A Century of Capital Structure: The Leveraging of Corporate America*

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Current Draft: February 25, 2013

* We thank Andy Abel, Effi Benmelech, Murray Frank, Joao Gomes, Boyan Jovanovich, Stew Myers, Ken Singleton, Ilya Strebulaev; seminar participants at Duke University, Miami University, Notre Dame, University of Oklahoma, University of British Columbia, University of Colorado, University of Illinois, University of Pennsylvania, University of Utah, Vanderbilt University, Yale University; and conference participants at the 2013 American Economics Association, ASU Winter Finance Conference, Financial Management Association and SITE for helpful comments. We also thank Ahn Dong and Jeremy Yoo for excellent research assistance. Roberts gratefully acknowledges financial support from an Aronson, Johnson and Ortiz Fellowship and Geewax-Terker Fellowship. Graham: (919) 660-7857, john.graham@duke.edu, Leary: (314) 935-6394, leary@wustl.edu, Roberts: (215) 573-9780, mrrobert@wharton.upenn.edu.

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Abstract

We document a substantial shift in capital structures of US corporations over the past century. Unregulated industries increased their aggregate leverage ratio from 11% in 1945 to 35% in 1970. An increase occurred in *all* unregulated industries and affected firms of all sizes. The median firm in 1946 had no debt in its capital structure, but by 1970 had a leverage ratio in excess of 30%. By contrast, the aggregate leverage ratio of nonfinancial, regulated corporations was nearly constant. Our analysis points to several potential explanations for the observed patterns including: competition for investors' funds, variation in expected default costs, and changes to the tax code.

Corporate financial policy plays an important role in many real economic decisions including fixed business investment, inventory investment, research and development expenditures, product market strategy, and employment decisions. As such, corporate capital structure has received a great deal of attention from financial economists.[1] The bulk of this attention has focused on understanding cross-sectional variation in financial policy, in part because of readily available accounting data for large cross-sections of firms. Studies focusing on time-series variation have been confined to either relatively short panels or aggregate data, such as the Flow of Funds. Both approaches have limitations because short time series exclude important variation in capital structure determinants, such as changes to the tax, legal, and institutional environment, and lead to imprecise estimates of the dynamic properties of financial policy. Likewise, aggregate data can mask heterogeneity in the cross-sectional distribution that is critical for understanding the mechanisms behind financial policy.

The goal of this paper is to shed light on the determination of corporate financial policy using an approach that overcomes these data limitations. Specifically, we analyze a unique dataset containing accounting and market information for U.S. nonfinancial publicly traded firms over the last century. These data enable us to examine secular changes to capital structure over a long horizon at both an aggregate and micro level. The combination of these perspectives provides new insight into the formation of corporate capital structures.

We begin by showing that the temporal stability of aggregate leverage (i.e., debt-to-capital) suggested by previous studies (e.g., Miller (1977) and Frank and Goyal (2008)) is a result of two countervailing forces. First, the share of aggregate assets held by the highly levered regulated industries (e.g., transportation and utility sectors) declined from 40% during the 1930's and 1940's to less than 20% by 1990.

Second, the aggregate leverage of the rest of the nonfinancial corporate sector (unregulated firms) more than tripled during the period 1945 to 1970. This dramatic increase in leverage affected firms of all sizes and occurred in every industry. This change is also robust, observed in a variety of different leverage measures. More firms began using debt following World War (WW) II and those that were using debt financing used more of it. The median firm went from a debt to capital ratio of zero in 1940 to over 30% by 1970. The fraction of investment

[1] See Hubbard (1998) and Stein (2003) for literature reviews of the link between investment and financing. See Harris and Raviv (1991), Frank and Goyal (2008), Parsons and Titman (2010), and Graham and Leary (2012) for reviews of the capital structure literature.

financed with debt increased from approximately 10% in the pre-WW II era to over 20% after 1970. Thus, the stability of aggregate leverage since 1945 is due in large part to the changing sectoral composition of the economy, which masked a dramatic change in the usage of debt financing.

Concomitant with the secular increase in debt usage, we find that cash holdings exhibited a secular decrease. Specifically, cash and short-term investments accounted for nearly 25% of assets in 1945, but fell to 6% of assets by 1970. As a result, measuring leverage net of liquid assets highlights an even more pronounced levering of corporate America.

To understand these financing patterns, we outline an economic framework using Taggart (1985) as a guide. Aggregate capital structure is determined by households' demand for asset characteristics, the corporate sector's financial transformation technology, and competition over cash flow transformation services among households, corporations, and the financial sector. More specifically, variation in corporate taxes, bankruptcy costs, agency costs, and the costs of issuing and servicing securities impact the level and shape of the aggregate supply curve of corporate securities. Personal taxes, attitudes towards risk, and future expectations, impact the shape of the demand curve. Competition over transformation services among sectors generates a role for corporate debt substitutes (e.g., U.S. Treasuries) and financial market development in influencing aggregate capital structure.

This discussion motivates our empirical analysis aimed at understanding the variation in aggregate leverage. A complete investigation into each mechanism outlined above is clearly beyond the scope of one paper. Therefore, in this paper, we take the important first step of documenting the substantive variation in aggregate corporate leverage and providing novel evidence on the potential forces behind this variation. We also lay the groundwork for future research that attempts to disentangle these forces, highlighting the empirical challenges.

Perhaps the most robust relation that we find could be described as "financial crowding out" by the government (e.g., Friedman (1978)). We document a robust negative association between corporate leverage and government leverage, the latter defined as the ratio of Federal debt held by the public to GDP. A one standard deviation increase in government leverage is associated with a one-quarter standard deviation decrease in aggregate corporate leverage. This marginal effect on capital structure is significantly larger than that of other macroeconomic factors, such as GDP growth, inflation, and the BAA-AAA corporate bond yield spread, as well

as firm characteristics, such as profit margins, asset growth, and the market-to-book equity ratio. This negative relation holds not just for the stocks of debt but also for the flows of debt from the two sectors. In contrast, we do not find an analogous relation between the net flows of government debt and corporate equity. Thus, when the government issues more debt, corporations issue less debt but do not change equity policy. The result is a decline in corporate leverage.

There are several interpretations of these findings. Fluctuations in the supply of government debt may coincide with changes in aggregate demand. Increases in the supply of Treasuries typically occur during economic downturns when consumer demand is low and corporate investment opportunities are poor. Firms reduce investment spending in response and their need for external financial capital falls. Because debt is the primary source of external capital (Gorton and Winton (2003)), leverage falls. Alternatively, market imperfections, such as taxes (McDonald (1983)) and informational frictions (Greenwood, Hansen, and Stein (2012)), generate an upward sloping demand curve for corporate debt. In this case, government deficit financing crowds out corporate debt financing via competition for investor funds. Disentangling these explanations will require exogenous variation in the Treasury supply.

A second potential explanation for aggregate leverage trends relates to taxes. Our analysis of the tax mechanism reveals that firms most likely substituted debt for preferred equity in the early part of the century as corporate tax rates increased. However, we find little evidence that taxes affect the choice between debt and common equity. The corporate income tax rate underwent 30 revisions ranging from a low of 10% in 1920 to a high of 52% in the 1950s. Combined with variation in tax rates on dividends and capital gains, the tax incentive to issue debt varied significantly over the last 100 years. Despite the debt incentive created by increases in the corporate tax rate, we do not find a reliably significant relation between leverage and taxes either in the short-run or long-run.

Visual inspection suggests a more than decade-long delay in the leverage response to changes in the corporate tax rate. However, this delay is difficult to reconcile with adjustment costs given the small magnitude of such costs relative to the value of the debt tax shield. Similarly, it seems unlikely that uncertainty regarding the permanence of the tax changes is behind the weak debt-tax elation because of the many increases in the corporate tax rate over a nearly 40 year period. However, like the negative relation with government leverage discussed

above, the tax-leverage relation may be obfuscated by latent variation in aggregate demand. A careful investigation into the political economy of the tax changes and, preferably, a treatment-control group analysis is needed to draw firm conclusions. Further, the aggregate analysis may mask firm level heterogeneity in which taxes differentially affect firms in a manner that nets out in the aggregate. Thus, taxes may shape capital structure at the firm level, but not in the aggregate.

A third possible explanation of leverage trends relates to distress costs. Economic uncertainty and cash flow volatility declined through the middle part of the century, contemporaneous with the large run-up in leverage. Indeed, several proxies for expected distress costs are significantly negatively associated with aggregate corporate leverage. These findings are consistent with a role for expected distress costs in determining leverage. However, these relationships lose statistical significance once we control for government borrowing. Of course, absent exogenous variation in government financing, this lack of robustness may be a consequence of government financing proxying for aggregate expected distress costs. As noted, declining government leverage coincides with improving economic times and decreases in economic uncertainty.

Fourth, financial institutions and markets changed dramatically over our sample period (Philippon (2012)). The proportion of corporate debt held by institutions roughly doubled from 45% in 1940 to over 90% by 1955, as banks and insurance purchased corporate bonds to replace retiring government bonds used to fund the war. Yet, these shifts were largely unrelated to changes in corporate financial policy. We find little relation between nonfinancial corporate leverage and the share of debt (or debt net of equity) held by financial institutions. Likewise, growth in the income share of the financial sector bears little relation to the leverage changes experienced by nonfinancial corporations. Thus, the efficiency of financial intermediation, as captured by these metrics (Philippon (2012)), has little direct effect on the secular change in corporate financial policy.

Finally, we find little evidence of a relation between managerial incentives and leverage in the aggregate. As noted by Frydman and Saks (2010), both the level and performance sensitivity of executive compensation was largely constant from the end of World War II through the mid-1970s – precisely when leverage ratios underwent their largest change. Only after 1980

did executive pay experience a significant increase in amount and sensitivity to performance, precisely as corporate leverage stabilized and began a slight decline.

The remainder of the paper proceeds as follows. Section I discusses our data and sample selection. We also provide a number of summary statistics. Section II examines trends in corporate financial policy. We investigate the evolution of aggregate corporate leverage and net security issuances over the last century. We also examine leverage at the industry level in order to better understand the aggregate patterns. Section III examines the economic forces behind the variation in aggregate leverage. We focus on the role of government deficit financing, tax incentives, expected distress costs, and several additional hypotheses such as managerial incentives and the growth of financial markets and intermediaries. Section IV concludes.

1. Sample Selection and Summary Statistics

Our sample frame begins with all firms listed in the Center for Research in Security Prices (CRSP) monthly stock files. This frame includes all firms listed on the New York Stock Exchange (NYSE) since 1925, all firms listed on the American Stock Exchange (AMEX) since 1962, and all firms listed on the NASDAQ since 1972. For these firms, stock market data comes from CRSP. Accounting data is obtained from two sources: Standard and Poor's (S&P) Compustat database and data hand-collected from Moody's Industrial and Railroad manuals. We exclude financial firms from all of our analysis. The end result is an unbalanced firm-year panel beginning in 1920 and ending in 2010.

Because of different institutional environments, we distinguish between two sectors of the economy that we loosely refer to as regulated (utilities, railroads, and telecommunications) and unregulated (all other nonfinancial industries). We recognize that regulatory status is dynamic, heterogeneous, and extends beyond our classification (e.g., airlines). Thus, we emphasize that these are merely labels to identify a division in our data that is consistent with previous capital structure research. For the most part, we focus our attention on the unregulated sector but discuss and analyze the regulated sector where relevant.

Table 1 presents summary statistics for the unregulated sector of the economy. In addition to their descriptive value, these results provide a context for subsequent analysis.[2] Panel A presents our aggregate measures of firm characteristics and macroeconomic variables. Aggregate firm characteristics are computed as the ratio of sums over firms within each year. Panel B presents results for the firm-year panel. And, Panel C presents mean firm characteristics by decade.

2. Trends in Corporate Leverage

A. Aggregate Trends

Figure 1 examines the long run trends in aggregate leverage. In order to prevent our inferences from potentially being affected by changes in non-financial liabilities (Welch, 2011), we present the ratio of debt to financial capital in Panel A and the ratio of total liabilities to assets in Panel B, for unregulated sectors. Debt to capital is defined as the ratio of total interest bearing debt divided by the sum of total debt plus book equity. Apparent from Panel A are three periods of distinct corporate leverage behavior. From 1920 to 1945, leverage among unregulated firms is fairly stable and relatively low, with total debt to capital ranging from 10% to 15% during this quarter century. From 1946 to 1970 leverage increased steadily and significantly – more than tripling – from approximately 11% in 1945 to almost 35% in 1970. Since 1970 leverage has remained fairly stable, but for an increase during the 1980s associated with the growth of the junk bond market that gradually reversed over the next two decades. We observe similar patterns when we restrict our sample to firms listed on the NYSE or only include the 500 largest firms each year, both of which mitigate a changing sample composition.

The dashed line in Panel A shows the ratio of long-term debt (maturity greater than one year) to capital. Comparing the two lines reveals that while most of the increase in financial leverage was due to long-term debt, a significant portion came from increased use of short-term debt starting in the late 1960s.

[2] Appendix A discusses the details of our data sources and variable construction.

Panel B shows that total leverage was also influenced by a secular rise in non-debt liabilities since 1970.[3] Combined with the increase in financial leverage (Panel A), the result has been a dramatic shift in the composition of corporate balance sheets. Total liabilities represented between 20% and 25% of assets in the 1920s and 1930s, but increased to over 65% of assets by the early 1990s before declining slightly to 56% by 2010.

Panel C shows that the secular trends are robust to alternative measures of leverage. The solid line treats preferred stock as debt and thus includes it in the numerator and denominator of the debt to capital ratio (e.g., Fama and French (2005) and Huang and Ritter (2009)). The dashed line includes only debt in the numerator, and uses the market value of equity in defining total capital in the denominator. The figure reveals two important nuances to the patterns in Panel A. First, the ratio of debt plus preferred to capital is quite stable between 1940 and 1960, suggesting that much of the increase in leverage over this period was due to substitution between debt and preferred equity rather than substitution between debt and common equity. Indeed, preferred stock was over 13% of aggregate assets in the early 1920s, but only 2% of assets in 1960. Second, market leverage is also fairly stable until the 1960s due to rising equity values in the 1950s. We also note a sharp decline in leverage coinciding with the bull market of the 1990s. While there are several components affecting the timing of this secular shift, these alternative measures continue to show the same broad pattern: a substantial shift toward higher leverage.

Panel D shows that corporate cash holdings also underwent a significant change over the last century that mirrors the change in leverage. The solid line shows the aggregate ratio of cash and marketable securities to assets. It has been well documented that corporate cash holdings have increased over the past three decades (Bates et al., 2009). However, looking back across the century, we see that cash holdings peaked at nearly 25% of assets in 1945, and then steadily declined between then and 1970, roughly the same period over which leverage increased. As a result, the ratio of net debt (debt minus cash) to assets has changed even more dramatically, from -16% in 1945 to 21% in 1970.

Because of the similarity of results across samples and leverage definitions, we focus our discussion on book debt to capital. Doing so avoids redundancy in exposition. Nonetheless, the majority of our analysis is repeated using many of the alternative samples and leverage

[3] Common examples of nondebt liabilities include pensions, leases, and accounts payable. The temporary spike in non-debt liabilities in the early 1940s was due mainly to increases in Federal income tax reserves reflecting a sharp increase in war-related tax obligations.

definitions just discussed. We note when differences or similarities in results have a material effect on our inferences.

B. Cross-Sectional and Industry Trends

Figure 2 examines the evolution of the cross-sectional leverage distribution by plotting the annual quartiles of leverage year-by-year. Evident from Panel A is that the change in aggregate leverage observed in Figure 1 reflects a broad-based shift in financial policy. All three quartile breakpoints move in tandem. Interestingly, the median firm was unlevered in the late-1930s and the mid-1940s and at least a quarter of the sample firms were unlevered in each year from 1920 through 1950. Thus, the secular increase in leverage was associated with an increase in leverage across the entire distribution of firms and an increase in the propensity to use debt. Panel B shows that the decline in the median and first quartile of leverage since 1980 is driven by small firms, entering the sample via NASDAQ listings. When we restrict our attention to NYSE firms, all three quartile breakpoints remain fairly stable from 1970 through the end of the sample period.

Figure 3 shows that the aggregate leverage pattern is experienced in virtually every unregulated industry. We plot the aggregate industry leverage, where industry is defined by the Fama-French 12-industry classification.[4] Each subpanel in the figure plots the aggregate debt-to-capital ratio for the indicated industry (solid line) and the aggregate debt-to-capital ratio for all unregulated industries (dashed line) as a point of reference. Industry leverage is somewhat more volatile than aggregate leverage due in large part to smaller sample sizes, particularly in the first half of the century. What is most notable, though, is the striking similarity in the leverage time series across every industry. Each industry reveals a strong positive trend between 1945 and 1970. Further, this upward trend tends to taper off after 1970. Thus, the increase in leverage experienced in the middle half of the 20th century was an economy-wide phenomenon, at least among unregulated industries.

C. Net Flows of Debt and Equity

[4] This classification aggregates SIC codes into economic industries and can be found on Ken French's website at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/Siccodes12.zip.

Figure 4 isolates the effects of financial policy on leverage by presenting the aggregate time series for the net flows of debt and equity. Panel A of Figure 4 plots net debt and net equity issuances scaled by lagged assets for each year.[5] To ease the interpretation of the figure, we plot a 5-year moving average. While both series exhibit a great deal of volatility, the increase in the relative use of debt financing can be seen after 1945 and especially in the late 1960s. Equity issuances also increase, but never again reach the heights of the late 1920s. More importantly, the leverage-increasing effect of net debt issuances is greater than the leverage-decreasing effect of net equity issuances at low levels of leverages, and particularly so for the very low levels in the pre-World War II era.

Also evident in Panel A is the correlation between debt and equity issuance, which is unsurprising if demand for all types of external of capital is driven by investment activity. In Panel B, we control for investment demand by plotting the fraction of investment financed with debt. That is, for the subsample of firms with positive investment we divide aggregate net debt issuance by aggregate investment.[6] For comparison, we also plot the aggregate debt-to-capital ratio. The figure highlights the increased use of debt financing through the first half of the sample period. External debt accounted for only 5 to 10% of investment in the 1920s and 1930s, but steadily increased to over 30% by the late 1960s. This shift toward a greater reliance on debt as a funding source appears to be at least one of the factors driving the increase in leverage.

D. Reconciling with Other Leverage Aggregates

Previous studies that use alternative data sources document a more temporally stable leverage process over the last century. (e.g., Sametz (1964), Wright (2004), and Frank and Goyal (2008)). In this section, we reconcile our data and findings with these earlier works. As will become clear, the persistent stability of leverage found in previous studies is due to two countervailing forces at work in what we refer to as regulated and unregulated sectors of the economy. The analysis here highlights the importance of our micro-level data for understanding the mechanisms behind capital structure determination.

[5] Net debt issuance for each firm is defined as the change in total balance sheet debt. Net equity issuance is defined, as in Fama and French (2005), as the split-adjusted change in shares outstanding multiplied by the average of the beginning and end of year stock price.

[6] Since statement of cash flow data is not available from the Moodys manuals, we calculate investment as the change in (gross) long-term assets plus the change in inventory from the balance sheet.

Frank and Goyal (2008) examine aggregate leverage from U.S. Flow of Funds data. They report the average book leverage within each decade and conclude that "the overall picture that emerges…is the remarkable stability of leverage ratios over the last half century." Panel A of Figure 5 presents this series (solid line). Consistent with Frank and Goyal (2008), the average aggregate book leverage is roughly 0.3 for each of the past four decades and stays within a narrow band of 0.25 to 0.30 for each decade since 1945, the inception of Flow of Funds data. The dashed line shows the analogous series from our sample. As in Figure 1, our series reveals a near tripling of leverage, from just over 10% in the 1940s to almost 30% in the 1990s. This difference begs the question of why our data provides such a different picture of the aggregate leverage time series.

Our sample differs from Flow of Funds data in two important ways that may drive these differences. First, Flow of Funds represents an aggregate of all public and privately held corporations, while our data is limited to publicly traded firms (and NYSE firms prior to 1960). Second, Flow of Funds reports aggregate balance sheets for all nonfinancial corporate businesses, while our sample excludes regulated industries such as utilities and railroads. In order to examine the impacts of these two differences, we use an additional source of data, Statistics of Income (SOI) collected by the Internal Revenue Service and reported in Historical Statistics of the United States. SOI reports aggregate balance sheets for all U.S. firms filing corporate tax returns. Panel B of Figure 5 shows that leverage ratios calculated from SOI data are very similar to those calculated from Flow of Funds, both in level and time series pattern.[7] However, the SOI data have two advantages for our purposes. First, they are available from 1926 until 1997, more closely covering the time span of our sample. Second, SOI reports aggregate balance sheets separately by 1-digit SIC sector, which allows us to control for differences in industry coverage between our sample and the Flow of Funds data.

In the left hand plot of Panel C, we compare aggregate debt to capital for all unregulated sectors (i.e., excluding utilities, transportation and telecommunications) from SOI (dashed line) to that from our sample (solid line). The two series follow the same time series pattern, though the SOI series is consistently about 5 percentage points above the series from our sample. This could be due to smaller and private firms making heavier use of accounts payable, a conjecture

[7] In these figures, debt includes trade accounts payable, since SOI does not report short-term debt separately from accounts payable.

corroborated by the right hand plot showing the long-term debt to capital ratio. In this case, both the level and trend are very similar across the two sources. This suggests that the addition of private firms is not responsible for the differences in leverage stability implied by our data and Flow of Funds.

Rather, the difference between our leverage series and the Flow of Funds is due to the exclusion of regulated industries, railroads and utilities in particular. Panel D makes this clear by showing debt to capital series for utilities, transportation, and communications and for all other nonfinancial industries, both from SOI data. Unlike the unregulated sectors, leverage for the regulated sector displays a remarkably stable capital structure that varies between approximately 40% and 50% for 70 years (40 to 55% for total debt including accounts payable). Before 1945, the long-term debt to capital ratio in the regulated sector was approximately four times that of the unregulated sector. By the 1990s, however, leverage for the regulated and unregulated sectors converged to within 10 percentage points of each other. At the same time, the share of assets for the regulated sector declines from a peak of 43% in 1934 to 26% by 1950. The net effect is a relatively stable economy-wide aggregate capital structure that reflects these two countervailing forces.

E. Summary of Financial Policy Trends

Our analysis of corporate balance sheet data from 1920 through 2010 reveals the following stylized facts that shed new light on the nature of time-series variation in capital structures:

1. The composition of the aggregate balance sheet of the unregulated industrial sector underwent a transformation over the past century, from less than 25% liabilities in the 1930s to more than 60% by 1990.
2. This shift was largely driven by a systemic change in financial leverage that affected all unregulated industries and firms of all sizes. The median firm was unlevered in 1945 but had a debt to capital ratio exceeding 30% by 1970.
3. Cash balances fell from nearly 25% of assets at the end of WW II to 6% of assets in 1970, leading to an even greater change in net leverage.

4. Preferred stock accounted for 10 - 15% of assets in the 1920s, but all but disappeared from corporate balance sheets by the 1960s.
5. By contrast, regulated sectors have shown remarkably stable and relatively highly levered capital structures with debt-to-capital ratios that typically vary between 45% and 55%.

Why did regulated industries' leverage ratios remain both high and stable for so long? Similarly, why did leverage ratios in unregulated industries increase so dramatically? A study of both questions is beyond the scope of any one paper. We focus attention on the latter because of the applicability of existing theory and for consistency with the existing capital structure literature. The former question requires an investigation into the regulatory structures governing industries, such as railroads and utilities. We postpone this analysis to future research.

3. Theoretical Framework

What determines aggregate leverage? This section discusses a theoretical framework for answering this question, closely following Taggart (1985).[8] See his paper for further details. Taggart begins with a three-sector economy consisting of households, nonfinancial corporations and financial institutions. Financial assets are in net zero supply so that the economy-wide balance sheet consists of tangible assets and household net worth. The role of the financial system is to reconcile the return stream generated by tangible assets with the planned consumption path of the household sector. That is, the securities issued by corporations and the services provided by financial intermediaries are designed to transform the timing and certainty of the cash flow streams generated by the economy's physical assets to meet household demands. Thus, aggregate capital structure is determined by households' demand for asset characteristics, the corporate sector's financial transformation technology, and competition over transformation services among the sectors.

Figure 6 presents several figures from Taggart (1985). Panels A through C illustrate the intuition behind the equilibrium of different theories of capital structure. Panel D describes a more general setting that embeds multiple theories. On the horizontal axis of each figure is the

[8] Taggart (1985) extends the aggregate model of Miller (1977). For other theories of aggregate corporate capital structure, see McDonald (1983) and Benninga and Talmor (1988).

aggregate quantity of corporate debt (B), on the vertical axis the risk-adjusted return on debt (r^*_D) and equity (r^*_E). The marginal corporate tax rate is denoted by t_C. Using returns on the y-axis instead of prices implies that the slopes of the supply and demand curves will be reversed. Throughout we assume that investment is held fixed so that movements along the horizontal axis correspond to substitutions between debt and equity.

In equilibrium, aggregate leverage will depend on the interaction of corporations' willingness to supply debt, and investor demands to hold debt at different yields. The elasticities of these supply and demand curves reflect the willingness of firms and investors, respectively, to freely substitute between debt and equity securities. Panel A presents the aggregate supply and demand curves under the perfect markets assumptions of Modigliani and Miller (1958). These assumptions imply that both supply and demand curves are infinitely elastic. Supply is infinitely elastic because corporations can costlessly transform their financing mix to any level of leverage as long as both debt and equity have the same risk-adjusted return. Demand is perfectly elastic because households can costlessly perform the same transformation on their own account.[9] Thus, investors are unwilling to accept any yield differential between debt and equity and corporate capital structure is indeterminate.

The presence of market frictions can alter both the level and slope of the supply curve. For example, Panel B presents the tax-bankruptcy cost tradeoff theory of capital structure. The tax shield provided by debt shifts the supply curve up because firms are initially willing to issue debt at a higher risk-adjusted yield than equity. As firms issue more debt the expected costs of financial distress increase and drive down the risk-adjusted yield firms are willing to pay on their debt. The result is a downward sloping supply curve. Equilibrium is achieved at the point in which the increase in bankruptcy costs from an additional dollar of debt equal the increase in tax shields. Changes in corporate taxes shift in the supply curve. Changes in expected distress costs change the slope of the supply curve. Thus, equilibrium aggregate leverage is increasing in corporate tax rates and decreasing with expected distress costs. Further, because the tax shield is based on nominal interest payments, an increase in inflation is also expected to lead to higher aggregate leverage.

[9] Demand would still be perfectly elastic if households could not costlessly perform transformation services but instead financial intermediaries could.

The agency theory of Jensen and Meckling (1976) generates a picture similar to that of the tradeoff theory. The supply curve intercept is greater than r_E but determined by the agency cost experienced by the marginal shareholder, as opposed to corporate tax rate. Starting from all equity, a firm can reduce its agency costs by substituting a dollar of debt for a dollar of equity. The supply curve is downward sloping because each additional dollar of debt has a smaller impact on reducing agency costs on the margin and increases in leverage engender agency costs of debt. While visually similar to the tax-bankruptcy cost tradeoff theory, variation in agency costs associated with equity and debt drive changes in the equilibrium capital structure in this setting.

As demonstrated by Miller (1977), the demand curve need not be perfectly elastic. Panel C presents the Miller (1977) model in which both corporate and personal taxes are present, and tax arbitrage restrictions make it costly for investors to mitigate the differing tax consequences of different securities. Because corporate taxes are the only market friction facing firms, their willingness to substitute debt for equity is independent of the level of debt, so the supply curve is perfectly elastic. However, because of corporate taxes, they are willing to offer debt at a higher risk-adjusted return, $r^*_E/(1-t_C)$. The demand curve is upward sloping in this model because of personal taxes. Investors are arrayed along the demand curve according to their personal tax rate. Low personal tax investors are closest to the y-axis followed by investors with successively higher personal tax rates. Because at the personal level returns are on corporate debt are taxed at a higher rate than returns on corporate equity ,investors in successively higher tax brackets must be enticed to buy debt with higher returns. Thus, firms issue debt until the corporate bond rate increases from r_E to $r_E/(1-t_C)$.

As discussed by Taggart (1985), taxes are not the only friction capable of producing an upward sloping demand curve. More generally, any transaction cost that impedes investors from transforming return streams from corporate securities can lead to an upward sloping demand curve in the presence of investor heterogeneity. This heterogeneity across investors may come, for example, from differences in transaction costs, risk aversion, or cash flow expectations.

An imperfectly elastic demand curve has several implications for the determinants of aggregate leverage. First, investor characteristics, such as risk preferences and tax rates, may play a role in determining aggregate leverage. As the segment of the population exhibiting high degrees of risk aversion, pessimistic cash flow expectations, or low personal tax rates grows, the

aggregate amount of corporate debt will increase. Second, when different securities are imperfect substitutes, changes in the supply of competing securities (e.g., government bonds) may affect relative yields and the equilibrium mix of corporate debt and equity. Third, development of the financial intermediation sector should decrease the cost of transforming return streams from one security to another. As a result, we expect the demand curve to become more elastic (and demand factors to matter less) as financial markets develop.

To summarize, Panel D presents the general case, in which both supply and demand curves are imperfectly elastic. We expect aggregate leverage to be a function of the determinants of the shape and level of both the supply and demand curves for corporate debt. The level of the supply curve should vary with corporate taxes and expected inflation rates. The shape of the supply curve reflects firms' costs of substituting debt for equity, such as expected costs of financial distress and the relative agency costs of debt and equity. The shape of the demand curve reflects the cost investors face in transforming the return streams from one security to another, either on their own account or through financial intermediaries. If these costs are significant, then aggregate leverage will depend on investor tax rates, risk preferences and expectations, as well as supplies of competing securities. As financial markets develop to reduce transformation costs, these factors should become less important. We use these predictions to guide our empirical analysis below.

4. The Economic Forces Behind Aggregate Leverage

A. The Role of Competing Securities

As Taggart (1985) notes, the demand curve for corporate securities must be *im*perfectly elastic in order for competing securities to have a role in determining aggregate leverage. Thus, any relation between corporate debt and substitute securities is driven by a costly transformation process for investors and financial intermediaries.

In Miller (1977) and McDonald (1983), this cost is personal taxes. McDonald shows that an increase in the supply of taxable bonds – e.g., Treasuries – will reduce the equilibrium quantity of corporate debt because they act as a debt substitute. More recently, Greenwood, Hansen, and Stein (2012) build a preferred habitat model (Modigliani and Sutch (1967)) of debt

markets that are segmented along the dimension of maturity. A limited supply of capital prevents arbitrageurs from completely eliminating predictability in bond returns and, thus, generates an upward sloping demand curve. While framed in the context of debt maturity, one can also think of their model in the context of the debt-equity decision in which government debt displaces debt more broadly.

Krishnamurthy and Vissing-Jorgensen (2012a) present a model in which a representative agent derives utility from holding Treasuries because of a convenience yield comprised of the safety and liquidity features of Treasuries. In their model, an upward sloping demand curve results from two key assumptions. First Treasuries are assumed to have unique convenience properties that cannot be perfectly replicated by other assets. Second, the marginal benefit of holding convenience assets declines as holdings increase. Like earlier works, their model predicts that fluctuations in the supply of Treasuries will impact the yield spread of substitute securities, such as corporate bonds, over Treasuries because of variation in the convenience yield. Indeed, they find a negative relation between the corporate-Treasury yield spread and government debt-to-GDP ratio.

A.1. Leverage and Net Security Issuances

Figure 7 plots corporate and government leverage over our sample period, where the latter is defined as the ratio of Federal debt held by the public to gross domestic product (GDP). We focus on Federal debt because it comprises the majority of total government debt and is responsible for most of its variation over time (see Figure A.1 in Appendix A). Focusing on the amount held by the public avoids the double counting of debt that arises from Treasury holdings by government entities, such as the social security administration.

During the last century, government debt experienced several notable transitions beginning with a dramatic expansion after the Great Depression to fund World War II. From its peak of 109% of GDP in 1946, government debt as a share of income fell steadily until 1972 when it leveled off at approximately 25% of GDP. The 1980s saw a renewed increase in public sector leverage that persisted until the mid-1990s. In 2008, public debt-to-GDP began another significant increase in response to the most recent recession and financial crisis.

A negative relation between the two series is apparent. As government leverage increased sharply from 1920 to 1945, corporate leverage experienced a moderate but nonetheless significant decline from 17% to 11% over this same period. From 1945 to 1970, as government debt fell, corporate leverage increased more than threefold to 35%. After little change during the 1970s, corporate leverage increased sharply in the mid to late-1980s in conjunction with the leveraged buyout boom (Kaplan and Stromberg (2009)) before trending downward over the next two decades.

Table 2 presents ordinary least squares (OLS) regression results for several models of corporate leverage. More precisely, we estimate the following regressions

$$(1)\ CL_t = \alpha + \beta GL_t + \Gamma X_t + \phi t + \varepsilon_t,$$

and

$$(2)\ \Delta CL_t = \alpha + \beta \Delta GL_t + \Gamma \Delta X_t + \eta_t.$$

Corporate leverage is denoted *CL*, government leverage *GL*, and control variables *X*. Our control variables are motivated by the discussion earlier. We include the growth rate in the CPI as a proxy for expected inflation. The real 3-month Treasury yield and the credit spread between BAA and AAA bonds are included to capture general level of interest rates in the economy and aggregate credit conditions. GDP growth captures real economic conditions and the equity market return represents the cost of a debt-alternative financing source.

We include a time trend, *t*, in the level specification to absorb any finite sample time trends. We use Δ to denote the first difference operator ($\Delta CL = CL_t - CL_{t-1}$). We focus on corporate leverage, measured as the ratio of total debt to capital. In robustness tests, we consider alternative measures of corporate leverage. Serial correlation in the error term of both equations is addressed with Newey-West standard errors assuming a two-period lag structure.

The estimates in Panel A reveal the following inferences. First, government leverage and corporate leverage are strongly negatively related. This relation is robust to the inclusion of both macroeconomic and firm characteristic control variables. This relation is also found in both levels and first differences. Looking at column (3) of Table 2, we see that a one percentage point increase in government leverage is associated with an 8.5 basis point decrease in corporate leverage. Combined with the summary information found in Panel A of Table 1, these estimates imply that a one standard deviation increase in government leverage (17.7%) leads to a 1.5%

decline in corporate leverage. Relative to the annual standard deviation of aggregate corporate leverage (6.9%), this marginal effect is economically large.

The estimates also indicate that macroeconomic conditions play an important role in shaping corporate leverage. Corporate leverage is counter-cyclical: high and increasing when output growth is low and slowing. Inflation is positively associated with the level of corporate leverage, consistent with the findings of Frank and Goyal (2009). Higher inflation reduces the real cost of debt. Changes in the credit spread (BAA – AAA yield spread) are strongly negatively related to corporate leverage, while the rate of change in the credit spread has the opposite effect. In other words, corporate leverage is lower when the spread is large and tends to increase when the spread widens. A wide spread implies that credit for (most) corporations is relatively expensive. Spreads increase precisely when firms take advantage of relatively inexpensive debt financing.

Finally, firm characteristics play an important role in determining leverage, some more so than others. Profit margins have a significant negative association with the level of leverage, consistent with firm-level evidence (Rajan and Zingales (1995)). Asset intangibility and the market-to-book ratio also reveal negative associations with leverage, consistent with micro-level evidence and theories predicated on the importance of collateral (e.g., Stulz (1985) and debt overhang (Myers (1977)), respectively. However, these two associations disappear in the difference specifications.

Panel B of Table 2 presents results for net issuance decisions. In particular, we estimate the following regressions of net debt and net equity issuances:

$$(3)\ \Delta CD_t = \alpha + \beta \Delta GD_t + \Gamma X_t + \eta_t,$$

$$(4)\ \Delta CE_t = \alpha + \beta \Delta GD_t + \Gamma X_t + \eta_t,$$

where ΔCD_t is the change in corporate debt from *t-1* to *t* divided by total assets at *t-1*, ΔCE_t is dollar value of corporate net equity issuances from *t-1* to *t* divided by total assets at *t-1*, and ΔGD_t is the change in Federal debt from *t-1* to *t* divided by GDP at *t-1*. Untabulated results normalizing net corporate security issuances by lagged GDP, instead of total assets, produces qualitatively similar results. The control variables in both equations (3) and (4) are denoted by X_t. These controls consist of both macroeconomic factors and firm characteristics found in Table 2. We include both levels and first differences of the control variables. Serial correlation in the

error term of equations (3) and (4) is addressed by Newey-West (1987) standard errors assuming a two-period lag structure.

Columns (1) through (3) of Panel B show a significant negative relation between corporate and government net debt issuing activity. A one percent increase in the relative flow of government debt is associated with a six to seven basis point reduction in the flow of corporate debt relative to assets. Columns (4) through (6) show that net equity issues also show a negative relation with government debt issues. However, this relation becomes statistically insignificant once we control for firm characteristics. Economically speaking, the magnitude of the equity coefficient is less than half that in the net debt issuance specification. Closer inspection reveals that the market-to-book equity ratio is largely responsible for the attenuation of the government issuance coefficient in the net equity issuance model. Finally, columns (7) through (9) show that the fraction of investment funded by debt is also significantly negatively associated with net debt issuances by the government.

These findings reinforce the leverage results above. Government financing has a strong negative effect on the net flow of corporate debt but not on corporate equity. Together these results suggest that government debt crowds out corporate debt, and to a lesser extent equity, which leads to a significant impact on corporate capital structure.

A.2. Challenges for Future Research

The interpretation of financial crowding out presumes that fluctuations in the supply of Treasury securities are exogenous with respect to corporate financial policy. They are not. An alternative interpretation of these findings is that aggregate demand is changing contemporaneously with government deficit financing in a way not captured by any of the controls. Under this alternative, variation in the debt-to-income ratio or deficit financing is proxying for the level or change in latent investment opportunities. Indeed, expansion of government debt tends to occur during economic contractions and vice versa.

Further, it is difficult to determine which of the economic mechanisms is behind the relation between government and corporate finance. The previous discussion mentions several different mechanisms including taxes (McDonald (1983)), segmented capital markets (Greenwood, Hansen, and Stein (2010)), and unique characteristics of Treasuries

(Krishnamurthy and Vissing-Jorgensen (2012a)). Thus, future research faces two identification challenges. Graham, Leary, and Roberts (2012a) takes a first step in this direction.

B. Tax Incentives

As discussed in Section III, variation in corporate taxes result in parallel shifts of the aggregate debt supply curve, all else equal. Specifically, increases in corporate tax rates will shift up the supply curve, resulting in a higher equilibrium debt level. Likewise for decreases in corporate tax rates. Variation in personal taxes, on the other hand, influence the elasticity of the aggregate demand curve. Increases in personal tax rates increase the elasticity of aggregate demand for debt, resulting in a decline in the equilibrium quantity of debt. Thus, as Miller (1977) notes, the tax incentive of debt is a function of both corporate and personal taxes, which offset one another's impact on the equilibrium debt level.

The prevailing rates during the last century have typically been such that the after tax cost of debt is less than equity on a certainty-equivalent basis (Graham (2003)). A challenge in identifying the effect of taxes on capital structure is finding observable, exogenous variation in corporate marginal tax rates. This challenge has forced studies to either estimate tax rates via simulation (e.g., Graham (1996)), or focus on relative differences in debt usage created by tax law changes (e.g. Givoly et al. (1992), Heider and Ljungqvist (2012), and Perez-Gonzalez, Panier, and Villanueva (2012)). In this section, we exploit a number of large changes to both corporate and personal taxes during our sample period to better understand the relation between debt and taxes.

B.1. Leverage and Net Security Issuances

Panel A of Figure 8 displays the time series of (top) corporate tax rates along with our aggregate book leverage series, as well as a measure of the debt tax incentive net of personal taxes.[10] The statutory corporate tax rate underwent 30 changes during the last century. Rates

[10] Following Taggart (1985), we define the net debt tax incentive as $1 - (1-t_c)/(1-t_p)$, where t_c is the corporate tax rate and t_p the lowest personal tax rate. This formula derives from Miller (1977), with the simplifying assumption that the effective tax rate on income to equity holders is zero. We use the lowest personal tax rate because the

were relatively low at the start of our sample period, staying below 15% from 1920 until the late 1930s. By the mid-1950s, however, the corporate tax rate exceeded 50%. Tax rates remained near 50% until the mid-1980s, and have been steady near 35% since.

Casual inspection of the figure suggests a positive relation between corporate taxes (or the net tax incentive) and leverage, particularly in the mid-20th century. Indeed, several past authors have interpreted this visual association as a casual one (Hickman (1953) and Sametz (1964)). Further suggestive evidence of this relation can be found in Panel B of Figure 8. This panel plots the corporate tax rate series with the ratio of debt to total fixed-charge finance, defined as debt plus preferred stock. As noted earlier, preferred stock's popularity declined significantly from the start of the 20th century, quite possibly as a consequence of the changing tax environment, as argued by Sametz (1964). Indeed, the debt-to-fixed charge finance ratio shows an even more dramatic rise than debt-to-assets, rising from 50 to 55% in the pre-war period to more than 90% by 1970. Further, the unconditional correlation between the tax rate and the debt-to-fixed charge finance series, 0.68, is even stronger than that between leverage and the tax rate, 0.36.

In Table 3 we examine this relation more carefully by adding measures of the corporate tax rate to our aggregate leverage regressions from Table 2. As before, we estimate the regressions both in levels, controlling for a time trend, and in first differences. To ease the presentation, we report only the coefficient estimates on the tax variables and government leverage. We report the latter to emphasize the robustness of our previous findings to these alternative specifications. The macroeconomic control variables include the real rate of return on three-month Treasury bills, the BAA-AAA yield spread, the rate of inflation, the return on the aggregate stock market, and real GDP growth. The firm characteristic control variables include the return on assets, the ratio of tangible assets to total assets, and the market-to-book ratio. We use both debt to capital (Panel A) and debt to total fixed-charge finance (Panel B) as dependent variables.

Column (1) of Panel A indicates, as expected, a significant positive relationship between tax rates and aggregate leverage when we do not control for a time trend. However, the coefficient actually flips sign once we include controls (column 2) or convert all variables to first

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highest reached levels during the middle of the century that few investors actually paid. (The top personal rate exceeded 90% for 16 out of the 20 years from 1944 through 1963).

differences (column 5). Thus, we cannot reject the hypothesis that the series are correlated because they share a common trend as opposed to a causal relationship.

In columns 3 and 6, we account for the possibility of a delayed reaction to the tax law change using a distributed lag model. That is, if recapitalization is costly, firms' leverage may not respond immediately to an increase in tax rates, but may still affect their choice of security the next time they raise external capital. In both the level and first-difference regression, we find insignificant coefficients. Columns 4 and 7 present results from a distributed lag model using a measure of net tax incentives to issue debt. The results are even less supportive than those obtained with the corporate tax rate, as they should be given the countervailing effect of personal taxes.

In Panel B, we show stronger evidence of a relationship between corporate tax rates and the choice between debt and preferred stock financing. The coefficient on the tax rate remains significant after controlling for a time trend, macroeconomic variables (including government borrowing), and firm characteristics. While the results in first differences are somewhat weaker than for levels, the long run effect is highly significant even in first differences. Economically, a one percentage point increase in tax rate is associated with an increase of 30 basis points in the ratio of debt to fixed charge finance. The total increase in tax rates between the late 1930s and early 1950s was about 37%. This would translate into an increase of about 11% in the D/(D+P) ratio, almost a third of the total increase in the ratio over that time span.

In Table 4, we investigate the extent to which corporate tax rates influence aggregate debt and equity issuance decisions. We estimate models similar to those in Panel B of Table 2, with the addition of a measure of the corporate tax rate. The results are not substantially supportive of a role for taxes in influencing issuance decisions in aggregate. Without controlling for aggregate firm characteristics or macroeconomic factors (other than government borrowing), we do find a significant positive association between tax rates and debt issuance (column 1) and between tax rates and the use of debt to fund investment (debt issuance scaled by investment for those firms with positive investment, column 7). However, when the macroeconomic and firm controls are added, both relationships become insignificant. In columns 3 and 9, we allow for a delayed response of financing activity to tax rate changes with a distributed lag model, but again find no significant effect. We do find some evidence that firms issue less external equity when tax rates

are high (columns 5-6). On the whole, though, tax rates do not appear to be a significant driver of aggregate debt issuance activity.

B.2. Challenges for Future Research

There are several challenges to uncovering the tax-leverage relation. Like the previous analysis, a careful understanding of the political economy surrounding tax changes is crucial for isolating variation in taxes. Rarely are taxes altered in a manner that is random with respect to economic fundamentals and, consequently, corporate financial policy. Even if the motivation for tax changes is plausibly exogenous, there are often other accompanying policy changes that can confound any inference. One example is investment incentives, such as investment tax credits or modifications to depreciation allowances. Another concern surrounds the permanence of the tax change. Firms may respond quite differently with their financial policy to a permanent versus a temporary tax change. Graham, Leary, and Roberts (2012b) examine these issues more closely.

C. Expected Default Costs

In traditional capital structure theories, the tax benefits of debt are offset by the expected costs of financial distress (e.g. Scott (1976)). In this section, we examine the extent to which the increase in aggregate leverage in the middle of the century was associated with changes in expected distress costs. In particular, we relate leverage to measures of aggregate uncertainty, which proxy for the probability of default for a given level of debt.

Figure 9 presents aggregate leverage (dashed line) along with three measures of uncertainty. The first (upper left plot) is the cross-sectional average of the within-firm standard deviation of return on assets, using (up to) the previous ten years of data.[11] This captures the average volatility of firm-level cash flows. The figure shows visual evidence that the increase in leverage coincided with a marked reduction in earnings volatility. While the decline in volatility appeared to start after the initial increase in leverage, the pattern is quite similar, with a higher and relatively stable level prior to 1950 and a lower and moderately increasing level post 1970.

[11] Return on assets is calculated as earnings before interest and taxes divided by total book assets. If fewer than 10 past years of data are available, we use all available previous years, but we require at least 4 years of data to calculate the standard deviation.

Similar patterns are also seen in the next two measures, both of which are constructed following Bansal, Coleman and Lundblad (2011), who propose two proxies for aggregate uncertainty. The first is conditional GDP growth volatility, based on a GARCH model of the annual real GDP growth rate. The second is an estimate of the market risk premium, defined as the fitted values from the following return predictability regression:

$$Ret_{mkt,t+1} = \alpha_0 + \alpha_1 MktDividendYield_t + \alpha_2 TermSpread_t + \alpha_3 TbillRate_t + \epsilon_{t+1}.$$

Bansal et al (2011) include this measure to capture risk compensation associated with economic uncertainty. While both of these measures are more volatile than the average earnings volatility, they both exhibit a similar decline between approximately 1950 and 1970 before stabilizing at a lower level after 1970.

In Table 5 we estimate similar aggregate leverage regressions as in Tables 2 and 3, including these three measures of uncertainty as explanatory variables. In Panel A, we see that the level of leverage is negatively correlated with all three measures of uncertainty when controlling for a time trend. The GDP growth volatility measure remains significantly negatively related to leverage after controlling for our set of macroeconomic and firm characteristic controls (columns 2). However, this is in part due to these measures' correlations with the government debt to GDP ratio. Once we control for government leverage (columns 3 and 9), both relationships lose significance. Further, Panel B shows that none of these relationships are significant in first differences. Ultimately, while the decline in volatility over the middle part of the century suggests an increase in optimal leverage ratios, our proxies for uncertainty have limited independent explanatory power.

C.2. Challenges for Future Research

While our initial evidence suggests a limited role for changes in uncertainty in determining aggregate financial structure, there are a few caveats. First, the relevant input to financial policy decisions is expected future volatility, which may not be accurately measured by our historical-based measures. Second, bankruptcy probabilities are only one element of expected costs of financial distress. Changes over time in the expected realized cost of distress

may have had important influences on leverage decisions. We leave for future research a detailed investigation of the extent to which changes in the bankruptcy code, contractual enforcement, and renegotiation costs are related to aggregate capital structure.

D. Financial Institution and Market Development

As Taggart (1985) notes, it is difficult to formulate precise hypotheses about the relationship between capital market development and aggregate capital structure. While a more developed financial market facilitates the issuance of new securities, it is not clear whether this should differentially favor debt or equity financing. To the extent that stock and bond markets develop at different rates, however, this may affect the relative costs of issuing different securities. An additional implication is that as financial intermediation becomes more efficient, a firm's ability to lower its cost of capital by tailoring its security mix to investor demands is expected to decrease. Thus, factors such as the supply of competing securities may become less important over time.

In this section, we take an initial look at the impact of growth in intermediation in the equity and bond markets, as well as the size of the financial sector as a whole, on aggregate financing decisions. Graham, Leary, and Roberts (2012a) explore in more depth the impact of financial intermediation growth on the relationship between government and corporate leverage documented in section IV.A.

D.1. Financial Institution and Market Development

Financial intermediaries play an important role in facilitating access to capital by mitigating information asymmetry and agency costs ((Diamond 1984, Leland and Pyle 1977). As a result, differences in the levels of development of financial markets across countries have been linked to differences in how firms finance their activities (Demirguc-Kunt and Maksimovic, 1996). Meanwhile, the size and complexity of the financial services sector in the U.S. have grown dramatically over the past century (Philippon (2012)). In this section, we explore the extent to which development of U.S. capital markets, and growth in financial intermediation in particular, is associated with changes in our sample firms' corporate capital structures over time.

Panel A of Figure 10 plots the share of corporate bonds and equity held through intermediaries over time. The series combine data from Goldsmith (1958) from 1920 through 1944 with US flow-of-funds data from 1945 through 2010. The share of equities held through intermediaries (largely investment companies and pension funds) has steadily increased over the latter half of the century, from 5% in 1945 to almost 60% by 2010. By contrast, the share of bonds held by intermediaries changed dramatically over a short period, between the late 1930s and early 1950s. In 1939, only 44% of bonds were held through intermediaries.[12] However, this fraction ballooned to over 85% by 1950 and over 90% by 1955. Thus, the share of bonds held by intermediaries increased sharply relative to that of equity in the 1940s. To the extent that intermediaries perform valuable information gathering and monitoring roles, this may have altered the relative costs of raising debt and equity capital for firms.

Panels B and C of Figure 10 plot our aggregate leverage series along with two measures of the size of the financial sector from Philippon (2012): the income share of the finance sector and his estimate of the level of output of the financial sector from business credit and equity issuance.[13] Both measures of the size of the financial sector appear to follow a similar time-series pattern as that of aggregate leverage, declining through the depression years and steadily rising post-WW II. However, the financial sector (particularly the income share) continues to grow in the last two decades even as aggregate leverage has leveled off. This is potentially consistent with the findings of Demirguc-Kunt and Maksimovic (1996) who conclude that "initial improvements in the functioning of a developing stock market produce a higher debt-equity ratio for firms and thus more business for banks. In stock markets that are already developed, further development leads to a substitution of equity for debt financing." We investigate this relationship more formally below.

Table 6 repeats the aggregate leverage regressions of Tables 2 and 5 with the addition of our measures of the intermediary shares of bonds and equity (Panel A) and Philippon's financial sector size measures (Panel B). Consistent with Figure 10, the intermediary share of debt (column 1 of Panel A) and both measures of financial sector size (columns 1 and 4 of Panel B) are positively correlated with aggregate leverage. However, the intermediary share relationships

[12] Goldsmith (1958) includes the following classes of intermediaries: Commercial Banks, Mutual Savings Banks, Insurance companies, Pension & Retirement Funds and Investment Companies.

[13] We thank Thomas Phillipon for sharing this data, which can be found on his website at website: http://pages.stern.nyu.edu/~tphilipp/research.htm

are not robust to controlling for a time trend or taking first differences. Thus, it is difficult to say more beyond noting that these series share common trends. On the other hand, aggregate leverage continues to be positively correlated with Philippon's measure of the output of the finance sector (based on business credit and equity issuance activity), after controlling for the time trend as well as macro and firm level variables.

Table 7 investigates the link between security issuance activity and financial market development proxies. From Panel A, we see some evidence that firms issue more debt (column 1) and finance a greater proportion of their investments with debt (column 5) as the share of bonds held by intermediaries grows. However, in both cases, the coefficient becomes insignificant when we control for our full set of firm level and macroeconomic controls. In Panels B and C, the results suggest that firms issue more equity relative to assets, but not more debt, as the financial sector grows, consistent with the findings of Demirguc-Kunt and Maksimovic (1996). While our initial evidence is suggestive of an association between corporate financing choices and growth of the financial sector, and of financial intermediation, further research is needed to understand this relationship more fully.

5. Conclusions

We document a substantial shift in corporate financial policy in US firms over the past century. While leverage of the regulated sector has remained quite stable over time, leverage of unregulated firms has increased significantly. Because this increase occurred prior to 1970, many empirical studies relying on more recent data miss important time-series variation in capital structures. We find that competition for investor capital, primarily from the government, is an important determinant of variation in aggregate leverage. Taxes, volatility and development of financial markets all appear to have moved in a direction to encourage increased reliance on debt financing. However, statistically these factors seem to play more limited roles. We hope that future research to more fully understand the causes of this secular rise in corporate leverage can deepen our understanding of the key market frictions that drive corporate financial policies.

References

Bates, Thomas, Kathleen Kahle, and Rene Stulz, 2009, Why do US firms hold so much more cash than they used to? *Journal of Finance* 64, 1985-2021.

Bansal, Ravi, John Coleman and Christian Lundblad, 2011, Endogenous liquidity supply, Working Paper, Duke University.

Benninga, Simon and Eli Talmor, The interaction of corporate and government financing in general equilibrium, *Journal of Business* 61, 233-258.

Demirguc-Kunt, A., and V. Maksimovic, 1996, Stock Market Development, and Firm Financing Choices, *World Bank Economic Review*, 341-371.

Diamond, Douglas, 1984, Financial intermediation and delegated monitoring, *Review of Economic Studies* 51, 393-414.

Fama, Eugene and Ken French, 2005, Financing decisions: Who issues stock? *Journal of Financial Economics* 76, 549-582.

Frank, Murray and Vidhan Goyal, 2008, Trade-off and pecking order theories of capital structure, in *Handbook of Corporate Finance: Empirical Corporate Finance*, ed. Espen Eckbo, *Elsevier*.

Frank, Murray and Vidhan Goyal, 2009, Capital structure decisions: Which factors are reliably important? *Financial Management* 38, 1-37.

Frydman, Carola and Raven Saks, 2010, Executive compensation: A new view from a long-term perspective, 1936-2005, *Review of Financial Studies* 23, 2099-2138.

Givoly, Dan, C Hayn, AR 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.

Graham, John R., 2003, Taxes and corporate finance: A review, *Review of Financial Studies* 16, 1074-1128.

Graham, John R. and Mark T. Leary, 2011, A review of empirical capital structure research and directions for the future, in *Annual Review of Financial Economics*, ed. Andrew Lo and Robert Merton.

Graham, John R., Mark T. Leary, and Michael R. Roberts, 2012a, Financial crowding out, Working Paper, University of Pennsylvania.

Graham, John R., Mark T. Leary, and Michael R. Roberts, 2012b, The role of taxes and distress costs in determining aggregate capital structure, Working Paper, University of Pennsylvania.

Goldsmith Raymond, 1958, *Financial Intermediaries in the American Economy Since 1900*, UMI.

Gorton, Gary and Andrew Winton, 2003, Financial intermediation, in the *Handbook of the Economics of Finance*, eds. George Constantinides, Milton Harris, and Rene Stulz, Elsevier.

Hanson, Samuel, Robin Greenwood, and Jeremy Stein, 2010, A gap-filling theory of corporate debt maturity choice, *Journal of Finance* 65, 993-1028.

Hedier, Florian and Alexander Ljungqvist, 2012, As certain as debt and taxes: Estimating the tax sensitivity of leverage from exogenous tax changes, *Review of Financial Studies*, Working Paper, NYU.

Hubbard, R. Glenn, 1998, Capital market imperfections and investment, *Journal of Economic Literature* 36, 193-225.

Harris, Milton and Artur Raviv, 1991, The theory of capital structure, *Journal of Finance* 46, 297-355.

Hickman, William, 1953, *The Volume of Corporate Bond Financing Since 1900*, Princeton University Press.

Huang, Rongbing and Jay Ritter, 2010, Testing theories of capital structure and estimating the speed of adjustment, *Journal of Financial and Quantitative Analysis* 44, 237-271.

Jensen, Michael and William Meckling, 1976, A theory of the firm: Mangerial behavior, agency costs, and ownership structure, *Journal of Financial Economics* 3, 305-360.

Kaplan, Steven and Per Stromberg, 2009, Leveraged buyouts and private equity, *Journal of Economic Perspectives* 2009, 1-27.

Krishnamurthy, Arvind and Annette Vissing-Jorgensen, 2012a, The aggregate demand for Treasury debt, *Journal of Political Economy* 120, 233-267.

Krishnamurthy, Arvind and Annette Vissing-Jorgensen, 2012b, Short-term debt and the financial crisis: What we can learn from US Treasury supply, Working Paper.

Leary, Mark, 2009, Bank Loan Supply, Lender Choice, and Corporate Capital Structure. *Journal of Finance*, 64: 1143-1185.

Leland, Hayne and David Pyle, 1977, Informational asymmetries, financial structure, and financial intermediation, *Journal of Finance* 32, 371-387,

Lemmon, Michael, Michael R. Roberts and Jaime Zender, 2008, Back to the beginning: Persistence and the cross-section of corporate capital structures, *Journal of Finance* 63, 1575-1608.

McDonald, Robert, 1983, Government debt and private leverage: An extension of the Miller theorem, *Journal of Public Economics* 22, 303-325.

Miller, Merton, 1977, Debt and Taxes, *Journal of Finance* 32, 261-275.

Modigliani, Franco and Merton Miller, 1958, The cost of capital, corporation finance and the theory of investment, *American Economic Review* 48, 261-297.

Modigliani, Franco and Richard Sutch, 1967, Debt management and the term structure of interest rates: An empirical anlaysis of recent experience, *Journal of Political Economy* 75, 569-589.

Myers, Stewart, 1977, Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147-175.

Newey, Whitney and Ken West, 1987, A simple, positive-definite, heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* 55, 703-708.

Parsons, Christopher and Sheridan Titman, 2009, Empirical capital structure, *Foundations and Trends in Finance* 3, 1-93.

Perez-Gonzalez, Francisco, Fred Panier and Pablo Villanueva, 2012, Capital structure and taxes: What happens when you also subsidize equity? Working Paper, Stanford University.

Philippon, Thomas, 2012, Has the US finance industry become less efficient? Working Paper, NYU.

Rajan, Raghuram and Luigi Zingales, 1995, What do we know about capital structure: Some evidence from international data. *Journal of Finance* 50: 1421-1460.

Sametz, Arnold, 1964, Trends in the volume and composition of equity finance, *Journal of Finance* 19, 450-469.

Scott J, 1976, A theory of optimal capital structure, *Bell Journal of Economics and Management Science* 7, 33-54.

Stein, Jeremy, 2003, Agency, information and corporate investment, in the *Handbook of the Economics of Finance*, eds. George Constantinides, Milton Harris, and Rene Stulz, Elsevier.

Stulz, Rene, 1985, An analysis of secured debt, *Journal of financial Economics* 14, 501-521.

Taggart, Robert A., 1985, *Secular patterns in corporate finance*, in *Corporate Capital Structures in the United States*, ed. Benjamin Friedman, University of Chicago Press.

Welch, Ivo, 2011, Two common problems in capital structure research: The financial debt-to-assets ratio and issuing activity versus leverage changes, *International Review of Finance* 11, 1-17.

Appendix A: Variable Definitions

This appendix provides details on the data sources, sample construction, and variable construction. We use the acronym GFD for Global Financial Database, a source for many macroeconomic series.

A.1 Government debt

Government leverage in our analyses is defined as the ratio of Federal debt held by the public to GDP. We focus on Federal debt because it comprises the majority of total government debt, and is responsible for most of its variation over time. This fact is made apparent in Figure A.4, which presents a stacked area chart of government debt divided by GDP. In fact, the estimates of state and local debt are somewhat misleading. A significant fraction of state and local assets consists of U.S. Treasuries (on average $0.5 trillion between 2000 and 2010). Thus, state and local governments can act as a pass through for Federal debt by issuing their own debt claims against these assets. Focusing on the debt held by the public avoids "double counting" since a significant fraction of U.S. Treasuries outstanding are held by other government entities, such as the social security administration.

A.2 Variable definitions

Gross Domestic Product Implicit Price Deflator: Source = GFD, Series = USGDPD, Annual data from 1947 to 2010.

United States Annualized Exports of Goods and Services: Source = GFD, Series = USEXPGSQ, Annual data from 1947 to 2010.

United States Annualized Exports of Goods and Services: Source = GFD, Series = USIMPGSQ, Annual data from 1947 to 2010.

United States Gross Federal Debt Held by the Public (Bil. of $, NA), Source = GFD, Series = USFYGFDPUBA, Annual data from 1938 to 2010. This series is extended back in time by

assuming that total Federal debt is equal to Federal debt held by the public. Pre-1938 Federal debt data is obtained from, http://www.usgovernmentspending.com/Federal_state_local_debt_chart.html.

Corporate Income Tax Rate: This rate corresponds to the top corporate income tax rate. Source = "Corporation Income Tax Brackets and Rates, 1909-2002", http://www.irs.gov/pub/irs-soi/02corate.pdf. Annual data from 1909 to 2010.

United States M1 Money Stock: Source = GFD, Series = USM1W, Year-end monthly data from 1929 to 2010.

United States M2 Money Stock: Source = GFD, Series = USM2W, Year-end monthly data from 1947 to 2010.

United States State and Local Debt: Source = US government spending (http://www.usgovernmentspending.com/Federal_state_local_debt_chart.html), Annual data from 1902 to 2010.

United States Nominal GDP: Source = GFD, Series = GDPUSA, Year-end annual data from 1790 to 2010.

United States Unemployment Rate: Source = GFD, Series = UNUSAM, Year-end annual data from 1890 to 1928. Year-end monthly data from 1929 to 2010

International Holdings of US Debt: Source = Flow of Funds, Series = Foreign Holdings of U.S. Treasuries. Annual data from 1945 to 2010. Prior to 1945 we assume that there are no foreign holdings of US Treasuries.

USA Government 90-day T-Bills Secondary Market: Source = GDP, Series = ITUSA3D, Year-end monthly data from 1920 to 2010.

USA 10-year Bond Constant Maturity Yield: Source GFD, Series, IGUSA10D, Year-end monthly data from 1790 to 2010.

United States BLS Consumer Price Index NSA: Source GFD, Series, IGUSA10D, Annual data from 1820 to 1874. Monthly data from 1875 to 2010 collapsed to an annual series by averaging within years.

Moody's Corporate AAA Yield: Source GFD, Series, MOCAAAD, Year-end monthly data from 1857 to 2010.

Moody's Corporate BAA Yield: Source GFD, Series, MOCBAAD, Year-end monthly data from 1919 to 2010.

Variable Construction

Inflation = [CPI(t) – CPI(t-1)] / CPI(t) where CPI(t) is the consumer price index in year t computed as the average monthly CPI for the year.

US Net exports = [US exports – US imports] / US GDP

GDP growth = [GDP(t) – GDP(t-1)] / GDP(t-1) where GDP(t) is US gross domestic product in year t.

Government Leverage = US public debt held by the public in year t / GDP(t)

Net Debt Issuances by the US Government = Change in US public debt held by the public from year t-1 to t / GDP(t-1)

Book Leverage = Total Debt / Total book value of assets

Market leverage = Total Debt / (Total Debt + Equity Market Capitalization)

Net Debt leverage = (Total Debt – Cash) / Total book value of assets

Net Debt Issuance = [Total Debt(t) – Total Debt(t-1)] / Total book value of assets(t-1)

Net Equity Issuance = [Equity issues(t) – Equity repurchases(t)] / Total book value of assets(t-1)

Market-to-Book Equity Ratio = Equity Market Capitalization / Book Equity

Profitability = operating income before depreciation / total book value of assets

Tangibility = net plant property and equipment / total book value of assets

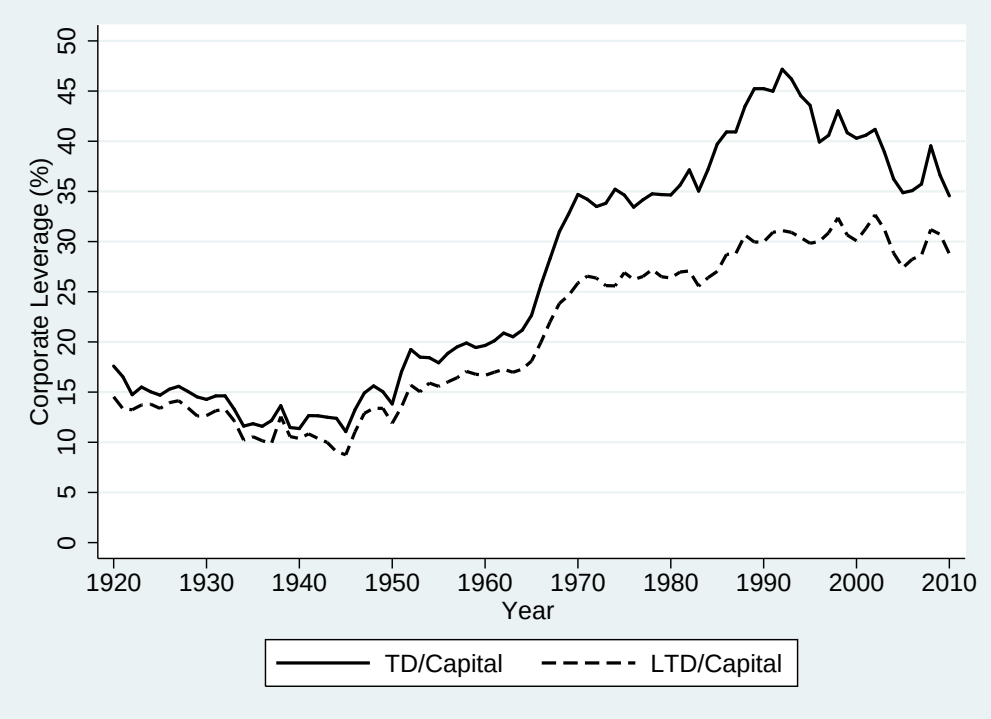
Intangible Assets = [Total Assets – (Net PP&E + cash and marketable securities + accounts receivable + inventories)] / Total Assets

Asset growth = [Total book value of assets(t) - Total book value of assets(t-1)] / Total book value of assets(t)

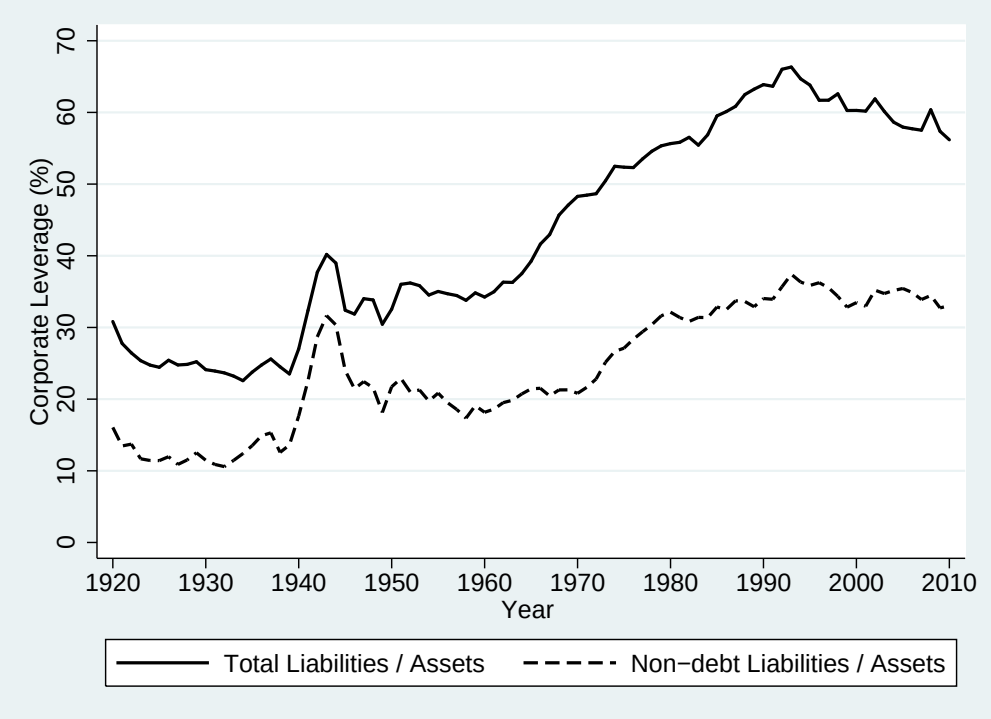
Figure 1
Aggregate Corporate Leverage Through Time

Panel A: Debt to Capital

The figure presents the annual ratio of aggregate total debt (short term plus long term) to aggregate financial capital (total debt plus book equity). Aggregate debt-to-capital is defined each year as the cross-sectional sum of total debt (short-term plus long-term) divided by the sum of total capital. The dashed line displays the aggregate ratio of long-term debt to capital. The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded.

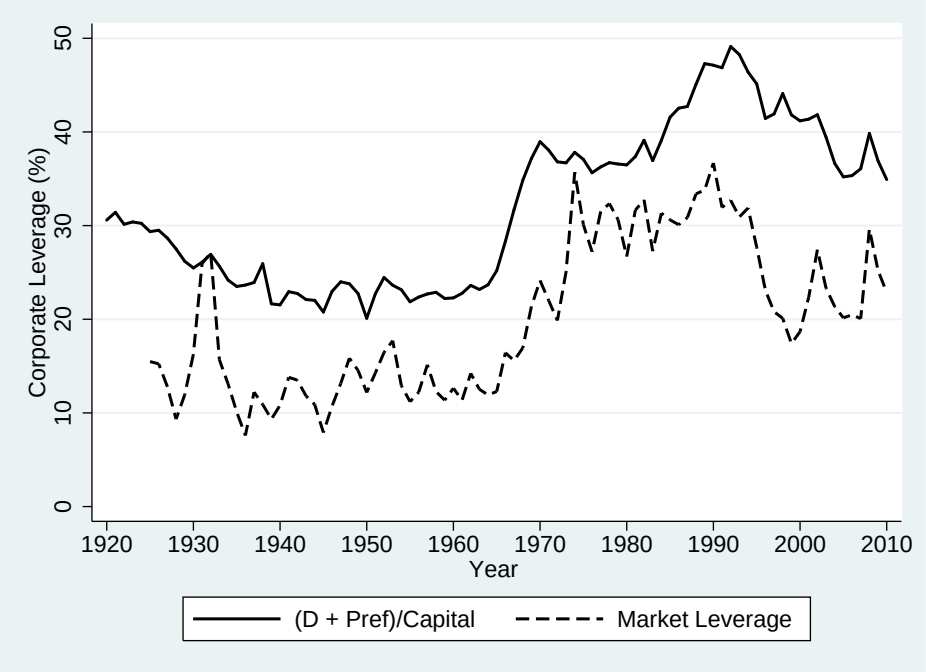


Panel B: Liabilities to Assets



Panel C: Alternative Leverage Measures

The solid line shows the aggregate ratio of debt plus preferred stock to total book capital for all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. The dashed line displays the aggregate ratio of total debt to the sum of book debt and market value of equity.



Panel D: Aggregate cash holdings

The figure shows aggregate cash and short-term investments to assets (solid line) and net debt to assets (dashed line) for all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Net Debt is total debt minus cash and marketable securities.

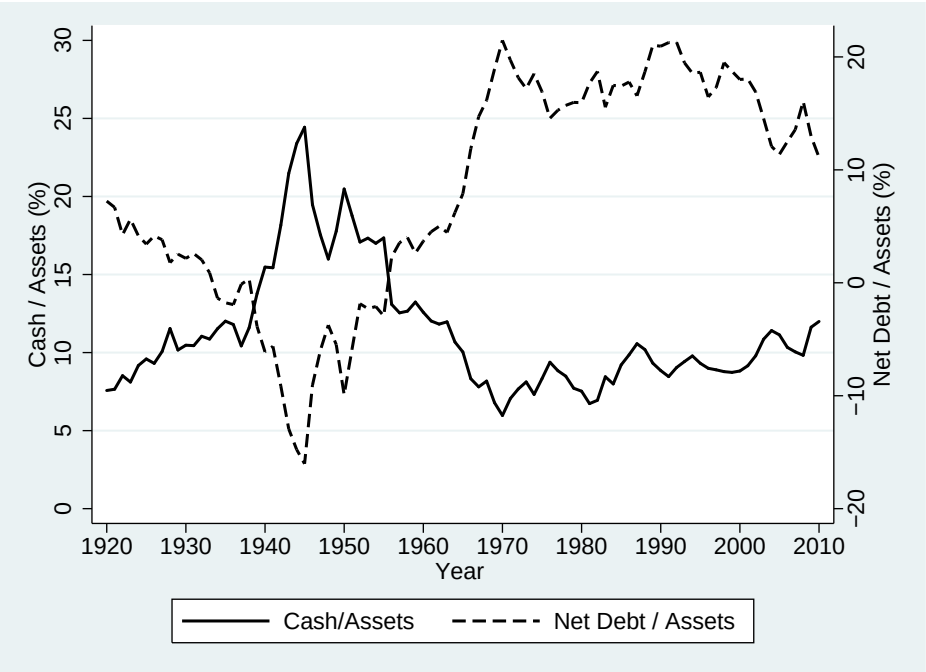
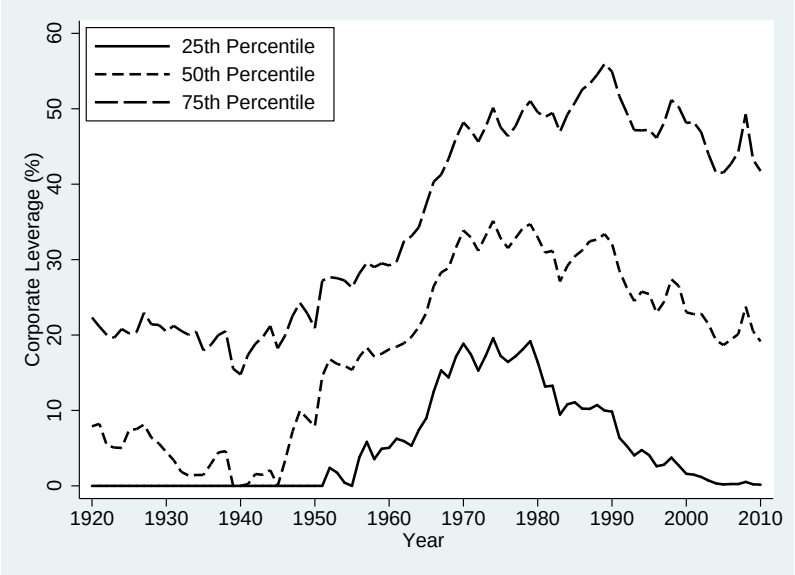


Figure 2
Corporate Leverage: Cross-sectional Distribution

The figure presents, for each year from 1920 to 2010, the cross-sectional median and first and third quartiles of the ratio of total debt (short term plus long term) to capital (total debt plus book value equity). The sample includes all firms in the CRSP database that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded.

Panel A: Full Sample



Panel B: NYSE Firms

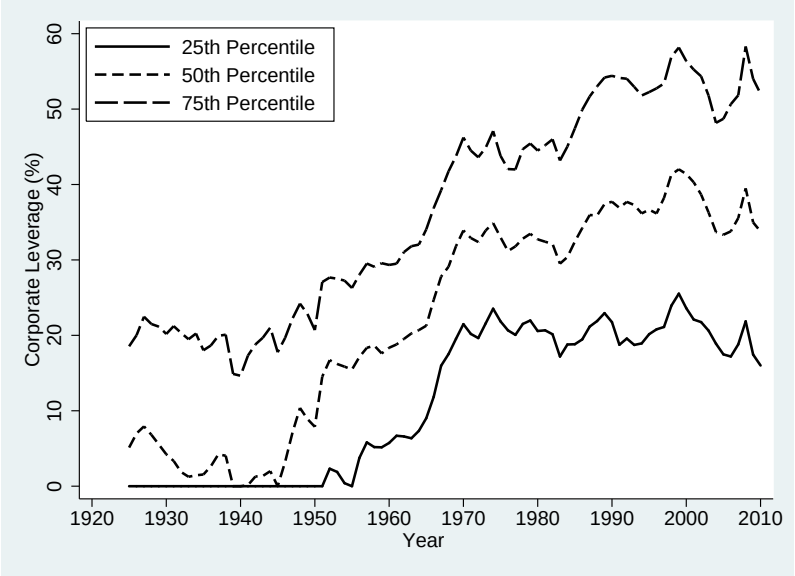
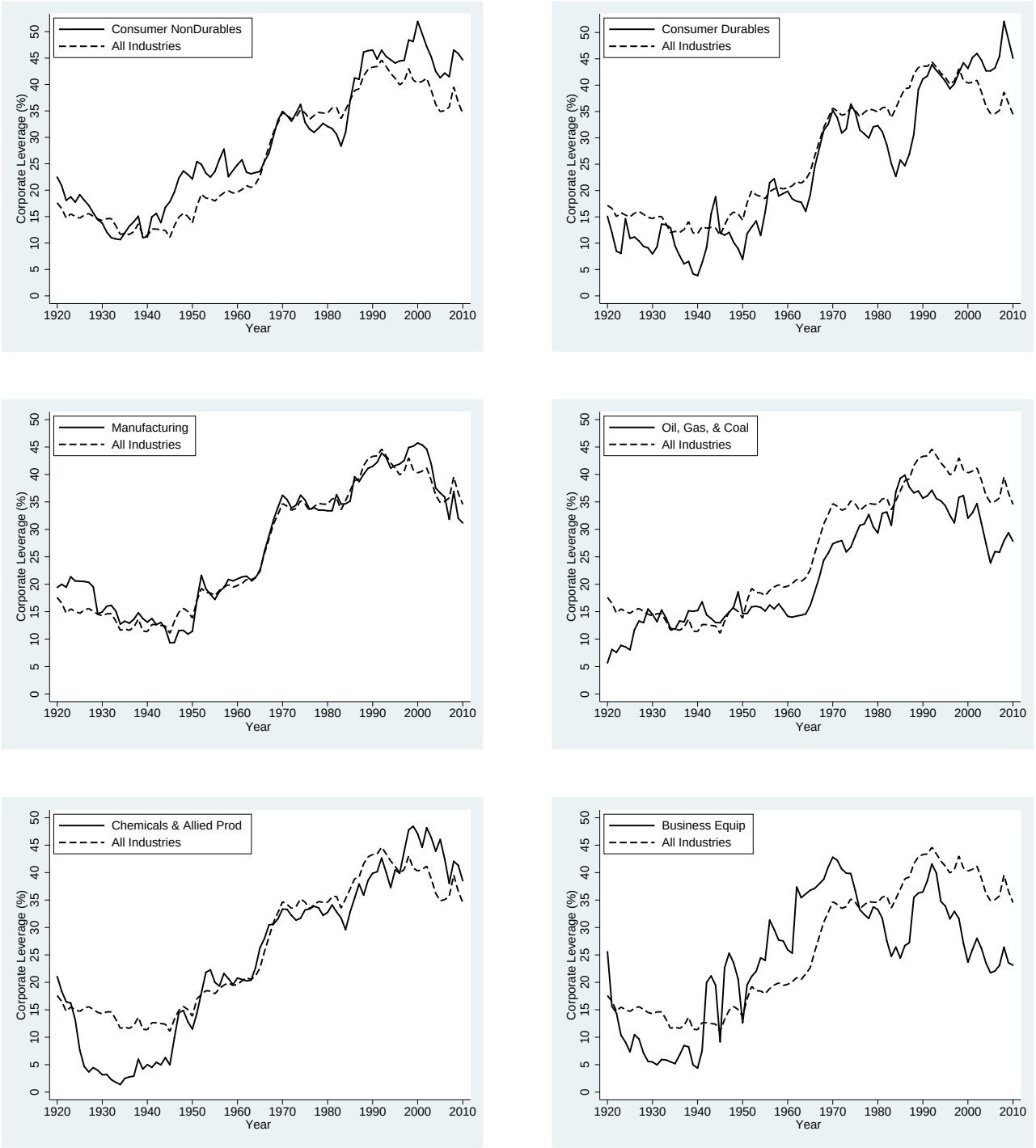
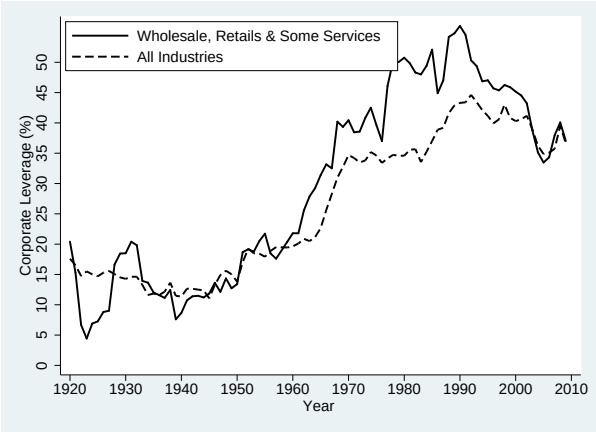
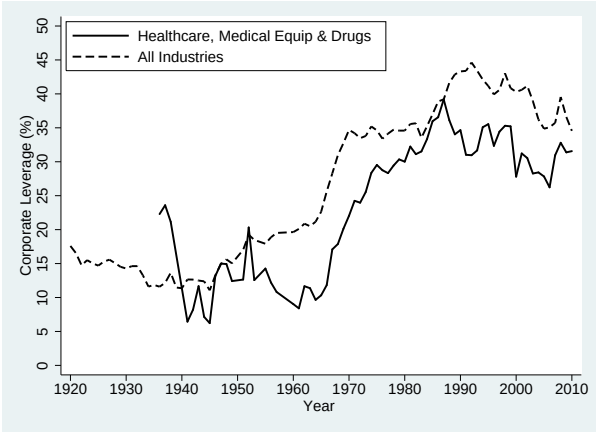


Figure 3
Industry Leverage

The solid line presents the asset value-weighted average leverage ratio for each of the 12 Fama and French industry classifications, excluding utilities, telecommunications, and finance. The dashed line presents the value-weighted average leverage ratio for all NYSE-listed industrial firms. Industry-years with fewer than 10 firms are excluded.




Wholesale, Retails & Some Services
All Industries
Corporate Leverage (%)
0
5
10
15
20
25
30
35
40
45
50
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year

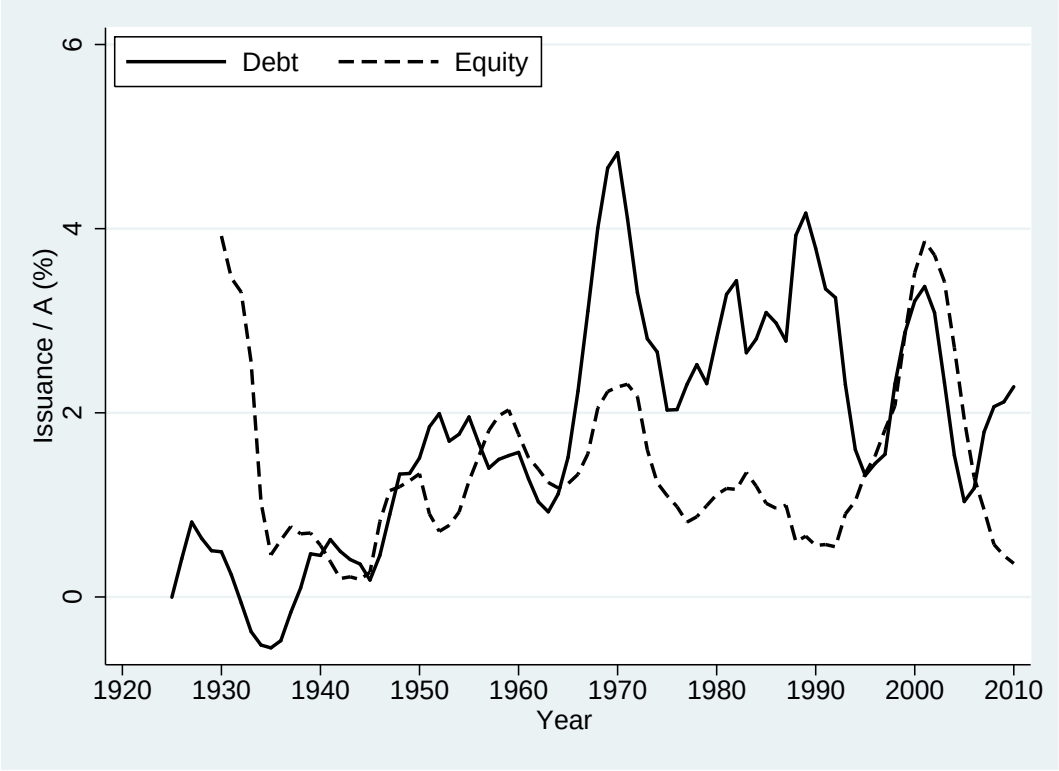

Healthcare, Medical Equip & Drugs
All Industries
Corporate Leverage (%)
0
5
10
15
20
25
30
35
40
45
50
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year


Everything Else
All Industries
Corporate Leverage (%)
0
5
10
15
20
25
30
35
40
45
50
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year

Figure 4
Aggregate Security Issuance

Aggregate net debt issuance is defined each year as the change in balance sheet debt summed across firms divided by the sum of lagged book assets. Net equity issuance is defined as the split-adjusted change in shares outstanding times the average of the beginning and end-of-year stock price.

Panel A: Net Debt and Equity Issuance (% of Assets) – 5 yr MA



Panel B: Debt Issuance / Investment (5 yr MA)

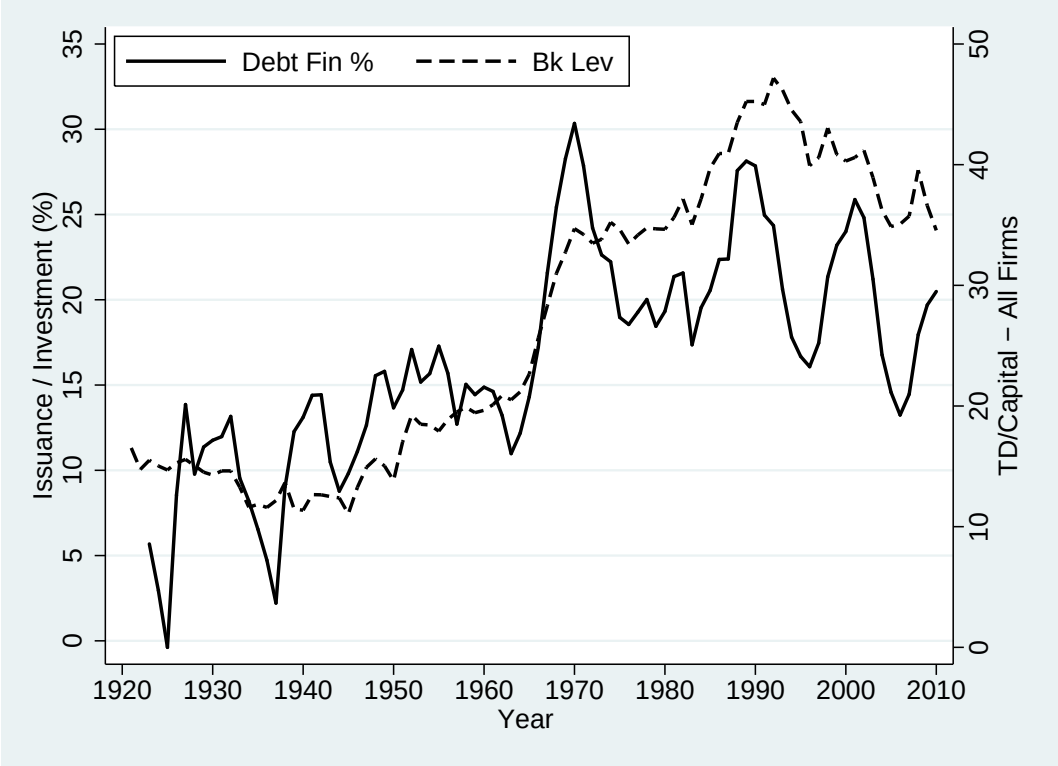
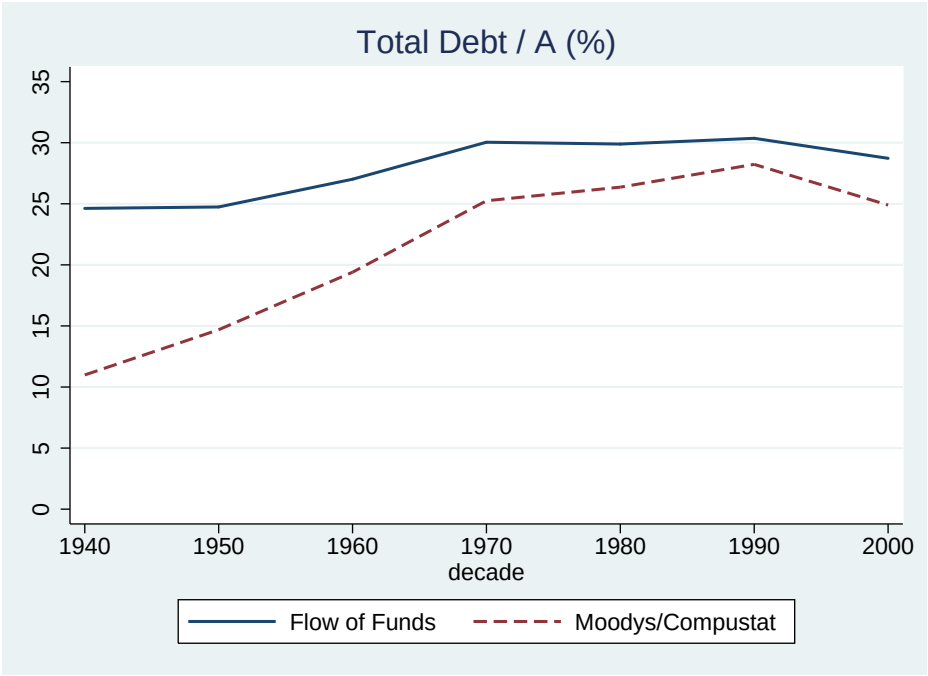


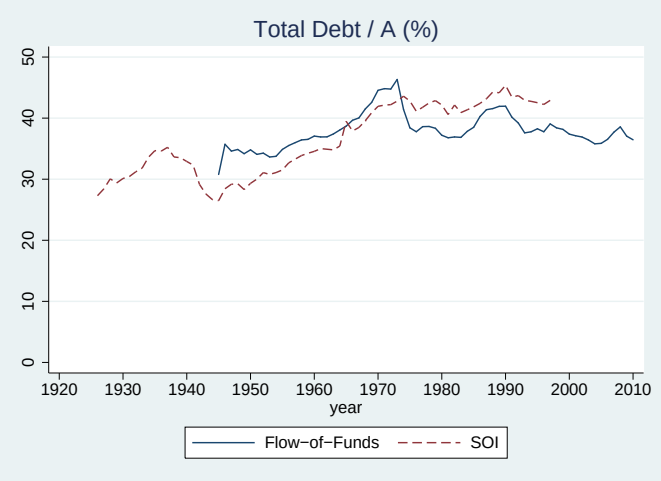
Figure 5
Comparing Aggregate Leverage Series

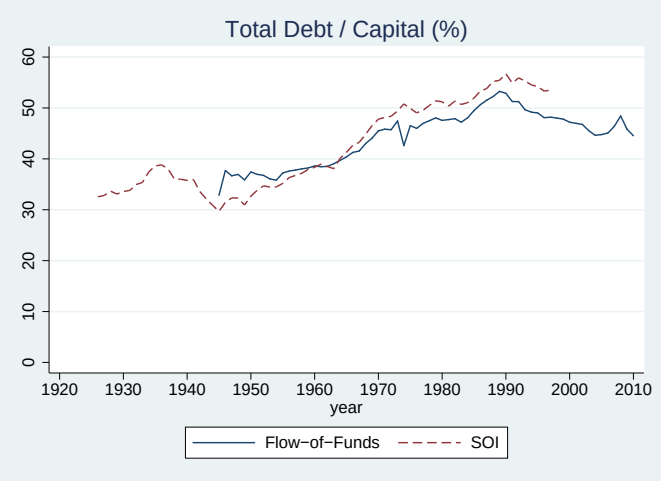
In Panel A, the solid line is average within each decade of the aggregate ratio of total debt to book value of assets (historical cost) for the nonfinancial corporate sector from U.S. Flow of funds. The dashed line shows the comparable series for our sample of firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. In Panel B, the solid line shows the aggregate ratio of total debt to assets (left plot) or total debt to capital (right plot) by year for the nonfinancial corporate sector from U.S. Flow of funds. The dashed line shows the analogous series from Statistics of Income data. In both cases, total debt includes trade accounts payable. Panel C presents total debt to capital (left plot) and long-term debt to capital (right plot) by year for industrial sectors excluding utilities, railroads and telecommunications, from Statistics of Income (dashed line) and the sample of firms from Compustat or the Moody's Industrial Manuals described in Figure 1. Trade accounts payable are included in total debt only. Panel D presents aggregate total debt to capital (left plot) and long-term debt to capital (right plot) by year from Statistics of Income for utilities, railroads and telecommunications firms (solid line) and all other industrial firms (dashed line).

Panel A: Moodys/Compustat vs. Flow-of-Funds (Decade averages)

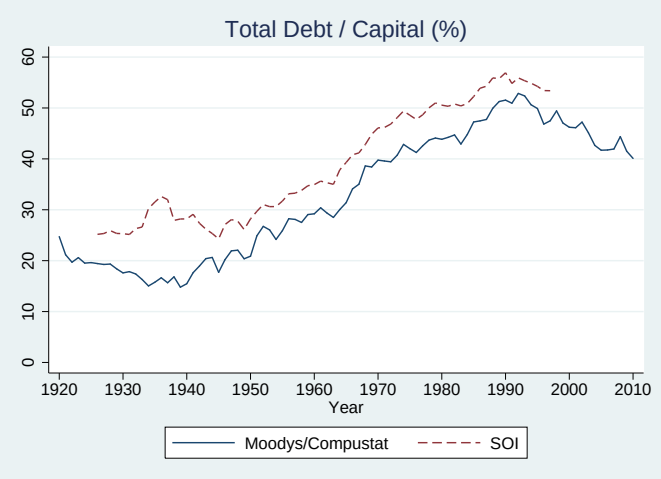


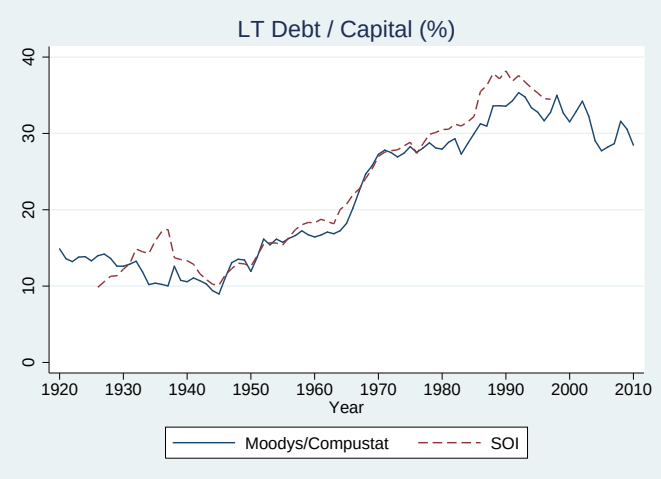
Panel B: Flow-of-Funds vs. Statistics of Income data



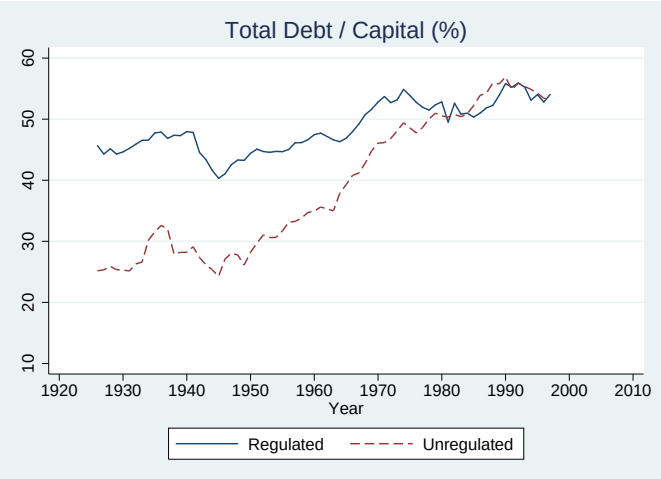


Panel C: Moodys vs. Statistics of Income data: Unregulated sectors





Panel D: Statistics of Income data: Regulated vs. Unregulated sectors



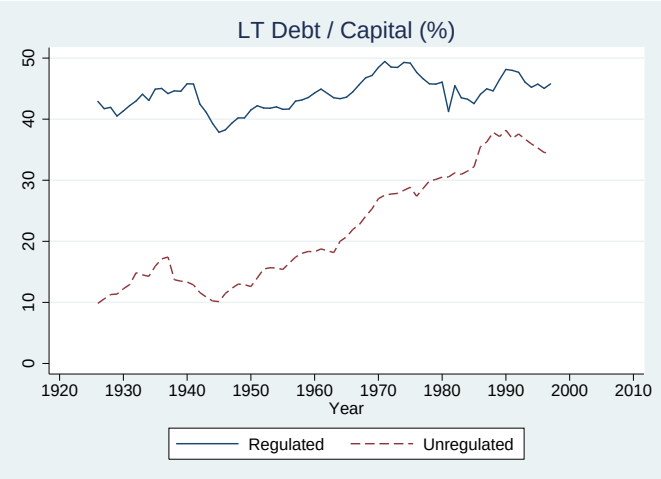


Figure 6
Supply and Demand for Corporate Debt

The figure shows theoretical demand and supply curves for corporate debt under different assumptions about the relevant market frictions. On the horizontal axis of each figure is the aggregate quantity of corporate debt (B), on the vertical axis the risk-adjusted return on debt (r_D^*) and equity (r_E^*). Panel A represents the case of perfect markets as in Modigliani and Miller (1958). In Panel B firms face corporate taxes (at rate t_c) and expected bankruptcy costs, while investors can costlessly transform return streams from one security to another. In panel C, firms face only corporate taxes, and investors face heterogeneous personal tax rates along with tax arbitrage restrictions. Panel D is the general case which allows for all of these frictions to be present simultaneously.

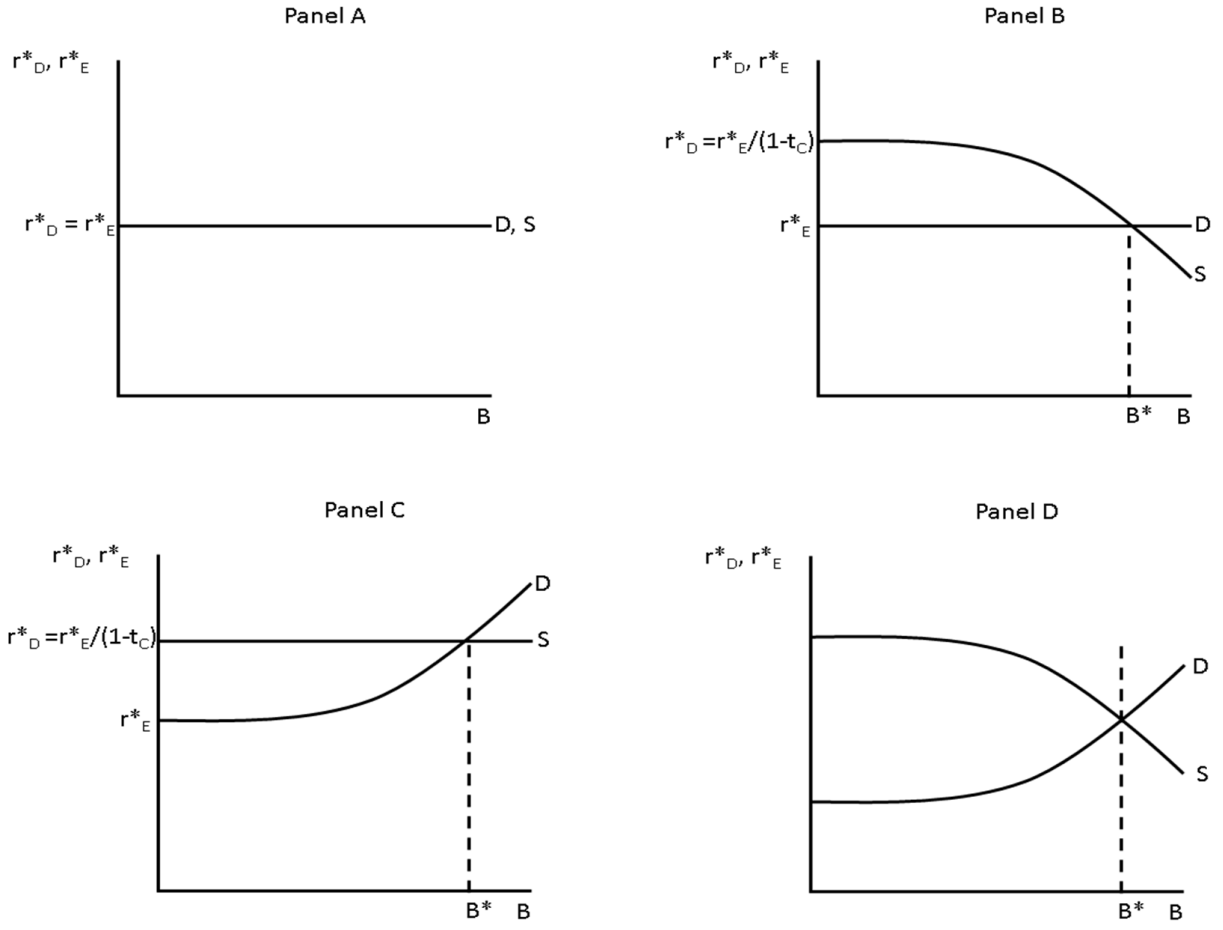


Figure 7
Corporate Leverage and Government Borrowing

Corporate leverage is the ratio of total debt to capital, defined as total debt plus book equity. Government leverage is the ratio of federal debt held by the public to GDP.

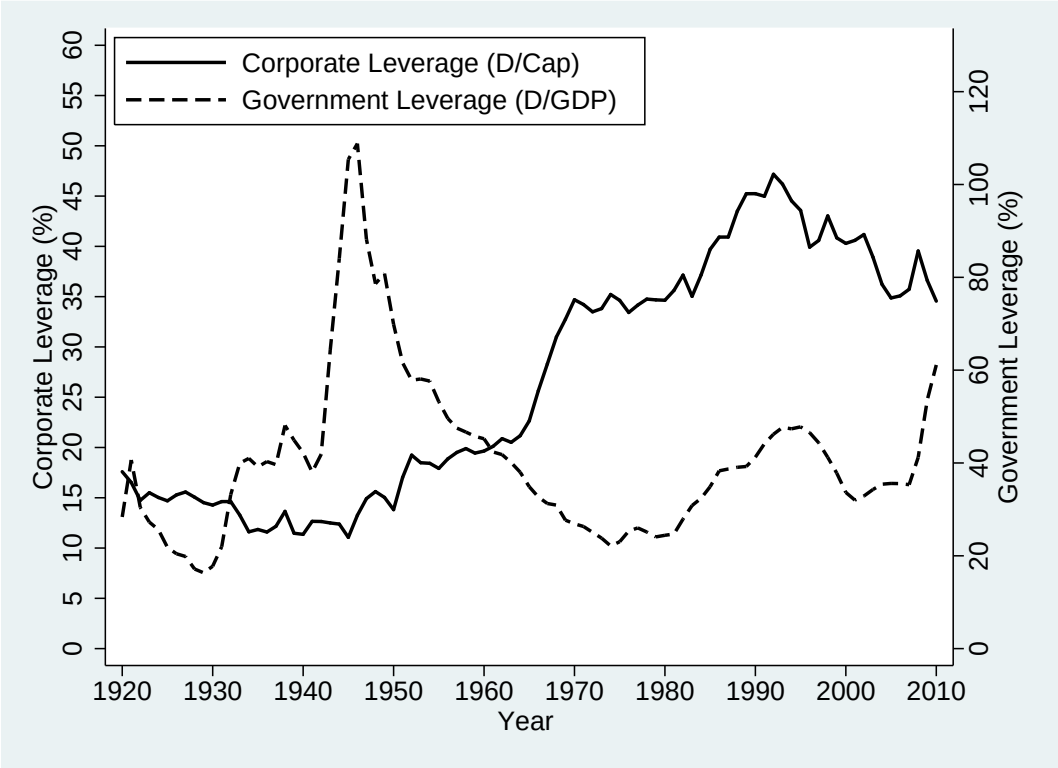
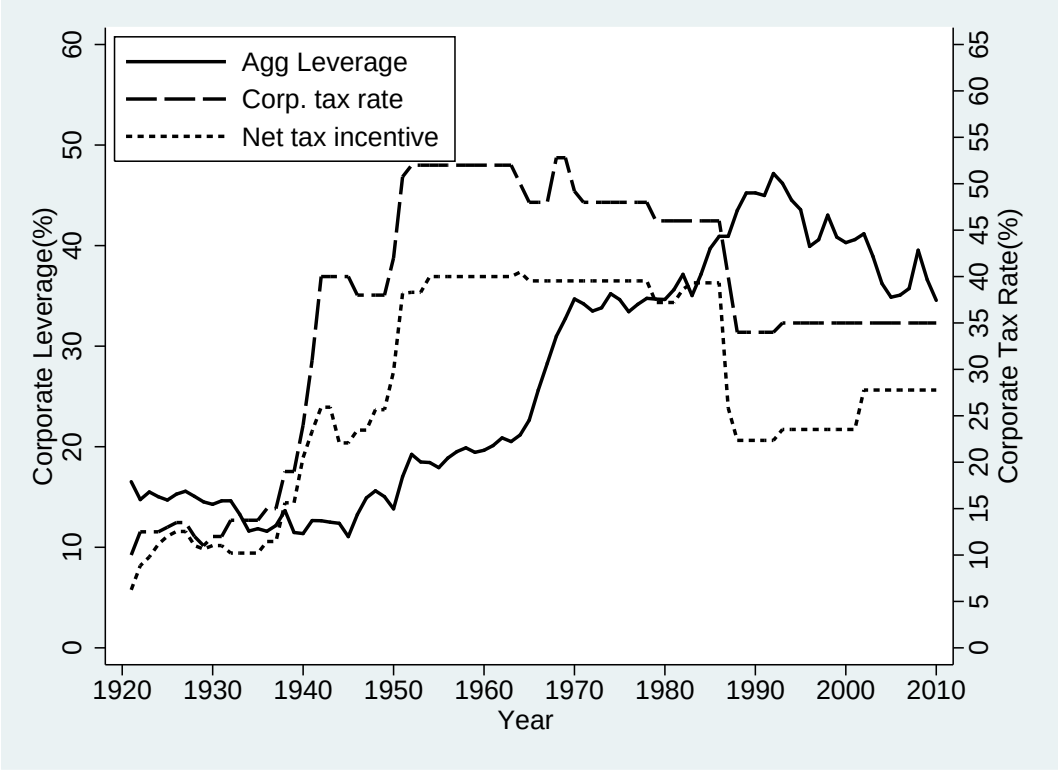


Figure 8
Leverage and Corporate Tax Rates

Corporate leverage is the ratio of total debt to capital, defined as total debt plus book equity. $D/(D+P)$ is the ratio of total debt to the sum of total debt plus preferred stock. Net tax incentive is defined following Taggart (1981) as $1-(1-t_c)/(1-t_p)$, where t_c is the corporate tax rate and t_p the lowest personal tax rate.

Panel A: Aggregate D/Capital Ratio



Panel B: Debt to Total Fixed Charge Capital

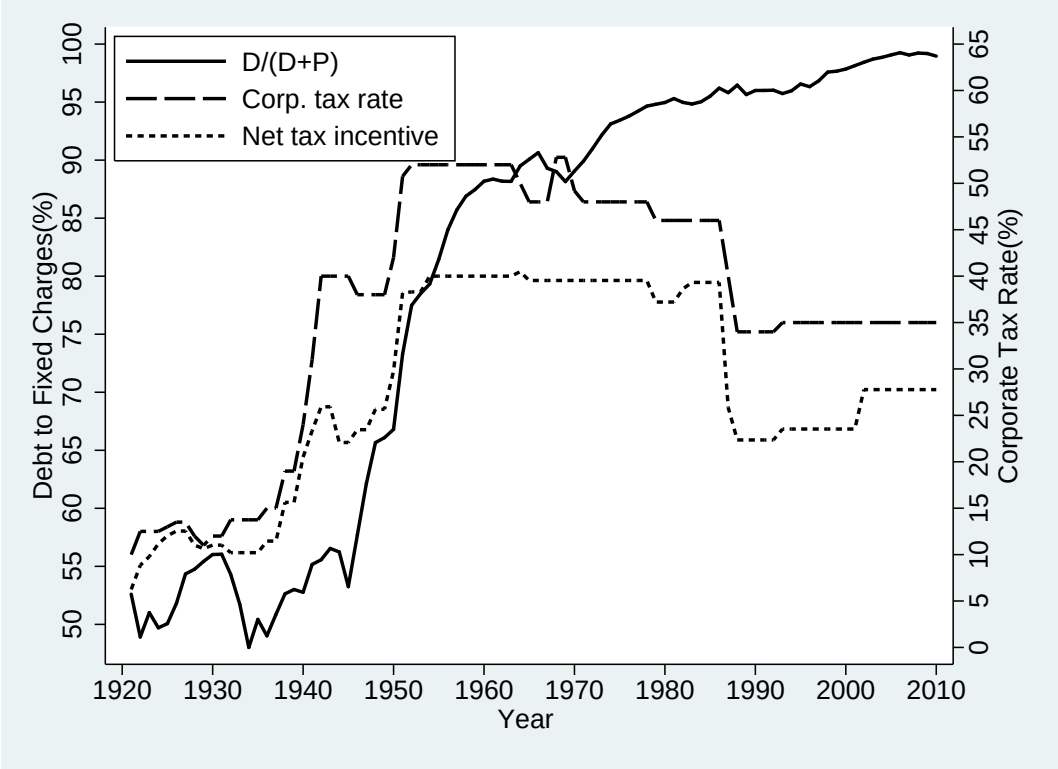
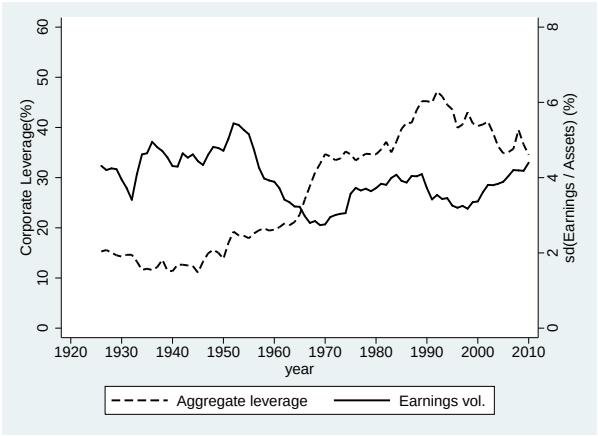
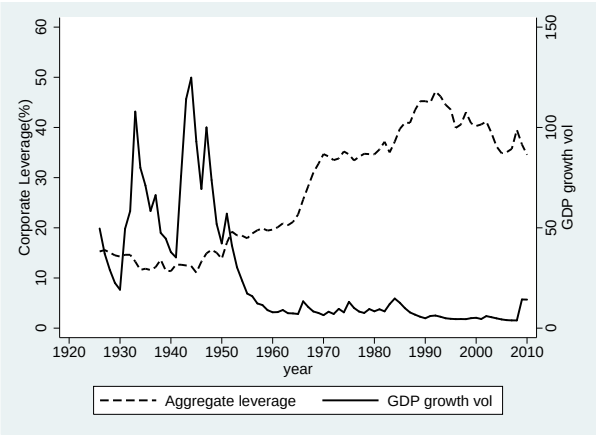


Figure 9
Aggregate Leverage and Volatility Measures

Corporate leverage is the ratio of total debt to capital. Government leverage is the ratio of federal debt held by the public to GDP.





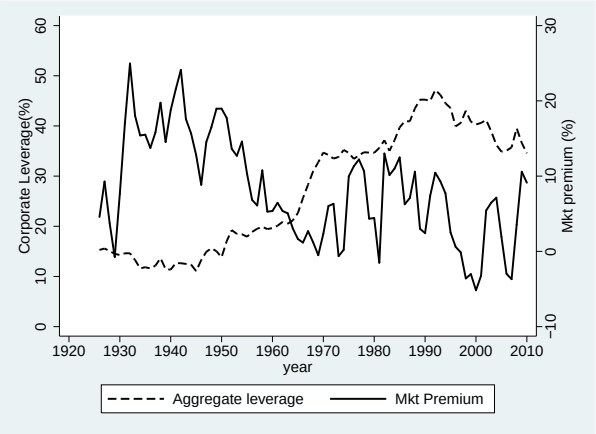
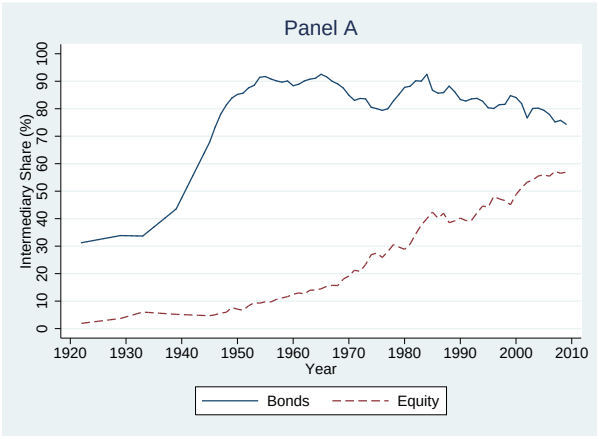
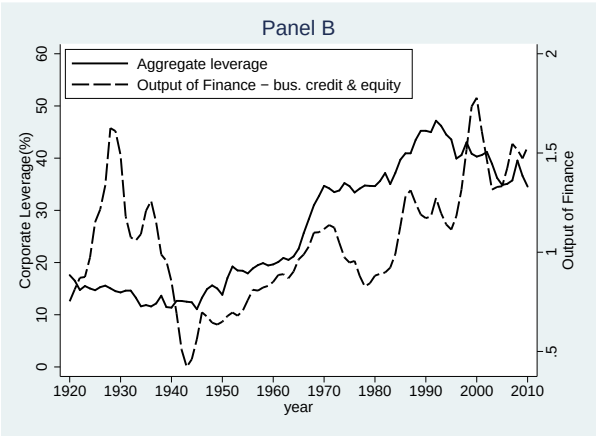


Figure 10
Intermediation, Financial Market Development and Corporate Leverage

Data in Panel A are from Goldsmith (1958) prior to 1945 and US Flow-of-Funds after 1945. Measures of financial sector output in panels B and C (dashed lines) are from Phillipon (2012). Panel B plots aggregate corporate leverage from our Moodys / Compustat sample along with Phillipon's estimate of the business credit and equity component of financial sector output. Panel C plots the same leverage series against Phillipon's value-added based measure of the income share of the financial sector.





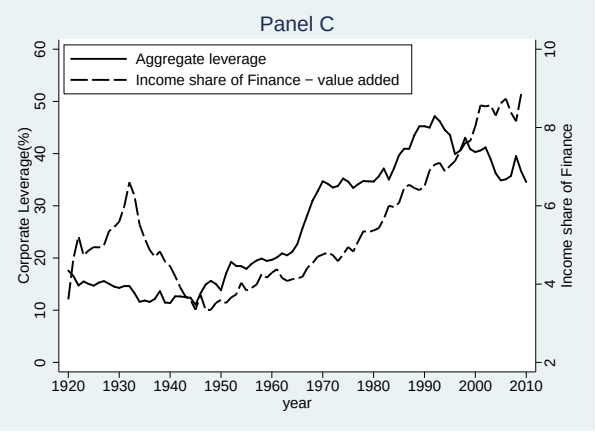


Table 1

Summary Statistics

Panel A: Annual Aggregate Summary Statistics

The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded.

	count	mean	sd	min	max	ar(1)
Firm Characteristics						
Debt / Capital (%)	91	26.63	11.81	11.06	47.17	0.990
Debt/(Debt + Mkt Equity) (%)	86	20.10	8.14	7.59	36.69	0.898
(Debt - Cash)/ Assets (%)	91	8.07	9.93	-16.03	21.47	0.971
EBIT / Assets (%)	91	9.99	2.98	1.83	17.54	0.807
Intangible Assets / Assets (%)	91	15.80	9.85	5.88	38.37	0.997
Mkt Assets / Book Assets	86	1.27	0.25	0.57	1.90	0.798
Avg. Book Assets ($mm)	91	682	1,061	42	4,908	0.999
Investment / Assets (%)	91	7.29	5.61	-6.42	19.64	0.684
Macroeconomic Factors						
Real AAA rate (%)	91	2.99	4.38	-11.77	16.90	0.558
BAA - AAA Yield Spread (%)	91	1.19	0.69	0.37	4.26	0.838
Inflation (%)	91	2.92	4.44	-10.94	15.63	0.564
Mkt Return (%)	85	0.12	0.21	-0.44	0.58	0.010
GDP growth (%)	91	3.40	5.41	-13.00	18.52	0.409
Corp. Tax Rate (%)	91	36.18	13.86	10.00	52.80	0.990
Govt Debt / GDP (%)	91	40.79	17.71	16.34	108.82	0.943

Panel B: Panel Data Summary Statistics

The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded.

	count	mean	sd	min	max
Debt / Capital (%)	214,486	29.45	27.68	0.00	137.96
Debt/(Debt + Mkt Equity) (%)	207,858	25.22	25.56	0.00	95.61
(Debt - Cash)/ Assets (%)	213,852	6.58	31.80	-77.45	82.96
EBIT / Assets (%)	208,945	4.07	17.65	-76.51	31.26
Intangible Assets / Assets (%)	208,298	16.92	17.61	-193.37	100.00
Mkt Assets / Book Assets	202,103	1.69	1.34	0.36	10.76
Book Assets ($mm)	216,175	1,166	7,195	0.001	360,297
Investment / Assets (%)	190,879	0.17	0.56	-0.71	3.62

Panel C: Averages by Decade – Full Sample

	# obs	Debt / Assets (%)	Debt/(Debt + Mkt Equity) (%)	(Debt - Cash)/ Assets (%)	EBIT / Assets (%)	Intang. / Assets (%)	Mkt Assets / Bk Assets	Avg. Book Assets ($mm)	Invest/ Asset (%)
1921 - 1930	1,402	12.24	20.14	0.67	7.68	15.36	1.20	63	0.10
1931 - 1940	3,569	11.54	19.60	-3.98	6.99	12.10	1.13	57	0.00
1941 - 1950	5,929	11.85	14.81	-10.86	13.46	6.59	1.06	81	0.12
1951 - 1960	6,087	18.20	19.72	-0.38	11.71	5.92	1.17	177	0.11
1961 - 1970	12,216	27.64	22.65	11.55	10.54	9.32	1.61	236	0.19
1971 - 1980	27,673	34.68	35.54	17.18	10.37	10.40	1.26	343	0.16
1981 - 1990	35,572	34.88	27.40	11.79	1.97	14.00	1.70	644	0.20
1991 - 2000	44,518	30.77	23.70	5.42	0.42	20.99	1.99	1,232	0.25
2001 - 2010	35,757	27.96	21.75	-1.23	-0.03	27.73	1.90	3,282	0.11
Total	31,324.6	29.45	25.22	6.58	4.07	16.92	1.69	1,166	0.17

Table 2

Aggregate Corporate Leverage and Government Debt

The sample includes all firms in the CRSP database that are also covered either in Compustat or the Moody's Industrial Manuals. The table presents results of OLS regressions of aggregate corporate book leverage (Debt-to-Capital) on government leverage (Debt-to-GDP). The regressions are run in both levels and first differences. Newey-West standard errors assuming two non-zero lags are used to compute all t-statistics (in parentheses). The dependent variable in panel A is the aggregate ratio of total debt to capital and in Panel B is net debt or equity issuance scaled by lagged aggregate assets. Statistical significance at the 1%, 5% and 10% levels are indicated by ***, ** and *, respectively.

Panel A: Debt to Capital Ratio

	Levels			First Differences		
	(1)	(2)	(3)	(4)	(5)	(6)
Government Leverage	-0.145***	-0.063**	-0.085***	-0.043**	-0.073***	-0.078***
	(-6.20)	(-2.09)	(-2.76)	(-2.26)	(-3.12)	(-2.97)
Real Tbill rate		0.904***	0.618**		-0.133	-0.093
		(2.91)	(2.32)		(-1.04)	(-0.63)
BAA - AAA Yield Spread		0.002	-4.527***		0.818**	0.594
		(0.00)	(-4.31)		(2.46)	(1.19)
Inflation		0.838**	0.720***		-0.073	-0.016
		(2.59)	(2.83)		(-0.57)	(-0.11)
Market Return		0.692	1.789		-0.357	-0.453
		(0.65)	(1.28)		(-0.71)	(-0.55)
Real GDP Growth		-0.103*	-0.003		-0.102***	-0.084**
		(-1.84)	(-0.05)		(-3.75)	(-2.62)
Firm Characteristics						
Profitability			-1.409***			-0.150
			(-4.31)			(-1.11)
Intangible Assets			-0.210*			-0.036
			(-1.71)			(-0.15)
Market-to-Book Assets			-8.680***			-0.164
			(-3.41)			(-0.13)
Trend	Yes	Yes	Yes	No	No	No
Observations	91	85	85	90	84	84
Adjusted R^2	0.870	0.910	0.953	0.030	0.263	0.276

Panel B: Aggregate Debt and Equity Issuance Regressions: Government Debt

The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded. The dependent variable in columns 1 - 3 (4 - 6) is the aggregate debt (equity) issuances scaled by lagged aggregate book assets. The dependent variable in columns 7 - 9 is aggregate debt issuance scaled by total investment for those firms with positive investment. Investment is defined as the change in the sum of gross long-term assets and inventory. The table presents results of OLS regressions of the issuance variables on aggregate firm characteristics and macroeconomic variables. Newey-West standard errors assuming two non-zero lags are used to compute all t-statistics (in parentheses). Statistical significance at the 10%, 5% and 1% levels are indicated by *, ** and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Debt Iss.	Debt Iss.	Debt Iss.	Eq. Iss.	Eq. Iss.	Eq. Iss.	DI/Invest	DI/Invest	DI/Invest
Government Net Debt Iss.	-0.074***	-0.071***	-0.052**	-0.074***	-0.012	-0.031	-0.268**	-0.253*	-0.230*
	(-3.72)	(-3.44)	(-2.05)	(-2.77)	(-0.68)	(-1.47)	(-2.01)	(-1.90)	(-1.67)
Macro vars (level)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm controls (level)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Macro vars (1st diff)	No	No	Yes	No	No	Yes	No	No	Yes
Firm controls (1st diff)	No	No	Yes	No	No	Yes	No	No	Yes
Observations	91	84	84	85	84	84	91	84	84
R^2	0.067	0.504	0.640	0.118	0.383	0.452	0.024	0.419	0.563

Table 3

Aggregate Leverage Regressions: Tax incentives

The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded. The table presents results of OLS regressions of aggregate corporate leverage on aggregate firm characteristics and macroeconomic variables. Firm characteristics include return on assets, the ratio of intangible to total assets, and the ratio of market to book value assets. Macroeconomic variables include the real 3-month Treasury yield, the BBB - AAA yield spread, inflation, real GDP growth, and the value-weighted market return. *Long-run tax effect* represents the sum of the first 8 lags of the corporate tax rate or tax incentive variable. See the appendix for all variable definitions. The dependent variable in Panel A is the aggregate ratio of total debt to capital, and in Panel B is the aggregate ratio of debt to the sum of debt and preferred stock. The regressions are run in both levels and first differences. Newey-West standard errors assuming two non-zero lags are used to compute all t-statistics (in parentheses). Statistical significance at the 10%, 5% and 1% levels are indicated by *, ** and **, respectively.

Panel A: Debt / Capital

	Levels				First Differences		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Corp. Tax Rate	0.365***	-0.182**	-0.142		0.018	-0.030	
	(3.76)	(-2.33)	(-0.94)		(0.27)	(-0.38)	
Net Tax Incentive				-0.232**			0.028
				(-2.09)			(0.58)
Long-run Tax Effect			-0.112	-0.303**		0.040	-0.050
			(-0.925)	(-2.035)		(0.246)	(-0.253)
Government Leverage	-0.237***	-0.093***	-0.054	-0.132***	-0.077***	-0.073***	-0.083**
	(-4.82)	(-3.22)	(-1.54)	(-4.40)	(-2.99)	(-2.80)	(-2.37)
Macro vars	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Trend	No	Yes	Yes	Yes	No	No	No
Observations	91	85	83	83	84	82	82

Panel B: Debt / (Debt + Preferred)

	Levels				First Differences		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Corp. Tax Rate	1.012***	0.298***	0.071		0.114	0.022	
	(9.65)	(3.45)	(1.01)		(1.29)	(0.26)	
Net Tax Incentive				0.173*			0.111
				(1.73)			(1.50)
Long-run Tax Effect			0.581***	0.559***		0.550***	0.594***
			(7.560)	(3.732)		(5.385)	(3.309)
Government Leverage	-0.344***	-0.223***	-0.172***	-0.147***	-0.166***	-0.178***	-0.144***
	(-4.35)	(-6.76)	(-7.31)	(-4.03)	(-3.77)	(-4.96)	(-4.11)
Macro vars	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Trend	No	Yes	Yes	Yes	No	No	No
Observations	91	85	83	83	84	82	82

Table 4

Aggregate Debt and Equity Issuance Regressions: Tax Incentives

The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded. The dependent variable in columns 1 - 3 (4 - 6) is the aggregate debt (equity) issuances scaled by lagged aggregate book assets. The dependent variable in columns 7 - 9 is aggregate debt issuance scaled by total investment for those firms with positive investment. The table presents results of OLS regressions of the issuance variables on the same aggregate firm characteristics and macroeconomic variables included in Table 2. *Long-run tax effect* represents the sum of the first 8 lags of the tax incentive variable. Newey-West standard errors assuming two non-zero lags are used to compute all t-statistics (in parentheses). Statistical significance at the 10%, 5% and 1% levels are indicated by *, ** and **, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Debt Iss.	Debt Iss.	Debt Iss.	Eq. Iss.	Eq. Iss.	Eq. Iss.	DI/Invest	DI/Invest	DI/Invest
Net Tax Incentive	0.077***	0.007	-0.030	-0.014	-0.081*	0.074*	0.387***	0.126	0.238
	(4.67)	(0.24)	(-0.32)	(-0.65)	(-1.91)	(1.72)	(3.04)	(0.70)	(0.42)
Long-run Tax Effect			0.032			-0.098**			0.252
			(0.985)			(-2.525)			(1.337)
Government Net Debt Iss.	-0.070***	-0.055*	-0.042	-0.076***	0.012	-0.010	-0.251**	-0.296*	-0.194
	(-4.37)	(-1.95)	(-1.13)	(-2.71)	(0.42)	(-0.43)	(-2.27)	(-1.85)	(-1.01)
Macro vars (level)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm controls (level)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Macro vars (1st diff)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm controls (1st diff)	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	90	84	82	85	84	82	90	84	82

Table 5

Aggregate Leverage Regressions: Expected Distress Costs

The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded. The table presents results of OLS regressions of aggregate corporate debt to capital on aggregate firm characteristics and macroeconomic variables. The regressions are run in both levels (Panel A) and first differences (Panel B). Newey-West standard errors assuming two non-zero lags are used to compute all t-statistics (in parentheses). Statistical significance at the 10%, 5% and 1% levels are indicated by *, ** and **, respectively.

Panel A: Levels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	GDP growth vol.			Mkt Risk Premium			Earnings vol.		
Volatility	-0.072***	-0.051**	0.007	-0.142	0.113	0.149	-0.030**	-0.014	-0.005
	(-2.79)	(-2.50)	(0.29)	(-1.23)	(0.73)	(1.17)	(-2.48)	(-1.40)	(-0.54)
Government Leverage			-0.100**			-0.098***			-0.086***
			(-2.41)			(-3.34)			(-2.99)
Corp. Tax Rate			-0.187**			-0.168**			-0.181**
			(-2.38)			(-2.21)			(-2.27)
Macro vars	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	85	85	85	85	85	85	91	85	85
Adjusted R^2	0.857	0.950	0.956	0.844	0.946	0.957	0.845	0.948	0.957

Panel B: First Differences

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	GDP growth vol.			Mkt Risk Premium			Earnings vol.		
Volatility	0.000	0.001	0.013	0.045*	0.002	-0.033	-0.001	0.006	0.006
	(0.05)	(0.09)	(1.28)	(1.69)	(0.03)	(-0.52)	(-0.12)	(0.70)	(0.88)
Government Leverage			-0.087***			-0.081***			-0.078***
			(-3.63)			(-3.04)			(-3.06)
Corp. Tax Rate			0.006			0.021			0.015
			(0.08)			(0.28)			(0.22)
Macro vars	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Firm controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Observations	84	84	84	84	84	84	90	84	84
Adjusted R^2	0.000	0.211	0.285	0.017	0.211	0.279	0.000	0.216	0.282

Table 6

Aggregate Leverage Regressions: Financial Market Development

The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded. The table presents results of OLS regressions of aggregate corporate debt to capital on aggregate firm characteristics and macroeconomic variables. The regressions are run in both levels and first differences. In Panel A, *Interm. Share Debt (Equity)* is the proportion of corporate bonds (equities) outstanding held through financial intermediaries. In Panel B, *Income share of finance* and *Output of Finance* are the variables e_finshv_ndnf and fin_bus from Phillipon (2012), respectively. Newey-West standard errors assuming two non-zero lags are used to compute all t-statistics (in parentheses). Statistical significance at the 10%, 5% and 1% levels are indicated by *, ** and **, respectively.

Panel A: Intermediary Holdings of Debt and Equity

	Levels			First Differences	
	(1)	(2)	(3)	(4)	(5)
	Book Lev	Book Lev	Book Lev	Book Lev	Book Lev
Interm. Share Debt	0.105***	0.033	0.102	-0.096	-0.031
	(2.92)	(0.36)	(1.53)	(-1.10)	(-0.35)
Interm. Share Equity	0.533***	0.307	-0.291	-0.013	-0.013
	(8.11)	(1.08)	(-1.44)	(-1.09)	(-0.94)
Government Leverage			-0.113***		-0.070***
			(-4.39)		(-2.83)
Corp. Tax Rate			-0.297***		0.003
			(-3.34)		(0.05)
Macro vars	No	No	Yes	No	Yes
Firm controls	No	No	Yes	No	Yes
Trend	No	Yes	Yes	No	No
Observations	88	88	84	87	83

Panel B: Size of the Financial Sector

	Levels					
	(1)	(2)	(3)	(4)	(5)	(6)
	Book Lev	Book Lev	Book Lev	Book Lev	Book Lev	Book Lev
Income share of Finance	5.391***	0.782	-2.764*			
	(7.66)	(1.08)	(-1.78)			
Government Leverage			-0.115***			-0.034
			(-3.88)			(-1.05)
Corp. Tax Rate			-0.217**			-0.044
			(-2.53)			(-0.55)
Output of Finance				20.247***	4.349**	11.024***
				(3.95)	(2.02)	(2.85)
Macro vars	No	No	Yes	No	No	Yes
Firm controls	No	No	Yes	No	No	Yes
Trend	No	Yes	Yes	No	Yes	Yes
Observations	90	90	84	91	91	85

Table 7

Aggregate Debt and Equity Issuance Regressions: Financial Market Development

The sample includes all firms in the CRSP data base that are also covered either in Compustat or the Moody's Industrial Manuals. Financial firms, utilities and railroads are excluded. The dependent variable in columns 1 - 2 (3 - 4) is the aggregate debt (equity) issuances scaled by lagged aggregate book assets and in columns 5 - 6 is the ratio of aggregate debt issuance to aggregate investment for those firms with positive investment. The table presents results of OLS regressions of the issuance variables on aggregate firm characteristics and macroeconomic variables. Newey-West standard errors assuming two non-zero lags are used to compute all t-statistics (in parentheses). Statistical significance at the 10%, 5% and 1% levels are indicated by *, ** and **, respectively.

Panel A: Intermediary Holdings of Debt and Equity

	(1)	(2)	(3)	(4)	(5)	(6)
	Debt Iss.	Debt Iss.	Eq. Iss.	Eq. Iss.	DI/Invest	DI/Invest
Interm. Share Debt	0.041***	0.030	-0.003	-0.043	0.152***	0.098
	(4.05)	(0.99)	(-0.20)	(-1.32)	(2.64)	(0.58)
Interm. Share Equity	0.013	0.016	0.003	-0.023	0.104	0.290
	(1.00)	(0.35)	(0.22)	(-0.48)	(1.57)	(1.08)
Government Net Debt Iss.		-0.047		0.008		-0.265
		(-1.20)		(0.27)		(-1.19)
Corp. Tax Rate		-0.038		-0.012		-0.154
		(-0.77)		(-0.30)		(-0.57)
Macro vars	No	Yes	No	Yes	No	Yes
Firm controls	No	Yes	No	Yes	No	Yes
Macro vars (1st diff)	No	Yes	No	Yes	No	Yes
Firm controls (1st diff)	No	Yes	No	Yes	No	Yes
Observations	88	83	84	83	88	83

Panel B: Output of the Financial Sector (bus. credit and equity)

	(1)	(2)	(3)	(4)	(5)	(6)
	Debt Iss.	Debt Iss.	Eq. Iss.	Eq. Iss.	DI/Invest	DI/Invest
Output of Finance	0.829	1.497	1.900**	2.525**	7.226**	8.907
	(1.16)	(1.26)	(2.25)	(2.22)	(2.04)	(1.17)
Government Net Debt Iss.		-0.023		0.022		-0.060
		(-0.89)		(0.92)		(-0.43)
Corp. Tax Rate		0.020		-0.043*		0.173
		(0.82)		(-1.93)		(0.99)
Macro vars	No	Yes	No	Yes	No	Yes
Firm controls	No	Yes	No	Yes	No	Yes
Macro vars (1st diff)	No	Yes	No	Yes	No	Yes
Firm controls (1st diff)	No	Yes	No	Yes	No	Yes
Observations	91	84	85	84	91	84

Panel C: Income Share of the Financial Sector

	(1) Debt Iss.	(2) Debt Iss.	(3) Eq. Iss.	(4) Eq. Iss.	(5) DI/Invest	(6) DI/Invest
Income share of Finance	0.111	-0.327	0.105	1.857***	1.115*	-3.447
	(0.85)	(-0.45)	(0.77)	(3.18)	(1.67)	(-0.84)
Government Net Debt Iss.		-0.039		0.020		-0.175
		(-1.57)		(0.88)		(-1.31)
Corp. Tax Rate		0.003		-0.079***		0.070
		(0.10)		(-3.00)		(0.47)
Macro vars	No	Yes	No	Yes	No	Yes
Firm controls	No	Yes	No	Yes	No	Yes
Macro vars (1st diff)	No	Yes	No	Yes	No	Yes
Firm controls (1st diff)	No	Yes	No	Yes	No	Yes
Observations	90	83	84	83	90	83

Figure A.1
Government Leverage

The figure presents a stacked area chart of government debt at the federal, state, and local levels. We normalize these levels by GDP.