revenues	100.00	100.00	100.00	100.00
Number of Firms	4,737,616	68,379	23,761	4,829,756

Table 5

Summary Statistics for Corporate Leverage Ratios. This table reports summary statistics for the corporate leverage ratio (debt to total assets) for the indicated categories. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The sample period for the individual size categories is 1931–2009. The sample period for the category including all firms is 1926–2009.

	Small	Medium	Large	All
Mean	0.607	0.644	0.675	0.656
Standard Deviation	0.124	0.078	0.062	0.070
Minimum	0.380	0.470	0.532	0.516
Median	0.621	0.642	0.676	0.654
Maximum	0.766	0.781	0.763	0.751
Serial Correlation	0.992	0.915	0.983	0.990
N	79	79	79	84

Table 6

Regression of Changes in Leverage on Changes in the Tax Rate. This table reports summary statistics from the regression of the change in the leverage ratio on its first two lags and on the previous three changes in the corporate tax rate for the highest bracket. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The t-statistics are based on the Newey-West estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period for the individual size categories is 1931–2009. The sample period for the category including all firms is 1926–2009.

$$\Delta \text{Lev}_t = \alpha + \sum_{i=1}^{2} \beta_i \, \Delta \text{Lev}_{t-i} + \sum_{i=1}^{3} \gamma_i \, \Delta \text{Tax Rate}_{t-i} + \epsilon_t$$

		Small	Medium	Large	All
Coefficient	Intercept	0.0065	0.0012	0.0004	0.0005
	ΔLev_{t-1}	−0.1486	−0.4261	0.0326	0.0733
	ΔLev_{t-2}	−0.1469	−0.1625	0.2058	0.2232
	$\Delta \text{Tax Rate}_{t-1}$	−0.0005	−0.0010	0.0013	0.0011
	$\Delta \text{Tax Rate}_{t-2}$	0.0007	0.0034	0.0006	0.0003
	$\Delta \text{Tax Rate}_{t-3}$	−0.0009	0.0027	0.0002	0.0004
t-Statistic	Intercept	3.48**	0.37	0.28	0.48
	ΔLev_{t-1}	−1.04	−2.69**	0.21	0.49
	ΔLev_{t-2}	−1.86*	−1.42	1.60	1.91*
	$\Delta \text{Tax Rate}_{t-1}$	−0.43	−0.52	2.14**	2.30**
	$\Delta \text{Tax Rate}_{t-2}$	0.85	2.43**	1.29	0.45
	$\Delta \text{Tax Rate}_{t-3}$	−0.82	2.12**	0.39	1.08
Adj. R^2		−0.017	0.169	0.135	0.145
N		79	79	79	84

Table 7

Regression of Changes in Leverage on Changes in the Tax Rate and Financial Distress and Business Cycle Variables. This table reports summary statistics from the regression of the change in the leverage ratio on its first two lags, the three previous changes in the corporate tax rate for the highest bracket during the prior year, and on a vector of lagged financial distress and business cycle variables. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The default rate is the value-weighted percentage default rate on all corporate bonds. GDP Growth denotes the annual growth rate in GDP. IP Growth denotes the annual growth rate in industrial production. The t-statistics are based on the Newey-West estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period for the individual size categories is 1931–2009. The sample period for the category including all firms is 1926–2009.

$$\Delta\text{Lev}_t = \alpha + \sum_{i=1}^{2} \beta_i \, \Delta\text{Lev}_{t-i} + \sum_{i=1}^{3} \gamma_i \, \Delta\text{Tax Rate}_{t-i} + \delta_1 \, \text{Default Rate}_{t-1} + \delta_2 \, \text{GDP Growth}_{t-1} + \delta_3 \, \text{IP Growth}_{t-1} + \epsilon_t$$

		Small	Medium	Large	All
Coefficient	Intercept	0.0054	0.0036	−0.0014	−0.0006
	ΔLev_{t-1}	−0.1666	−0.4586	−0.0476	0.0184
	ΔLev_{t-2}	−0.1204	−0.1329	0.2236	0.2233
	$\Delta\text{Tax Rate}_{t-1}$	−0.0003	−0.0003	0.0011	0.0010
	$\Delta\text{Tax Rate}_{t-2}$	0.0006	0.0039	0.0005	0.0001
	$\Delta\text{Tax Rate}_{t-3}$	−0.0007	0.0034	0.0003	0.0005
	$\text{Default Rate}_{t-1}$	0.2398	−0.3653	0.1924	0.1164
	GDP Growth_{t-1}	−0.0341	−0.2010	0.0150	0.0105
	IP Growth_{t-1}	0.0173	0.0903	0.0146	0.0081
t-Statistic	Intercept	2.65**	0.81	−0.99	−0.46
	ΔLev_{t-1}	−1.10	−2.49**	−0.27	0.10
	ΔLev_{t-2}	−1.46	−1.09	1.81*	1.88*
	$\Delta\text{Tax Rate}_{t-1}$	−0.35	−0.21	2.03**	2.25**
	$\Delta\text{Tax Rate}_{t-2}$	0.75	2.17**	0.86	0.21
	$\Delta\text{Tax Rate}_{t-3}$	−0.66	2.51**	0.53	1.14
	$\text{Default Rate}_{t-1}$	2.02**	−1.01	1.18	1.82*
	GDP Growth_{t-1}	−0.91	−1.41	0.62	0.66
	IP Growth_{t-1}	0.79	2.01**	0.90	0.65
Adj. R^2		−0.029	0.229	0.140	0.139
N		79	79	79	84

Table 8

Regression of Changes in Leverage on Changes in the Tax Rate and Firm Liquidity and Profitability Measures. This table reports summary statistics from the regression of the change in the leverage ratio on its first two lags, the three previous changes in the corporate tax rate for the highest bracket, the previous changes in the ratios of cash and current assets to total assets, and the previous ratio of earnings before taxes to total assets. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The t-statistics are based on the Newey-West estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period for all categories is 1931–2009.

$$\Delta\text{Lev}_t = \alpha + \sum_{i=1}^{2} \beta_i \ \Delta\text{Lev}_{t-i} + \sum_{i=1}^{3} \gamma_i \ \Delta\text{Tax Rate}_{t-i} + \delta_1 \ \Delta\text{Cash Ratio}_{t-1} + \delta_2 \ \Delta\text{Current Ratio}_{t-1} + \delta_3 \ \text{Profitability}_{t-1} + \epsilon_t$$

		Small	Medium	Large	All
Coefficient	Intercept	0.0191	0.0009	0.0018	0.0021
	ΔLev_{t-1}	−0.1254	−0.0456	0.0554	0.0947
	ΔLev_{t-2}	−0.2678	−0.2643	0.2037	0.2364
	$\Delta\text{Tax Rate}_{t-1}$	0.0002	−0.0015	0.0014	0.0012
	$\Delta\text{Tax Rate}_{t-2}$	0.0007	0.0038	0.0006	0.0001
	$\Delta\text{Tax Rate}_{t-3}$	0.0000	0.0031	0.0003	0.0007
	$\Delta\text{Cash Ratio}_{t-1}$	−0.2314	−0.4435	−0.1762	−0.1920
	$\Delta\text{Current Ratio}_{t-1}$	0.6235	0.6088	0.0317	0.0419
	$\text{Profitability}_{t-1}$	−0.2653	−0.2085	−0.0482	−0.0553
t-Statistic	Intercept	4.14**	0.13	0.53	0.73
	ΔLev_{t-1}	−1.45	−0.38	0.35	0.62
	ΔLev_{t-2}	−3.09**	−1.82*	1.70*	2.07**
	$\Delta\text{Tax Rate}_{t-1}$	0.23	−0.90	2.11**	2.51**
	$\Delta\text{Tax Rate}_{t-2}$	0.90	2.59**	1.00	0.22
	$\Delta\text{Tax Rate}_{t-3}$	0.02	2.47**	0.58	1.67*
	$\Delta\text{Cash Ratio}_{t-1}$	−0.88	−0.84	−0.55	−0.60
	$\Delta\text{Current Ratio}_{t-1}$	2.52**	2.17**	0.33	0.41
	$\text{Profitability}_{t-1}$	−3.53**	−0.15	−0.53	−0.68
Adj. R^2		0.304	0.256	0.100	0.109
N		79	79	79	79

Table 9

Regression of Changes in Leverage on Changes in the Tax Rate, Stock Returns, and Changes in Volatility and Corporate Credit Spreads. This table reports summary statistics from the regression of the change in the leverage ratio on its first two lags, the three previous changes in the corporate tax rate for the highest bracket, the previous return on the stock market, and the previous changes in stock market volatility and corporate credit spreads. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The t-statistics are based on the Newey-West estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period for the individual size categories is 1931–2009. The sample period for the category including all firms is 1926–2009.

$$\Delta \text{Lev}_t = \alpha + \sum_{i=1}^{2} \beta_i \, \Delta \text{Lev}_{t-i} + \sum_{i=1}^{3} \gamma_i \, \Delta \text{Tax Rate}_{t-i} + \delta_1 \, \text{Stock Return}_{t-1} + \delta_2 \, \Delta \text{Volatility}_{t-1} + \delta_3 \, \Delta \text{Spread}_{t-1} + \epsilon_t$$

		Small	Medium	Large	All
Coefficient	Intercept	0.0060	0.0028	0.0013	0.0013
	ΔLev_{t-1}	−0.1327	−0.4380	0.0341	0.0713
	ΔLev_{t-2}	−0.1499	−0.1797	0.1486	0.1853
	$\Delta \text{Tax Rate}_{t-1}$	−0.0003	−0.0008	0.0013	0.0011
	$\Delta \text{Tax Rate}_{t-2}$	0.0009	0.0032	0.0007	0.0003
	$\Delta \text{Tax Rate}_{t-3}$	−0.0011	0.0029	0.0002	0.0005
	$\text{Stock Return}_{t-1}$	0.0002	−0.0135	−0.0083	−0.0062
	$\Delta \text{Volatility}_{t-1}$	−0.0496	−0.0017	−0.0331	0.0212
	$\Delta \text{Spread}_{t-1}$	1.2369	0.2089	0.0281	−0.0393
t-Statistic	Intercept	2.51**	0.70	0.82	1.09
	ΔLev_{t-1}	−0.93	−2.59**	0.23	0.49
	ΔLev_{t-2}	−1.92*	−1.43	1.02	1.43
	$\Delta \text{Tax Rate}_{t-1}$	−0.28	−0.45	2.23**	2.27**
	$\Delta \text{Tax Rate}_{t-2}$	1.13	2.53**	1.46	0.50
	$\Delta \text{Tax Rate}_{t-3}$	−1.03	2.08**	0.36	1.22
	$\text{Stock Return}_{t-1}$	0.02	−0.91	−1.26	−1.28
	$\Delta \text{Volatility}_{t-1}$	−1.39	−0.04	−1.98*	−1.84*
	$\Delta \text{Spread}_{t-1}$	1.37	0.15	0.05	−0.08
Adj. R^2		0.019	0.139	0.149	0.143
N		79	79	79	84

Online Appendix

Introduction to the IRS Statistics of Income

The IRS provides an extensive introduction to the Statistics of Income Program on its website at http://www.irs.gov/uac/SOI-Tax-Stats-About-SOI. As discussed on this website, the Revenue Act of 1916 requires the IRS to publish an annual report relating to the operations of the internal revenue laws pertaining to the collection of taxes from individuals, and all forms of business including corporations, estates, nonprofit organizations, and trusts. The SOI program fulfills this mandate through its information office, Statistical Information Services.

Beginning in 2009, the IRS began to digitize its library of historical reports, and these are now all available online. In particular, the website http://www.irs.gov/uac/SOI-Tax-Stats-Archive contains links to pdf versions of the annual SOI reports from 1916 to 1933 which contain statistics for both individuals and business returns. Beginning in 1929, the IRS published a separate annual report for businesses, and the above archive website contains links to these reports for the 1929 to 1999 period. The US Bureau of the Census has summarized much of the key information about corporate financial statements from the SOI annual reports for the period from 1926 to 1970 in its publication *Historical Statistics of the United States, Colonial Times to 1970, Part 2*. More recent annual reports for corporate tax statistics can be found at http://www.irs.gov/uac/SOI-Tax-Stats-Corporation-Complete-Report.

Robustness Analysis Using Net Leverage

The empirical results in Tables 5 through 9 of the paper are based on the leverage ratio, which is defined as the ratio of total debt to total assets. As a robustness check, we repeat the analysis in these tables using net leverage, which is defined as the ratio of total debt minus cash to total assets. The results using this alternative measure of leverage are given below as Tables A1 through A5, where Table A1 corresponds to Table 5, Table A2 corresponds to Table 6, etc. As can be seen by comparing the results in Tables A1 through A5 with the corresponding tables in the paper, the empirical results using the net leverage ratio are virtually identical to those in the paper based on the leverage ratio.

Table A1

Summary Statistics for Corporate Net Leverage Ratios. This table reports summary statistics for the corporate net leverage ratio (net leverage over total assets, where net leverage is defined as debt minus cash) for the indicated categories. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The sample period for the individual size categories is 1931–2009. The sample period for the category including all firms is 1926–2009.

	Small	Medium	Large	All
Mean	0.496	0.550	0.606	0.584
Standard Deviation	0.107	0.093	0.075	0.082
Minimum	0.309	0.387	0.446	0.439
Median	0.526	0.547	0.612	0.602
Maximum	0.641	0.710	0.706	0.699
Serial Correlation	0.987	0.905	0.988	0.993
N	79	79	79	84

Table A2

Regression of Changes in Net Leverage on Changes in the Tax Rate. This table reports summary statistics from the regression of the change in the net leverage ratio (net leverage over total assets, where net leverage is defined as debt minus cash) on its first two lags and on the previous three changes in the corporate tax rate for the highest bracket. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The t-statistics are based on the Newey-West estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period for the individual size categories is 1931–2009. The sample period for the category including all firms is 1926–2009.

$$\Delta\text{Net Lev}_t = \alpha + \sum_{i=1}^{2} \beta_i \, \Delta\text{Net Lev}_{t-i} + \sum_{i=1}^{3} \gamma_i \, \Delta\text{Tax Rate}_{t-i} + \epsilon_t$$

		Small	Medium	Large	All
Coefficient	Intercept	0.0049	0.0009	0.0002	0.0003
	ΔNet Lev$_{t-1}$	−0.0827	−0.4592	0.1743	0.1808
	ΔNet Lev$_{t-2}$	−0.0980	−0.2258	0.1812	0.2443
	ΔTax Rate$_{t-1}$	−0.0017	−0.0025	0.0016	0.0013
	ΔTax Rate$_{t-2}$	0.0004	0.0033	0.0004	−0.0001
	ΔTax Rate$_{t-3}$	−0.0014	0.0027	0.0001	0.0003
t-Statistic	Intercept	2.62**	0.21	0.16	0.32
	ΔNet Lev$_{t-1}$	−0.70	−3.13**	1.46	1.65
	ΔNet Lev$_{t-2}$	−1.37	−1.94*	1.50	2.07**
	ΔTax Rate$_{t-1}$	−1.51	−1.01	2.28**	2.35**
	ΔTax Rate$_{t-2}$	0.47	2.06**	0.78	−0.18
	ΔTax Rate$_{t-3}$	−1.11	2.00**	0.09	0.83
Adj. R^2		0.018	0.168	0.196	0.180
N		79	79	79	84

Table A3

Regression of Changes in Net Leverage on Changes in the Tax Rate and Financial Distress and Business Cycle Variables. This table reports summary statistics from the regression of the change in the net leverage ratio (net leverage over total assets, where net leverage is defined as debt minus cash) on its first two lags, the three previous changes in the corporate tax rate for the highest bracket during the prior year, and on a vector of lagged financial distress and business cycle variables. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The default rate is the value-weighted percentage default rate on all corporate bonds. GDP Growth denotes the annual growth rate in GDP. IP Growth denotes the annual growth rate in industrial production. The t-statistics are based on the Newey-West estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period for the individual size categories is 1931–2009. The sample period for the category including all firms is 1926–2009.

$$\Delta\text{Lev}_t = \alpha + \sum_{i=1}^{2} \beta_i \ \Delta\text{Net Lev}_{t-i} + \sum_{i=1}^{3} \gamma_i \ \Delta\text{Tax Rate}_{t-i} + \delta_1 \ \text{Default Rate}_{t-1} + \delta_2 \ \text{GDP Growth}_{t-1} + \delta_3 \ \text{IP Growth}_{t-1} + \epsilon_t$$

		Small	Medium	Large	All
Coefficient	Intercept	0.0052	0.0085	-0.0003	0.0005
	ΔNet Lev$_{t-1}$	-0.1173	-0.5360	0.1100	0.1532
	ΔNet Lev$_{t-2}$	-0.0634	-0.2273	0.1684	0.2430
	ΔTax Rate$_{t-1}$	-0.0013	-0.0013	0.0014	0.0012
	ΔTax Rate$_{t-2}$	0.0006	0.0043	0.0003	-0.0001
	ΔTax Rate$_{t-3}$	-0.0010	0.0039	0.0001	0.0003
	Default Rate$_{t-1}$	0.1487	-1.0491	-0.1280	-0.0739
	GDP Growth$_{t-1}$	-0.0879	-0.3364	0.0308	0.0108
	IP Growth$_{t-1}$	0.0231	0.1162	0.0122	0.0042
t-Statistic	Intercept	2.14^{**}	1.44	-0.19	0.36
	ΔNet Lev$_{t-1}$	-0.92	-2.92^{**}	0.74	1.18
	ΔNet Lev$_{t-2}$	-0.87	-1.76^{*}	1.19	1.92^{*}
	ΔTax Rate$_{t-1}$	-1.29	-0.63	2.09^{**}	2.23^{**}
	ΔTax Rate$_{t-2}$	0.68	2.16^{**}	0.52	-0.22
	ΔTax Rate$_{t-3}$	-0.90	2.69^{**}	0.10	0.72
	Default Rate$_{t-1}$	1.06	-2.08^{**}	-0.82	-1.39
	GDP Growth$_{t-1}$	-1.86	-1.68^{*}	1.14	0.72
	IP Growth$_{t-1}$	0.80	1.95^{*}	0.74	0.33
Adj. R^2		0.032	0.301	0.192	0.160
N		79	79	79	84

Table A4

Regression of Changes in Net Leverage on Changes in the Tax Rate and Firm Liquidity and Profitability Measures. This table reports summary statistics from the regression of the change in the net leverage ratio (net leverage over total assets, where net leverage is defined as debt minus cash) on its first two lags, the three previous changes in the corporate tax rate for the highest bracket, the previous changes in the ratios of cash and current assets to total assets, and the previous ratio of earnings before taxes to total assets. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 and $100 million, and greater than $100 million, respectively (measured in current (2009) dollars). The t-statistics are based on the Newey-West estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period for all categories is 1931–2009.

$$\Delta\text{Lev}_t = \alpha + \sum_{i=1}^{2} \beta_i \, \Delta\text{Net Lev}_{t-i} + \sum_{i=1}^{3} \gamma_i \, \Delta\text{Tax Rate}_{t-i} + \delta_1 \, \Delta\text{Cash Ratio}_{t-1} + \delta_2 \, \Delta\text{Current Ratio}_{t-1} + \delta_3 \, \text{Profitability}_{t-1} + \epsilon_t$$

		Small	Medium	Large	All
Coefficient	Intercept	0.0154	−0.0063	−0.0018	−0.0013
	ΔNet Lev$_{t-1}$	−0.1487	−0.1569	0.1212	0.1283
	ΔNet Lev$_{t-2}$	−0.1599	−0.3238	0.1255	0.2411
	ΔTax Rate$_{t-1}$	−0.0007	−0.0028	0.0017	0.0014
	ΔTax Rate$_{t-2}$	0.0005	0.0034	0.0002	−0.0002
	ΔTax Rate$_{t-3}$	−0.0004	0.0035	0.0002	0.0004
	ΔCash Ratio$_{t-1}$	−0.6392	−0.8155	−0.3649	−0.2894
	ΔCurrent Ratio$_{t-1}$	0.6513	0.7417	0.0520	0.0312
	Profitability$_{t-1}$	−0.2154	0.1429	0.0661	0.0459
t-Statistic	Intercept	3.24**	−0.69	−0.55	−0.48
	ΔNet Lev$_{t-1}$	−1.83*	−1.11	0.88	0.99
	ΔNet Lev$_{t-2}$	−2.21**	−1.99**	1.17	2.15**
	ΔTax Rate$_{t-1}$	−1.03	−1.23	2.14**	2.40**
	ΔTax Rate$_{t-2}$	0.58	2.00**	0.43	−0.29
	ΔTax Rate$_{t-3}$	−0.52	2.49**	0.34	0.93
	ΔCash Ratio$_{t-1}$	−1.56	−1.26	−1.19	−1.00
	ΔCurrent Ratio$_{t-1}$	3.02**	1.86*	0.48	0.30
	Profitability$_{t-1}$	−2.81**	0.54	0.81	0.68
Adj. R^2		0.311	0.265	0.200	0.185
N		79	79	79	79

Table A5

Regression of Changes in Net Leverage on Changes in the Tax Rate, Stock Returns, and Changes in Volatility and Corporate Credit Spreads. This table reports summary statistics from the regression of the change in the net leverage ratio (net leverage over total assets, where net leverage is defined as debt minus cash) on its first two lags, the three previous changes in the corporate tax rate for the highest bracket, the previous return on the stock market, and the previous changes in stock market volatility and corporate credit spreads. Small, Medium, and Large denote firms with total assets of roughly less than \$10 million, between \$10 and \$100 million, and greater than \$100 million, respectively (measured in current (2009) dollars). The t-statistics are based on the Newey-West estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period for the individual size catergories is 1931–2009. The sample period for the category including all firms is 1926–2009.

$$\Delta\text{Net Lev}_t = \alpha + \sum_{i=1}^{2} \beta_i \, \Delta\text{Net Lev}_{t-i} + \sum_{i=1}^{3} \gamma_i \, \Delta\text{Tax Rate}_{t-i} + \delta_1 \, \text{Stock Return}_{t-1} + \delta_2 \, \Delta\text{Volatility}_{t-1} + \delta_3 \, \Delta\text{Spread}_{t-1} + \epsilon_t$$

		Small	Medium	Large	All
Coefficient	Intercept	0.0035	0.0020	0.0008	0.0009
	ΔNet Lev$_{t-1}$	−0.0536	−0.4623	0.1736	0.1739
	ΔNet Lev$_{t-2}$	−0.1051	−0.2473	0.1682	0.2373
	ΔTax Rate$_{t-1}$	−0.0017	−0.0024	0.0017	0.0013
	ΔTax Rate$_{t-2}$	0.0008	0.0029	0.0004	−0.0001
	ΔTax Rate$_{t-3}$	−0.0016	0.0030	−0.0000	0.0003
	Stock Return$_{t-1}$	0.0079	−0.0080	−0.0060	−0.0051
	ΔVolatility$_{t-1}$	−0.0352	0.0410	−0.0265	−0.0131
	ΔSpread$_{t-1}$	0.9855	0.1407	0.0560	−0.1356
t-Statistic	Intercept	1.58	0.38	0.50	0.75
	ΔNet Lev$_{t-1}$	−0.43	−2.96**	1.63	1.75*
	ΔNet Lev$_{t-2}$	−1.36	−1.85*	1.66*	2.19**
	ΔTax Rate$_{t-1}$	−1.42	−0.99	2.20**	2.22**
	ΔTax Rate$_{t-2}$	0.82	2.29**	0.75	−0.16
	ΔTax Rate$_{t-3}$	−1.26	2.03**	−0.02	0.83
	Stock Return$_{t-1}$	0.59	−0.45	−0.79	−0.97
	ΔVolatility$_{t-1}$	−1.10	0.72	−1.60	−1.25
	ΔSpread$_{t-1}$	0.88	0.08	0.08	−0.25
Adj. R^2		0.013	0.140	0.192	0.164
N		79	79	79	84