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Corporate Taxes and Capital Structure: A Long-Term Historical Perspective

Matthias Fleckenstein[1]
Francis A. Longstaff[2]
Ilya A. Strebulaev[3]*

[1]*University of Delaware, USA; mflecken@udel.edu*
[2]*UCLA Anderson School of Management and the NBER, USA; francis.longstaff@anderson.ucla.edu*
[3]*Graduate School of Business at Stanford University and the NBER, USA; istrebulaev@stanford.edu*

ABSTRACT

We study the time series relation between leverage and corporate tax rates using an extensive data set constructed from all corporate income tax returns filed with the Internal Revenue Service from 1926 to 2013. This data set includes financial statement data from millions of private and public corporations. 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. Furthermore, the results hold for both financial and nonfinancial firms as well as for different measures of firm leverage and the marginal corporate income tax rate. An increase in the marginal corporate tax rate of 1% translates into a 0.15% increase in corporate leverage, representing a $132 billion increase in aggregate leverage based on current values.

Keywords: Corporate taxes, Leverage, Capital structure

JEL Codes: G01, G21, G23, H25

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1 Introduction

The capital structure decisions of corporations are one of the most important areas of study in financial economics 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 twofold. 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 second challenge is the need for sufficient time series variation in the marginal tax rate to be able to identify its effects on leverage. The first problem often compounds the second since many of the largest changes in tax laws and rates occur during the first half of the 20th century.

This paper studies the time series relation between corporate taxes and leverage using an extensive 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 US from 1926 to 2013 (Statistics of Income (SOI)). 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. Further, by spanning almost the entire history of the corporate income tax, the data set allows us to evaluate the effects of tax rate changes over a much broader range of tax regimes.

Three important results emerge from this analysis. First, we find strong evidence of a direct relation between changes in corporate tax rates and subsequent changes in leverage. In particular, an increase in the marginal corporate tax rate of 1% is associated with a 0.15% increase in corporate leverage, representing roughly a $132 billion increase in aggregate corporate leverage (based on 2013

referee. We acknowledge Yuji Sakurai and Mike Schwert for their capable research assistance. All errors are our responsibility.

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 support for one of the central pillars of standard corporate capital structure tradeoff theory.

Second, our results provide evidence that financial constraints play a central role in determining corporate capital structure. In particular, we find that larger firms experience capital structure changes following changes in corporate tax rates. In contrast, the capital structure decisions of smaller firms appear to be unrelated to changes in tax rates. Given that smaller firms are likely to face greater financial constraints than larger firms, these results imply the first-order importance of financial constraints in capital structure decisions.

Third, we show that the relation between corporate tax rates and capital structure is not due to capital regulation in the financial sector. In particular, we find that the relation between changes in corporate tax rates and subsequent changes in leverage is significant for both financial and nonfinancial firms.

Finally, we show that these results are robust to alternative measures of corporate leverage. Specifically, the results hold when leverage is measured based on total liabilities, on total liabilities minus accounts payable, on short-term debt and other liabilities, and on long-term debt. Furthermore, we demonstrate that the results are robust to alternative measures of the marginal corporate tax rate. In particular, the results hold when the marginal corporate tax rate is identified as the rate on the highest income bracket, the lowest nonzero tax rate, the maximum tax rate (including surtaxes), and the average effective corporate tax rate based on data from the Financial Accounts of the US (Flow of Funds).

There is an extensive empirical literature on the determinants of corporate capital structure. Much of this literature focuses on identifying cross-sectional factors influencing capital structure. Examples include Mackie-Mason (1990), Slemrod (1992), Givoly *et al.* (1992), and Rajan and Zingales (1995), Graham (2000, 2008), Fama and French (2002) and Panier *et al.* (2015), and Heider and Ljungqvist (2015). Other papers use exogenous shocks to corporate tax rates or the costs of financial distress to study the causal links between these factors and corporate leverage decisions. An important example is Van Binsbergen *et al.* (2010) who use the US Tax Reform Act of 1986 as an instrument for exogenous variation to identify the marginal benefits of debt. They find that the 1986 Tax Reform Act was associated with a significant decline in leverage.

Other recent research has emphasized that macroeconomic risk has a profound impact on corporate financing decisions (Bhamra *et al.*, 2010; Hackbarth *et al.*, 2006). 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 credit availability in the presence

of financial constraints. DeAngelo and Roll (2015) show that there is significant variability in capital structure over time at the individual firm level. Graham *et al.* (2015) show that firm characteristics are unlikely to account for the long-term trends in leverage and attribute the rise of debt to changes in government borrowing, macroeconomic uncertainty, and financial sector development.

There is also a literature on the time series relation between corporate tax rates and leverage. Important earlier work in this area includes Gordon and Lee (2001) who use SOI data for the 37-year period from 1954 to 1995 (excluding 1962 and 1966 to 1969) to study the contemporaneous response of corporations to changes in tax rates. They find that tax rates have significant effects on the leverage decisions of the smallest and largest firms. Similarly, Faccio and Xu (2015) use a panel data set for 29 OECD countries for the 29-year period from 1981 to 2009 to study the relation between the maximum corporate tax rate and corporate leverage. Across all countries, they find that there is a significant positive relation between tax rates and corporate leverage. Bargeron *et al.* (2014) study the capital structure decisions of US firms during 1905 to 1924.

Our paper complements and extends the time series literature in several important ways. First, we study the time series relation using SOI data spanning the 88-year period from 1926 to 2013—a sample period more that 50 years longer than in previous studies. The longer time series allows us to include periods during which corporate tax rates were much lower. This feature is important since Li *et al.* (2016) show that the relation between tax rates and leverage may be much stronger when tax rates are relatively low. Second, the SOI data allows us to stratify results by firm size and by industry, potentially shedding light on the role of financial constraints and capital regulation in corporate capital structure decisions. Third, by only using lagged changes in corporate tax rates as explanatory variables for subsequent changes in leverage, we avoid some of the potential endogeneity issues that might be present in previous studies that focus on contemporaneous relations. Finally, we show evidence that time series effects in corporate leverage decisions in response to tax rate changes are not artifacts of how leverage or marginal tax rates are measured.

2 The US Corporate Income Tax

The taxation of corporate income in the US has a long history. During the Civil War in 1862, President Lincoln signed a revenue act that introduced a 3 to 5% 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]

[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).

The current corporate income tax was initiated in 1909 with the levy of a 1% 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 4 years. The passage of the 16th Amendment in 1913 resolved the issue of the constitutionality of both the personal and corporate income taxes.

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 1% from 1909 to 1915 to a high of 53% from 1942 to 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 to 1918 when all corporate income was taxed at the same rate, to nine in 1940. Note also that the corporate tax rate is not always an increasing function of income.

Since the corporate tax rate varies across income levels, we need some measure of the marginal or representative tax rate.[2] In our baseline specification, we 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 show later, however, that the results are robust when alternative measures of the marginal tax rate are used.

3 The Data

The Revenue Act of 1916 mandated the annual publication of statistics associated with the collection of income taxes. From 1916 to 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 SOI publication. We provide an introduction to the SOI reports in the Appendix and describe where this data may be accessed.[3] In addition to the data for all corporations, the SOI reports also provide aggregate balance sheet and income statement information for eight broad industry categories. We use this data to report results separately for nonfinancial and financial firms. Beginning in 1931, the IRS has also reported aggregate balance sheet and income statement data for all firms within specific size categories (although this data is not stratified on the basis of industry). The number of size categories ranges from 8 to 12 during the 1931 to 2013 period.[4]

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

[3] We note, however, that a number of previous studies have also used IRS SOI data. Key examples include Gordon and Lee (2001) and Graham *et al.* (2015, 2016) who also document an upward trend in leverage over the past century.

[4] The SOI data are aggregated by simply totaling the balance sheet and income statement data for all of the individual firms. Thus, the ratios we compute and use in our analysis are based on aggregated data, and are not averages of ratios for individual firms.

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
1993–2013	8	18,333,333.00	15.00	39.00	35.00

Table 1: Summary Statistics for Federal Corporate Income Tax Rates for the 1909–2013 Period.

Description: 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.

Interpretation: This table provides an overview of the history of corporate income tax brackets and rates from 1909 to 2013.

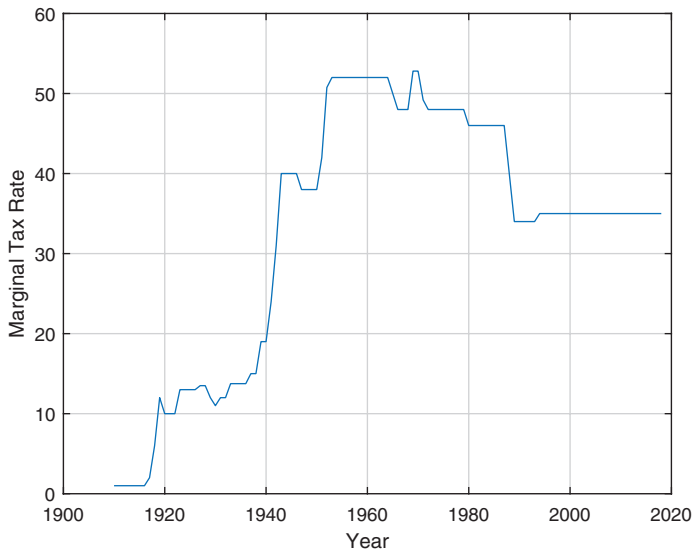

Figure 1: Time Series Plot of the Marginal Corporate Income Tax Rate.

Description: This figure plots the marginal corporate income tax rate for the 1909 to 2013 period. The marginal corporate income tax rate is defined as the rate on the highest bracket of corporate income.

Interpretation: This figure shows the time series of the marginal corporate income tax rate over the past century. The marginal corporate income tax rate varies significantly over time. The highest marginal corporate income tax rates during the late 1960s reach levels in excess of 50%.

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 2013 by the IRS. The total number of corporate tax returns included is 4,786,649. The distribution of returns, however, is heavily skewed toward smaller firms. In fact, firms with total assets from $1 to $500,000 total 3,825,213, which represents 79.91% 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 $80.28 billion, which represents 93.12% 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.

Size Category		Number of Firms	Percentage of Total	Total Assets of All Firms	Percentage of Total
From	**To**				
1	500,000	3,825,213	79.91	382.82	0.44
500,000	1,000,000	374,436	7.82	264.06	0.31
1,000,000	5,000,000	415,997	8.69	881.34	1.02
5,000,000	10,000,000	70,737	1.48	497.39	0.58
10,000,000	25,000,000	48,639	1.02	754.76	0.88
25,000,000	50,000,000	19,031	0.40	667.50	0.77
50,000,000	100,000,000	11,674	0.24	827.95	0.96
100,000,000	250,000,000	10,344	0.22	1,651.80	1.92
>250,000,000		10,578	0.22	80,280.74	93.12
Total		4,786,649	100.00	86,208.36	100.00

Table 2: Size Distribution of Corporations in the 2013 IRS Statistics of Income.

Description: This table shows the number of firms in each of the size categories reported by the IRS for the year 2013. 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.

Interpretation: This table presents the size distribution of firms in the 2013 IRS Statistics of Income.

Size Category		Number of Firms	Percentage of Total	Total Assets of All Firms	Percentage of Total
From	**To**				
1	500,000	297	4.43	0.04	0.00
500,000	1,000,000	95	1.42	0.07	0.00
1,000,000	5,000,000	365	5.44	1.00	0.00
5,000,000	10,000,000	204	3.04	1.50	0.00
10,000,000	25,000,000	389	5.80	6.47	0.01
25,000,000	50,000,000	385	5.74	14.05	0.02
50,000,000	100,000,000	394	5.88	28.76	0.05
100,000,000	250,000,000	641	9.56	106.71	0.19
>250,000,000		3,934	58.68	56,557.79	99.72
Total		6,704	100.00	57,716.39	100.00

Table 3: Size Distribution of Corporations in the 2013 Compustat Universe.

Description: This table shows the number of firms in each of the size categories reported by Compustat for the year 2013. 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.

Interpretation: This table presents the size distribution of firms in the 2013 Compustat universe.

As shown, the 2013 Compustat universe includes information for 6,704 firms in 2013 (the SOI and Compustat universes include both financial firms and nonfinancial firms). Thus, the SOI universe includes more than 700 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 that 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 10,578 firms in the $250 million and larger category, while the Compustat universe only includes 3,934 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, number of 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 2013 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 2013 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 the basic balance sheet and income statement categories (such as cash, accounts receivable, shareholders equity, etc.) are likely relatively constant over time. Thus, leverage ratios based on total liabilities (or equivalently, one minus the ratio of equity over total assets) should be generally consistent over time.[5]

Although corporate tax returns are for a specific tax year, not all firms have the same year end. For example, based on the 2013 Compustat universe, 77.8% of firms have a December year end, 5.4% 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 2013 report is based on the corporate income returns for tax years ending between July 1, 2012 and June 30, 2013, 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 to 1950 are based on actual totals of all corporate tax returns filed. Beginning with 1951, totals for smaller size categories are based

[5] In contrast, narrower definitions of leverage based on specific legal forms of debt contracts such as leases or pension liabilities are more likely to have evolved over time.

	Small	Medium	Large	Nonfinancial	Financial	All
Cash	11.10	8.91	6.57	5.33	8.64	7.18
Receivables	20.66	21.94	18.20	16.27	20.61	19.31
Inventories	16.47	9.50	3.78	12.90	0.10	5.81
Investments	10.07	31.67	45.69	17.41	56.95	39.22
Capital Assets	33.63	21.63	20.37	40.03	6.47	21.13
Other Assets	8.07	6.35	5.39	8.06	7.23	7.35
Total Assets	100.00	100.00	100.00	100.00	100.00	100.00
Expenses	97.37	95.31	92.27	95.54	85.51	94.83
Earnings before Tax	2.63	4.69	7.73	4.46	14.49	5.17
Corporate Tax	0.87	1.94	2.80	1.95	2.73	2.04
Revenues	100.00	100.00	100.00	100.00	100.00	100.00
Number of Firms	4,686,383	79,344	20,922	3,942,457	844,192	4,786,649

Table 4: Summary Statistics for Corporate Financial Statements.

Description: 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 (2013) dollars). Nonfinancial and Financial denote firms classified as nonfinancial and financial firms in the IRS Statistics of Income, respectively. Number of firms denotes the total number of corporate returns in 2013 for the indicated size categories. The sample period for the individual size categories is 1931–2013. The sample period for the nonfinancial and financial firms and the category including all firms is 1926–2013.

Interpretation: This table reports summary statistics for common-size balance sheet and income statement items.

on a stratified sampling of returns filed. For example, for the 2013 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 items (expressed as a percent of total assets) and income statement items (expressed as a percent of total revenues). In addition to the results for all firms, Table 4 also reports the statistics separately for the small, medium, and large firm size categories, and for nonfinancial and financial firms.

As shown, there are 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 than it does for the medium-sized and large firms. This finding is 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 2.63% of total revenues for small firms, but represents 7.73% for the large firms. Because large firms are historically more successful, and because successful small firms become larger firms with time, path dependency likely 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% for small firms, 41.4% for medium-sized firms, and 36.2% 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.

Table 4 also illustrates some of the key differences between the balance sheets of nonfinancial and financial firms. For example, financial firms tend to hold far more investments than nonfinancial firms. In contrast, nonfinancial firms hold far more capital assets.

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 to 2013 period and compare them with those for Compustat firms during the same period. For example, cash, receivables, inventories, and capital assets represent 7.18%, 19.31%, 5.81%, and 21.13% of total assets for SOI firms, respectively. The same ratios for Compustat firms are 4.03%, 28.39%, 8.17%, and 27.70%, respectively. Similarly, earnings before taxes and corporate taxes paid are 5.17% and 2.04% of total revenues for SOI firms, respectively. The same ratios for Compustat firms are 7.87% and 3.56%, respectively.

Turning next to corporate leverage, our baseline measure of leverage is simply one minus the ratio of total equity to total assets. We use this measure since the definition of total equity and assets is unlikely to have varied much over time. As we will show, however, the results are robust to alternative measures of leverage.

Table 5 presents summary statistics for the leverage ratios for each of the three size categories, for nonfinancial and financial firms, and for all firms. Figure 2 plots the leverage ratio for all firms for the 1926 to 2013 period. As illustrated, the leverage ratio for all firms also varies significantly over time. The highest corporate leverage ratios occur during the 1970s when they reach a level in excess of 75%.[6]

[6]The increasing trend in leverage over much of the previous century has also been documented by other researchers including DeAngelo and Roll (2015) and Graham *et al.* (2015, 2016).

	Small	**Medium**	**Large**	**Nonfinancial**	**Financial**	**All**
Mean	0.618	0.660	0.678	0.524	0.765	0.654
Standard Deviation	0.117	0.080	0.053	0.117	0.118	0.068
Minimum	0.410	0.499	0.549	0.359	0.507	0.516
Median	0.661	0.655	0.680	0.539	0.819	0.653
Maximum	0.767	0.782	0.760	0.682	0.888	0.751
Serial Correlation	0.991	0.975	0.974	0.994	0.987	0.989
N	83	83	83	88	88	88

Table 5: Summary Statistics for Corporate Leverage Ratios.

Description: This table reports summary statistics for the corporate leverage ratio (defined as one minus the ratio of equity to total assets) for the indicated categories. Small, Medium, and Large denote firms with total assets of roughly less than $10 million, between $10 million and $100 million, and greater than $100 million, respectively (measured in current (2013) dollars). Nonfinancial and Financial denote firms classified as nonfinancial and financial firms in the IRS Statistics of Income, respectively. The sample period for the individual size categories is 1931–2013. The sample period for the nonfinancial and financial firms and the category including all firms is 1926–2013.

Interpretation: This table reports summary statistics for the corporate leverage ratio for the indicated size and industry categories.

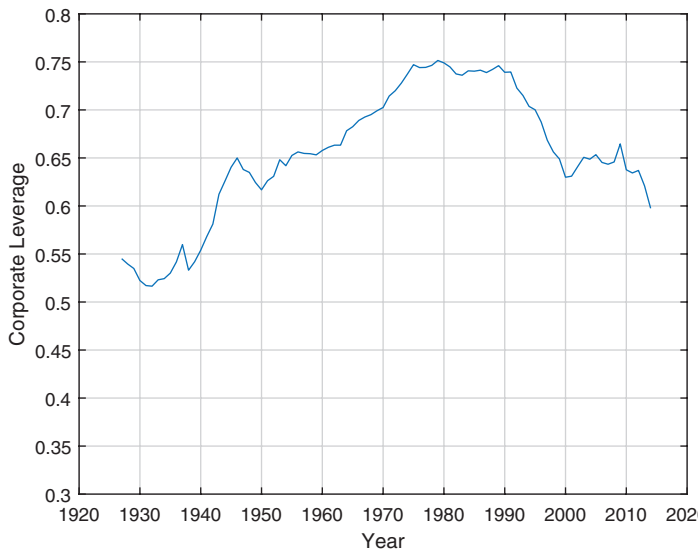

Figure 2: Time Series Plot of the Corporate Leverage Ratio for All Firms.

Description: This figure plots the corporate leverage ratio for all firms for the 1926 to 2013 period. The corporate leverage ratio is defined as one minus the ratio of equity to total assets.

Interpretation: This figure shows the leverage ratio for all firms for the 1926 to 2013 period. The leverage ratio for all firms varies significantly over time. The highest corporate leverage ratios occur during the 1970s when they reach a level in excess of 75%.

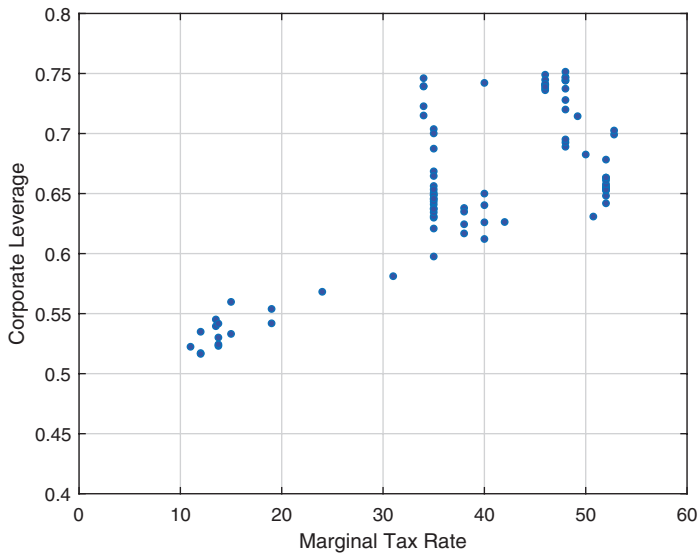

Figure 3: Scatterdiagram of the Corporate Leverage Ratio for All Firms and the Marginal Corporate Income Tax Rate.

Description: This figure plots the corporate leverage ratio for all firms against the marginal corporate income tax rate for the 1926 to 2013 period. The corporate leverage ratio is defined as one minus the ratio of equity to total assets. The marginal corporate income tax rate is defined as the rate on the highest bracket of corporate income.

Interpretation: This figure shows a scatterdiagram of the level of the marginal corporate tax rate and the level of aggregate corporate leverage for the 1926 to 2013 period. There is a strong positive relation between the level of the marginal corporate tax rate and the level of aggregate corporate leverage.

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 to 2013 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 to 2013 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 61.8% for small firms, 66.0% for medium-sized firms, and 67.8% for large firms. The lower average leverage

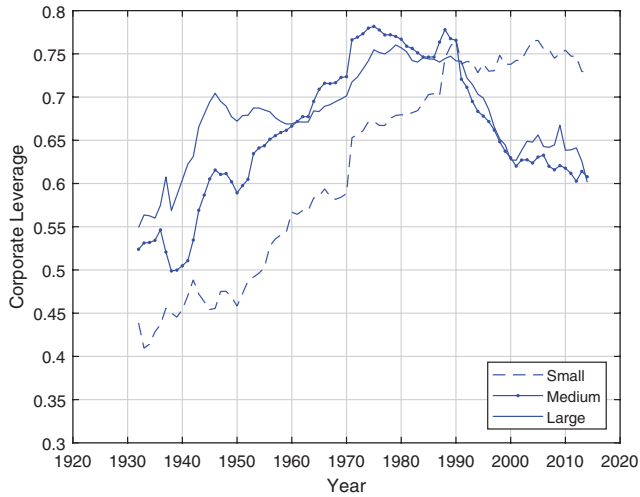

Figure 4: Time Series Plots of Leverage Ratios for Small, Medium-Sized, and Large Corporations.

Description: This figure plots the leverage ratios for firms in the small, medium, and large categories for the 1931 to 2013 period. The leverage ratio is defined as one minus the ratio of equity to total assets for each category of firms.

Interpretation: This figure shows that leverage ratios are generally increasing throughout the 1931 to 2013 period. The leverage ratios for the medium-sized and large firms, reach a maximum in 1988 and then begin to decline. In contrast, the leverage ratio for small firms continues to increase.

for smaller firms is again consistent with the perspective that smaller firms face greater financial constraints and are less able to acquire outside funding. Not surprisingly, the average leverage of financial firms is significantly higher than that of nonfinancial firms.

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 to 2013 period is 69.39%. The ratio of liabilities to total assets for all Compustat firms during the same period is 64.78%.

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.

4.1 The Control Variables

In testing whether changes in tax rates are followed by changes in corporate capital structure, we also include three categories of other explanatory variables as controls. These categories and the specific variables used are described below.

4.1.1 The Cost 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 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 *et al.* (2011, 2014), 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 *et al.* (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 *et al.* (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.

4.1.2 Firm liquidity and internal capital

Recent literature emphasizes the central role that financial constraints play in determining the capital structure of corporations.[7] Firms that face severe constraints or frictions may find that changes in the leverage ratio over time are heavily

[7] See Almeida *et al.* (2004), Opler *et al.* (1999), Gryglewicz (2011), Acharya *et al.* (2012), Anderson and Carverhill (2012), and Pinkowitz *et al.* (2013).

influenced by the amount of internal cash flow generated by operations or the liquidity of their assets. In light of this, we include three proxies for firm liquidity and internal cash flow. In particular, we calculate the cash and current ratios for the 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 the profitability ratio as the ratio of earnings before taxes to total assets.

4.1.3 External Capital Markets

As discussed earlier, corporate capital structure could be influenced by events in the external capital markets. To address this, we include three variables as proxies for capital market conditions in the regression. 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.

4.2 The Effects of Tax Rate Changes

To examine the time series relation between corporate tax rates and capital structure, our approach is to regress changes in leverage on its lagged values and on lagged changes in the marginal corporate income tax rate. 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 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 lagged values of the change in the marginal tax rate. Finally, we include the lagged values of the nine additional control variables described above. We include only one lag of these control variables in the regression (and all subsequent regressions) since the results are unaffected by the inclusion of these variables and since additional lagged values of these variables are generally insignificant.

	All Firms	
Variable	**Coeff**	***t*-Stat**
Intercept	−0.0029	−1.00
ΔLev_{t-1}	0.1197	0.93
ΔLev_{t-2}	0.1877	1.36
$\Delta\text{Tax Rate}_{t-1}$	0.1266	2.47**
$\Delta\text{Tax Rate}_{t-2}$	−0.0549	−0.75
$\Delta\text{Tax Rate}_{t-3}$	0.0734	1.63
$\text{Default Rate}_{t-1}$	0.2174	1.47
GDP Growth_{t-1}	0.0291	1.12
IP Growth_{t-1}	0.0282	1.30
$\Delta\text{Cash Ratio}_{t-1}$	−0.4444	−1.67*
$\Delta\text{Current Ratio}_{t-1}$	−0.0026	−0.03
$\Delta\text{Profitability}_{t-1}$	−0.3504	−1.30
$\text{Stock Return}_{t-1}$	−0.0130	−2.04**
$\Delta\text{Volatility}_{t-1}$	−0.0212	−0.37
$\Delta\text{Spread}_{t-1}$	−0.2176	−1.80*
Adj. R^2		0.145
N		84

Table 6: Regression of Changes in Leverage on Changes in the Tax Rate.

Description: This table reports summary statistics from the regression of the change in the leverage ratio on its first two lags, the previous three changes in the corporate tax rate for the highest bracket, and a vector of control variables. The t-statistics are based on the Newey-West (1987) estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period is 1926–2013.

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

Interpretation: This table shows that lagged changes in the marginal corporate tax rate forecast changes in corporate leverage.

Table 6 presents the results from the regression. As shown, the results 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 2.47. The coefficient estimates for the lagged changes in marginal tax rates imply that a 1% change in the marginal tax rate cumulates to an increase in the leverage rate of 0.15%. While this increase may seem modest as a percentage, it represents an increase in aggregate corporate leverage of about $132 billion (based on 2013 statistics). These results are clearly consistent with the hypothesis that tax rates are an important determinant of corporate capital structure.

A number of the control variables are also related to changes in corporate leverage. In particular, an increase in the cash ratio of firms tends to be followed by

a marginally significant decline in corporate leverage. This result is intuitive since it suggests that firms may tend to substitute internal sources of capital for external borrowing. Similarly, changes in corporate credit spreads are negatively related to subsequent changes in leverage. These results are also intuitive since they imply that firms tend to use less debt when borrowing becomes more expensive and when their equity becomes more valuable.

4.3 The Effects of Financial Constraints

As discussed earlier, financial constraints may play a major role in corporate capital structure decisions. Since smaller firms are likely to face greater financial constraints than larger firms, we can explore the impact of financial constraints by comparing the results across the various size categories. To do this, we estimate the regression described in the previous section separately for the small, medium, and large firm categories. Table 7 reports the regression results.

The results provide strong support for the hypothesis that capital structure decisions are influenced by the financial frictions faced by firms. In particular, we find that there is a strong positive relation between changes in marginal tax rates and subsequent changes in leverage for both the medium and large firm categories. In contrast, there is no apparent relation between marginal tax rates and leverage for the smaller firms. This distinction suggests that the capital structure of small firms may be driven by different factors than those affecting larger firms. For example, small firms may face financial constraints that limit their ability to optimize capital structure, while larger firms may have more flexibility to adjust their leverage. This is consistent with recent dynamic capital structure models that emphasize optimal inaction by firms in the presence of transaction costs (Goldstein *et al.*, 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, 2015). Recent empirical evidence by Dinlersoz *et al.* (2018) confirms that firm size serves as an effective predictor of financial constraints.

These findings are reinforced by the results for the control variables in the regression. As shown, none of the control variables is significant for the smaller firms. In contrast, changes in the leverage of medium and large firms are significantly related to both macroeconomic factors and external capital market variables, although the specific patterns differ between medium and large firms. These results again illustrate that capital structure decisions by smaller firms may be driven primarily by firm specific financial constraints rather than external marketwide forces.

4.4 The Effects of Capital Regulation

Empirical studies of corporate capital structure decisions typically exclude financial firms from the analysis. One important reason for this is that financial firms may face significant additional restrictions on their ability to adjust their

	Small Firms		Medium Firms		Large Firms	
Variable	**Coeff**	***t*-Stat**	**Coeff**	***t*-Stat**	**Coeff**	***t*-Stat**
Intercept	0.0062	1.63	0.0072	2.20**	−0.0008	−0.31
ΔLev_{t-1}	0.0058	0.06	0.1257	1.18	0.3882	3.32**
ΔLev_{t-2}	0.0362	0.38	0.1695	1.88*	0.1834	1.70*
$\Delta\text{Tax Rate}_{t-1}$	−0.0387	−0.51	0.1783	2.40**	0.0856	2.31**
$\Delta\text{Tax Rate}_{t-2}$	0.1854	1.12	0.1767	1.73*	−0.0169	−0.33
$\Delta\text{Tax Rate}_{t-3}$	−0.0024	−0.03	0.0288	0.36	0.0048	0.11
$\text{Default Rate}_{t-1}$	0.1463	0.92	−0.3995	−2.41**	0.0761	0.41
GDP Growth_{t-1}	−0.0494	−1.47	−0.0467	−1.84*	−0.0089	−0.32
IP Growth_{t-1}	−0.0038	−0.17	0.0094	0.75	0.0386	2.47**
$\Delta\text{Cash Ratio}_{t-1}$	−0.3648	−0.81	−0.0421	−0.14	−0.3519	−1.78*
$\Delta\text{Current Ratio}_{t-1}$	0.0994	0.60	0.0149	0.13	−0.0407	−0.65
$\Delta\text{Profitability}_{t-1}$	−0.0157	−0.80	−0.0168	−0.66	−0.0563	−1.55
$\text{Stock Return}_{t-1}$	0.0074	0.83	−0.0202	−2.18**	−0.0074	−1.18
$\Delta\text{Volatility}_{t-1}$	−0.0520	−0.75	−0.1429	−2.40**	0.0431	0.81
$\Delta\text{Spread}_{t-1}$	−0.0159	−0.06	−0.0591	−0.43	−0.2772	−1.85*
Adj. R^2		−0.056		0.382		0.251
N		79		79		79

Table 7: Regression of Changes in Leverage on Changes in the Tax Rate by Firm Size Category.

Description: This table reports summary statistics from the regression of the change in the leverage ratio on its first two lags, the previous three changes in the corporate tax rate for the highest bracket, and a vector of control 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 (2013) dollars). The t-statistics are based on the Newey-West (1987) estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period is 1931–2013.

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

Interpretation: This table shows that lagged changes in the marginal corporate tax rate forecast changes in corporate leverage for medium and large firms.

capital structures because of the major role that capital regulation plays in the financial sector. To explore the potential impact of capital regulation on how firms respond to changes in corporate tax rates, we estimate the regression separately for nonfinancial and financial firms. Table 8 reports the results from the regression.

Surprisingly, the results show that there is relatively little difference in how nonfinancial and financial firms appear to adjust their leverage following changes in the corporate marginal tax rate. In particular, the coefficient for the first lagged change in the marginal tax rate is positive and significant for both nonfinancial and financial firms. The t-statistics for the coefficients are 2.04 and 2.40, respectively.

	Nonfinancial		Financial	
Variable	**Coeff**	***t*-Stat**	**Coeff**	***t*-Stat**
Intercept	−0.0021	−0.72	−0.0035	−0.95
ΔLev_{t-1}	0.1214	1.01	0.0799	0.67
ΔLev_{t-2}	0.2345	1.72*	0.1304	1.00
$\Delta\text{Tax Rate}_{t-1}$	0.1026	2.04**	0.2374	2.40**
$\Delta\text{Tax Rate}_{t-2}$	0.0081	0.17	−0.0632	−0.84
$\Delta\text{Tax Rate}_{t-3}$	0.0373	0.87	0.0652	1.01
$\text{Default Rate}_{t-1}$	0.2046	1.52	0.1937	0.73
GDP Growth_{t-1}	0.0297	1.00	0.0337	0.98
IP Growth_{t-1}	0.0127	0.90	0.0200	0.87
$\Delta\text{Cash Ratio}_{t-1}$	−0.3444	−1.40	−0.5146	−1.55
$\Delta\text{Current Ratio}_{t-1}$	0.0128	0.16	0.0430	0.44
$\Delta\text{Profitability}_{t-1}$	−0.0496	−0.82	0.2292	0.97
$\text{Stock Return}_{t-1}$	−0.0181	−2.40**	−0.0334	−2.37**
$\Delta\text{Volatility}_{t-1}$	0.0020	0.03	0.0676	0.52
$\Delta\text{Spread}_{t-1}$	−0.3588	−1.90*	−0.7878	−2.42*
Adj. R^2		0.152		0.141
N		84		84

Table 8: Regression of Changes in Leverage on Changes in the Tax Rate for Nonfinancial and Financial Categories.

Description: This table reports summary statistics from the regression of the change in the leverage ratio on its first two lags, the previous three changes in the corporate tax rate for the highest bracket, and a vector of control variables. Nonfinancial and Financial denote firms classified as nonfinancial and financial firms in the IRS Statistics of Income, respectively. The t-statistics are based on the Newey-West (1987) estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period is 1926–2013.

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

Interpretation: This table shows that lagged changes in the marginal corporate tax rate forecast changes in corporate leverage for both nonfinancial and financial firms.

Similarly, changes in the leverage of both nonfinancial and financial firms are significantly negatively related to the lagged stock market return and the change in the corporate credit spread.

One key difference, however, is that the coefficient for the first lagged change in the marginal tax rate for financial firms is roughly twice that for the nonfinancial firms. Thus, the results suggest that financial firms may actually be more responsive to tax-based incentives to leverage their capital structure than less-regulated firms.

5 Robustness Results

As discussed earlier, our baseline measure of leverage is just one minus the ratio of total equity to total assets. In using this measure, we are defining debt to include all liabilities of the firm such as accounts payable and accruals as well as formal indebtedness such as bank loans, mortgages, and corporate bonds. In some cases, however, empirical researchers may prefer to focus on leverage ratios that are based on debt that is either explicitly interest bearing or represents formal contractual claims on the firm. Since our emphasis is on time series patterns in changes, these distinctions are probably of less importance in our analysis unless the composition of debt and nondebt liabilities changes dramatically over time. 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 nondebt liabilities is moot, because most of these firms do not have access to public debt markets.

To examine whether the relation between changes in marginal tax rates and subsequent changes in corporate leverage is robust to the measure of leverage used, we estimate the regression using three alternative definitions of debt. In the first, debt is defined as total liabilities minus accounts payable. In the second, debt is defined as short-term debt (mortgages, notes, and bonds payable with a maturity of less than 1 year) plus other liabilities. In the third, debt is defined as long-term debt (mortgages, notes, and bonds payable with a maturity greater than or equal to 1 year). Leverage is defined as the ratio of debt to total assets. Table 9 reports the regression results.

The results indicate that the relation between changes in the marginal tax rate and subsequent changes in corporate leverage is robust to alternative leverage measures. In particular, the first lagged change in the marginal tax rate is positive and significant for all three of the alternative leverage measures.

In the previous analysis, we used the tax rate applied to the highest income bracket as the measure of the marginal corporate income tax rate. To explore the robustness of the results to the definition of the marginal tax rate, we estimate the regressions using three alternative measures. As the first alternative, we use the minimum or lowest nonzero tax rate applied to corporate profits. As the second alternative, we use the maximum tax rate applied to corporate profits. Since tax rates are not always monotonically increasing in corporate profits, this measure differs somewhat from the baseline measure. As the third alternative, we use an average corporate tax rate implied from the US Flow of Funds data. Specifically, we take the ratio of total corporate income taxes to total corporate profits as given by Table F.3 Distribution of National Income from the Financial Accounts of the US–Z.1 (formerly Flow of Funds Accounts) as a measure of the effective average corporate tax rate. By using alternative measures of the marginal tax rate that

	Total Liabilities Less Accounts Payable		Short-Term Debt and Other Liabilities		Long-Term Debt	
Variable	**Coeff**	***t*-Stat**	**Coeff**	***t*-Stat**	**Coeff**	***t*-Stat**
Intercept	0.0027	−0.94	−0.0026	−1.08	−0.0059	−2.01**
ΔLev_{t-1}	0.0848	0.56	0.1011	0.92	0.3886	2.46**
ΔLev_{t-2}	−0.0398	−0.30	0.1063	1.33	−0.0943	−0.92
$\Delta\text{Tax Rate}_{t-1}$	0.1070	2.18**	0.1627	2.75**	0.0639	2.29**
$\Delta\text{Tax Rate}_{t-2}$	−0.0236	−0.27	−0.0015	−0.03	−0.0164	−0.21
$\Delta\text{Tax Rate}_{t-3}$	0.1521	1.84*	0.1254	1.47	0.0431	0.81
$\text{Default Rate}_{t-1}$	0.1428	0.89	0.0768	0.58	0.1944	1.16
GDP Growth_{t-1}	0.0384	1.36	0.0156	0.69	0.0519	1.75*
IP Growth_{t-1}	0.0233	0.89	0.0805	2.99**	0.0836	1.89*
$\Delta\text{Cash Ratio}_{t-1}$	−0.2686	−1.02	−0.2415	−0.67	0.0865	0.20
$\Delta\text{Current Ratio}_{t-1}$	0.0485	0.36	−0.0916	−0.68	0.1791	1.11
$\Delta\text{Profitability}_{t-1}$	−0.3815	−1.24	−0.4266	−1.94*	−0.0049	−0.49
$\text{Stock Return}_{t-1}$	−0.0143	−2.02**	−0.0171	−2.50**	−0.8065	−2.10**
$\Delta\text{Volatility}_{t-1}$	−0.0599	−1.01	−0.1551	−2.67**	−0.0003	−0.01
$\Delta\text{Spread}_{t-1}$	−0.1275	−0.88	0.3368	1.62	0.2049	−0.71
Adj. R^2		0.111		0.346		0.169
N		84		84		84

Table 9: Regression of Changes in Leverage on Changes in the Tax Rate for Alternative Leverage Measures.

Description: 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, and a vector of control variables. Leverage is defined as the ratio of debt to total assets. In the first regression, debt is defined as total debt excluding accounts payable. In the second regression, debt is defined as short-term debt and other liabilities. In the third regression, debt is defined as long-term debt. The t-statistics are based on the Newey-West (1987) estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period is 1931–2013.

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

Interpretation: This table shows that lagged changes in the marginal corporate tax rate forecast changes in alternative measures of corporate leverage.

range from the lowest tax rate to the maximum tax rate, we hope to cover the full spectrum of possible marginal tax rates.

Table 10 reports the results from estimating the regression using these alternative measures of the marginal corporate income tax rate. As shown, the key results are robust to the alternative definitions. In particular, the first lagged change in

	Lowest Tax Rate		Maximum Tax Rate		Average Flow of Funds Tax Rate	
Variable	**Coeff**	***t*-Stat**	**Coeff**	***t*-Stat**	**Coeff**	***t*-Stat**
Intercept	−0.0015	−0.58	−0.0029	−1.21	0.0000	0.00
ΔLev_{t-1}	0.1245	1.02	0.1036	0.89	0.2266	2.25**
ΔLev_{t-2}	0.3350	2.52**	0.1354	1.09	0.2648	1.89*
$\Delta\text{Tax Rate}_{t-1}$	0.2346	2.37**	0.0309	1.75*	0.0636	1.97**
$\Delta\text{Tax Rate}_{t-2}$	−0.0781	−1.26	0.0235	0.47	−0.0077	−0.23
$\Delta\text{Tax Rate}_{t-3}$	0.0122	0.41	0.0846	2.14**	0.0046	0.26
$\text{Default Rate}_{t-1}$	0.0881	0.69	0.2269	1.73*	−0.1465	−0.57
GDP Growth_{t-1}	0.0072	0.29	0.0267	1.43	−0.0067	−0.22
IP Growth_{t-1}	0.0433	2.40**	0.0282	1.74*	0.0285	0.98
$\Delta\text{Cash Ratio}_{t-1}$	−0.2932	−1.12	−0.5158	−1.97**	−0.5143	−1.71*
$\Delta\text{Current Ratio}_{t-1}$	−0.0565	−0.71	0.0923	0.88	−0.0003	−0.00
$\Delta\text{Profitability}_{t-1}$	−0.2965	−1.11	−0.4739	−1.58	−0.3217	−1.30
$\text{Stock Return}_{t-1}$	−0.0097	−1.77*	−0.0108	−2.39**	−0.0076	−1.21
$\Delta\text{Volatility}_{t-1}$	−0.0497	−1.03	−0.0296	−0.76	0.0558	0.69
$\Delta\text{Spread}_{t-1}$	−0.1263	−1.04	−0.2249	−2.12**	−0.3252	−2.36**
Adj. R^2		0.217		0.155		0.163
N		84		84		84

Table 10: Regression of Changes in Leverage on Changes in the Tax Rate for Alternative Measures of the Marginal Tax Rate.

Description: 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, and a vector of control variables. The first regression uses the lowest non-zero corporate tax rate as the measure of the marginal tax rate. The second regression uses the maximum corporate tax rate (including surtaxes and excess profit taxes) as the the measure of the marginal tax rate. In the third regression, the marginal corporate tax rate is the aggregate income tax by all corporations in the U.S. as a percentage of total corporate income as reported by the United States Flow of Funds statistics. The t-statistics are based on the Newey-West (1987) estimate of the covariance matrix (three lags). The superscripts * and ** denote significance at the ten-percent and five-percent levels, respectively. The sample period is 1931–2013.

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

Interpretation: This table shows that lagged changes in alternative measures of the marginal corporate tax rate forecast changes in corporate leverage.

the marginal tax rate is positive and significant (at either the 5% or 10% level) in all three specifications. Furthermore, the third lagged change in the marginal tax rate is also significant in the regression using the maximum tax rate.[8]

[8]We are grateful to the referee for suggesting these robustness checks for the results.

6 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 previous studies. On the other hand, the data we have access to is based on aggregated size and industry categories rather than individual tax returns.

Our results provide strong support for capital structure tradeoff theory in that firms appear to respond to the tax incentives for debt. In particular, we find a strong relation between changes in marginal corporate income tax rates and subsequent changes in corporate leverage. These results are robust to how leverage is defined and also to alternative measures of the marginal corporate tax rate.

We also find, however, that the relation between marginal tax rates and leverage holds only for larger firms—we find no such relation for the smallest firm size category. This result is consistent with the view that capital structure decisions for smaller firms may be driven more by the frictions and constraints they face than is the case for larger firms. Smaller firms may simply find it either not feasible or too costly to vary their leverage in response to tax incentives.

Finally, we also show that the relation between marginal tax rates and leverage holds for both nonfinancial and financial firms. In fact, despite facing greater capital regulation, financial firms appear to adjust their capital structures more aggressively in response to changes in tax rates than other firms.

7 Appendix

7.1 Introduction to the IRS Statistics of Income

The IRS provides an extensive introduction to the SOF 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.

The SOI data uses four different categories for liabilities. These categories are: accounts payable, other liabilities, mortgages, notes, and bonds payable—maturity less than 1 year, and mortgages, notes, and bonds payable—maturity 1 year or more. The definitions for these SOI category are taken from the section titled "Explanation of Terms" and are as follow:

Accounts payable: This balance sheet account consists of relatively short-term liabilities arising from the conduct of trade or business and not secured by promissory notes.

Other liabilities: These are obligations which are not allocable to a specific account on the balance sheet and which are either noncurrent accounts (in general not due within 1 year) or accounts which could not be identified as either current or long-term. The excess of reserves for amortization, depreciation, and depletion over the respective asset accounts is included in this balance sheet account. Examples of other liabilities are deferred or unearned income not reported as part of a current account, provisions for future or deferred taxes based on the effects of either accelerated depreciation or possible income tax adjustments, and principal amounts of employee and similar funds. Borrowed securities, commissions, intercompany accounts, loans, overdrafts, and unearned income are also included.

Mortgages, notes and bonds payable: Mortgages, notes, and bonds payable are separated on the balance sheet according to the length of time to maturity of the obligations. The length of time to maturity is based on the date of the balance sheet rather than on the date of issue of the obligations. Accordingly, long-term obligations maturing within the coming year are reportable with short-term obligations as having a maturity of less than 1 year. Deposits and withdrawable shares may have been reported in mortgages, notes, and bonds payable by banks and savings institutions. When identified, such amounts are transferred to "other liabilities".

References

Acharya, V., S. Bharath, and A. Srinivasan. 2007. "Does Industry-Wide Distress Affect Defaulted Firms? Evidence from Creditor Recoveries". *Journal of Financial Economics*. 85: 787–821.

Acharya, V., S. Davydenko, and I. A. Strebulaev. 2012. "Cash Holdings and Credit Risk". *Review of Financial Studies*. 25: 2959–2999.

Almeida, H., M. Campello, and M. S. Weisbach. 2004. "The Cash Flow Sensitivity of Cash". *Journal of Finance*. 59: 1777–1804.

Anderson, R. W. and A. Carverhill. 2012. "Corporate Liquidity and Capital Structure". *Review of Financial Studies*. 25: 797–837.

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

Bargeron, L., D. Denis, and K. Lehn. 2014. "Taxes, Investments, and Capital Structure: A Survey of US. Firms in the Early 1900s". *Working Paper*. University of Pittsburgh.

Bhamra, H. S., L.-A. Kuehn, and I. A. Strebulaev. 2010. "The Aggregate Dynamics of Capital Structure and Macroeconomic Risk". *Review of Financial Studies*. 23: 4187–4241.

Davydenko, S., I. A. Strebulaev, and X. Zhao. 2012. "A Market-Based Study of the Cost of Default". *Review of Financial Studies*. 25: 3573–3609.

DeAngelo, H. and R. Roll. 2015. "How Stable are Corporate Capital Structures?" *Journal of Finance*. 70: 373–418.

Dinlersoz, E., H. Hyatt, S. Kalemli-Ozcan, and V. Penciakova. 2018. "Leverage Over the Life Cycle and Implications for Firm Growth and Shock Responsiveness". *NBER Working Paper 25226*. National Bureau of Economic Research.

Faccio, M. and J. Xu. 2015. "Taxes and Capital Structure". *Journal of Financial and Quantitative Analysis*. 50: 277–300.

Fama, E. F. and K. R. French. 2002. "Testing Tradeoff and Pecking Order Predictions about Dividends and Debt". *Review of Financial Studies*. 15: 1–37.

Gertler, M. and S. 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, K., F. A. Longstaff, S. M. Schaefer, and I. A. Strebulaev. 2011. "Corporate Bond Default Risk: A 150-Year Perspective". *Journal of Financial Economics*. 102: 233–250.

Giesecke, K., F. A. Longstaff, S. M. Schaefer, and I. A. Strebulaev. 2014. "Macroeconomic Effects of Corporate Default Crisis: A Long-Term Perspective". *Journal of Financial Economics*. 111: 297–310.

Givoly, D., C. Hayn, A. R. Ofer, and O. 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, R., N. Ju, and H. Leland. 2001. "An EBIT-Based Model of Dynamic Capital Structure". *Journal of Business*. 74: 483–512.

Gordon, R. H. and Y. Lee. 2001. "Do Taxes Affect Corporate Debt Policy? Evidence from U.S. Corporate Tax Return Data". *Journal of Public Economics*. 82: 195–224.

Graham, J. R. 1996a. "Debt and the Marginal Tax Rate". *Journal of Financial Economics*. 41: 41–73.

Graham, J. R. 1996b. "Proxies for the Corporate Marginal Tax Rate". *Journal of Financial Economics*. 42: 187–221.

Graham, J. R. 2000. "How Big are the Tax Benefits of Debt?" *Journal of Finance*. 55: 1901–1941.

Graham, J. R. 2008. "Taxes and corporate finance". In: *Handbook of Corporate Finance; Empirical Corporate Finance*. Edited by B. E. Eckbo. Amsterdam: Elsevier Science.

Graham, J. R., M. Leary, and M. Roberts. 2015. "A Century of Capital Structure: The Leveraging of Corporate America". *Journal of Financial Economics*. 118: 658–683.

Graham, J. R., M. Leary, and M. Roberts. 2016. "The Leveraging of Corporate America: A Long-Run Perspective on Changes in Capital Structure". *Journal of Applied Corporate Finance*. 28: 29–37.

Gryglewicz, S. 2011. "A Theory of Corporate Financial Decisions with Liquidity and Solvency Concerns". *Journal of Financial Economics*. 99: 365–384.

Hackbarth, D., J. Miao, and E. Morellec. 2006. "Capital Structure, Credit Risk and Macroeconomic Conditions". *Journal of Financial Economics*. 82: 519–550.

Heider, F. and A. Ljungqvist. 2015. "As Certain as Debt and Taxes: Estimating the Tax Sensitivity of Leverage from State Tax Changes". *Journal of Financial Economics*. 118: 684–712.

Joseph, R. 2004. *The Origins of the American Income Tax*. Syracuse, NY: Syracuse University Press.

Korajczyk, R. and A. Levy. 2003. "Capital Structure Choice: Macroeconomic Conditions and Financial Constraints". *Journal of Financial Economics*. 68: 75–109.

Kurshev, A. and I. A. Strebulaev. 2015. "Firm Size and Capital Structure". *Quarterly Journal of Finance*. 5: 1–46.

Li, S., T. M. Whited, and Y. Wu. 2016. "Collateral, Taxes and Leverage". *The Review of Financial Studies*. 29: 1453–1500.

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

Modigliani, F. and M. H. Miller. 1958. "The Cost of Capital, Corporation Finance and the Theory of Investment". *American Economic Review*. 48: 261–297.

Modigliani, F. and M. H. Miller. 1963. "Corporate Income Taxes and the Cost of Capital: A Correction". *American Economic Review*. 53: 433–443.

Newey, W. K. and K. D. West. 1987. "A Simple, Positive Semidefinite, Heteroskedasticity and Autocorrelation Consistent Correlation Matrix". *Econometrica*. 59: 703–708.

Opler, T., L. Pinkowitz, R. Stulz, and R. Williamson. 1999. "The Determinants and Implications of Corporate Cash Holdings". *Journal of Finance*. 52: 3–46.

Panier, F., F. Perez-Gonzalez, and P. Villanueva. 2015. “Capital Structure and Taxes: What Happens When You (Also) Subsidize Equity?” *Working Paper*. Stanford University.

Pinkowitz, L., J. Sturgess, and R. Williamson. 2013. “Do Cash Stockpiles Fuel Cash Acquisitions?” *Journal of Corporate Finance*. 23: 128–149.

Rajan, R. G. and L. Zingales. 1995. “What Do We Know about Capital Structure?, Some Evidence from International Data”. *Journal of Finance*. 50: 1421–1460.

Slemrod, J. 1992. “Do Taxes Matter? Lessons from the 1980’s”. *The American Economic Review*. 82: 250–256.

Strebulaev, I. A. 2007. “Do Tests of Capital Structure Mean What They Say?” *Journal of Finance*. 62: 1747–1787.

Van Binsbergen, J. H., J. R. Graham, and J. Yang. 2010. “The Cost of Debt”. *Journal of Finance*. 65: 2089–2136.