The Secular Decline in Private Firm Leverage

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Abstract

Using firm-level administrative tax data, we document dramatic reductions in private leverage since the Global Financial Crisis, while leverage among public firms rose during this period. Changing firm characteristics are unable to account for this pattern. Younger and smaller private firms experience large declines in leverage. Reduced leverage among private firms is correlated with lower investment. The decline in private firm leverage and investment is strongly related to plausibly exogenous increases in local area bank capital requirements. Our findings suggest that banks' credit supply plays a prominent role in explaining the leverage pattern of private firms.

Keywords: Corporate finance, debt, leverage, private firms.

JEL Codes: E22, E32, E44, G32.

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How do firms choose their leverage? This question has been at the heart of corporate finance since at least Modigliani and Miller (1958). More broadly, understanding firms' decisions regarding their leverage is of fundamental interest, as a large literature in finance and macroeconomics has shown that leverage affects firms' response to aggregate economic shocks (Bernanke, Gertler and Gilchrist, 1999; Schularick and Taylor, 2012).[1] Despite a secular decrease in the number of public corporations and the fact that 43% of U.S. business debt outstanding is from privately held companies, most extant research on corporate debt levels has focused on public firm data. This paper uses detailed and representative administrative tax data in the United States to document that private firms adhere to significantly different leverage patterns than their more widely studied public counterparts.

We find that private firms reduced their leverage between 8 to 25 percent over our sample period of 2004 to 2018, depending on the leverage measure used. Private firms' leverage steadily declined following the financial crisis and the Great Recession. In contrast, publicly traded firms increased their leverage over our sample period, experiencing pro-cyclical peaks in 2008 and towards the end of our sample. At the beginning of the sample period, private firms have between 6% to 15% higher leverage than public firms, depending on the leverage definition used, but by 2018 this leverage gap had effectively closed. The fundamentally different patterns in leverage between private and public firms, which can be seen in Figure 1, are the focus of this paper. We assess their robustness and sensitivity in different contexts and relate them to the theories of firm leverage and lending frictions in an effort to shed light on the leverage dynamics of a substantial portion of the U.S. economy.

Our findings on leverage dynamics are robust to including standard firm-level predictors of leverage (size, age, profitability, and asset tangibility). Whether controlling for these predictors at the firm level in regressions, or sorting the data into quintiles across these predictors, the message is the same: private firms experience steadily declining leverage, while public firms experience flat or increasing leverage. Even the largest one percent of private firms—which are arguably the most comparable to public firms—exhibit a decline in leverage. Moreover, the differential pattern in leverage dynamics holds across different

[1]Since the Great Recession, policymakers and academics have pointed to rising corporate debt levels as a potential concern in amplifying economic fluctuations (Kaplan, 2019) as well as a concern for stability of the financial system (Federal Reserve, 2021; Powell, 2019).

industries and there is no clear geographic explanatory pattern.

The decline in leverage we observe is the strongest among smaller and younger private firms. These firms are likely the most vulnerable to credit market frictions (Hadlock and Pierce, 2010). These firms are also the ones that experienced the strongest pullback in new lending in the wake of the Great Recession. Specifically, the number of new loans originated to businesses with less than $1 million in sales fell 38% between 2007 and 2018 for banks that have Community Reinvestment Act reporting requirements. Moreover, we find that firms do not substitute into other forms of finance such as leased capital that might obviate financial frictions they face. Unlike public firms, which have better access to both equity and debt capital markets, private firms have limited sources of alternative capital.

Leverage changes as firms grow, issue equity, or issue debt. Decomposing the drivers of leverage, we see asset growth amongst both public and private firms over time; however, public firms have greater asset growth than private firms. Specifically, public firm assets increase by 170% across our sample period, compared to 120% for private firms. Moreover, in public firms, liabilities and debt grow even faster than assets. In contrast, among private firms, liabilities and debt grow more slowly than assets. These results are consistent with public firms levering up, as many academics and market observers have observed. At the same time, we find that private firms are levering down, driven by asset growth that outstrips borrowing.

Asset growth increasing faster than leverage could be an indication that private firm investment is being held back. We explicitly test the link between leverage and investment among public and private firms. Consistent with prior literature (Lang, Ofek and Stulz, 1996), we find that leverage is negatively correlated with investment for public firms. However, we find that for private firms, leverage is positively correlated with investment. Hence the decline in leverage we observe may have reduced the investment of private firms. On average, a one standard deviation increase in leverage is linked with a 1.6% increase in investment intensity. To put this in context, for private firms, a standard deviation change in leverage has approximately one-third of the effect of a standard deviation in sales growth (a proxy for investment opportunities).

These stylized facts are mostly consistent with a reduction in the supply of capital fol-

lowing the financial crisis that affected private firms more. We next validate these stylized facts using cross-sectional variation in the supply of capital following the financial crisis. Specifically, we exploit the increase in bank capital requirements enacted as part of the Dodd-Frank Act of 2010. After this policy change, any banks newly required to increase capital holdings may have reduced business lending to do so. We examine the relationship between county-level bank capital ratios and leverage following Buchak et al. (2018), Gopal and Schnabl (2022), and Gropp et al. (2019). We find that a significant portion of private firms' leverage declines from 2007 to 2016 is associated with the change in local bank capital ratios—explaining about 15% of the leverage decline overall for private firms and about 20% of the leverage decline for private firms in the smallest two size quintiles. We also show that affected firms reduced investment and did not increase their equity. The results are consistent with the view that private firms face stronger lending constraints than public corporations.

We are careful to note that we do not have random assignment of listing status, nor do we have random assignment of leverage in our investment regressions. With this caveat in mind, the stylized facts are consistent with an effect driven by the higher sensitivity of private firms to credit supply shocks. Two non-exclusive explanations can rationalize the higher sensitivity of private firms' leverage to credit supply shocks. First, private firms' debt growth could be more stifled by credit rationing than public corporations because private companies are more opaque than public firms. Public firms are required to disclose information in filings with the Securities and Exchange Commission, while private firms are not. The opacity of private firms exposes them to heightened information frictions. The level of asymmetric information is a crucial friction that underpins theories of credit rationing (Stiglitz and Weiss, 1981), which explains why private firms are more likely to face a reduction in credit following a negative credit supply shock. Second, private firms' asset growth depends more on credit than public corporations because it is less costly for public corporations—compared to private companies—-to tap into the public equity market to finance their projects. Indeed, the owner's preferences in maintaining control are one of the main reasons why private firms are private (Pagano, Panetta and Zingales, 1998). Equity issuance among private firms is also more costly than for public firms because minority shareholders of private firms do not

benefit from the same level of protection and disclosure as public firms.

Our paper relates to the literature on capital structure and firm ownership (Graham and Leary, 2011). We use a representative panel of U.S. private firms to study their leverage dynamics. We show several stylized facts highlighting the role of time-varying credit constraints in explaining the leverage patterns of private firms. The literature has examined the role of taxes (MacKie-Mason, 1990; Graham, 1996; Ivanov, Pettit and Whited, 2020), legal developments (Graham, Leary and Roberts, 2015), asset redeployability (Rauh and Sufi, 2010), financial flexibility (Gamba and Triantis, 2008; DeAngelo, DeAngelo and Whited, 2011; Denis and McKeon, 2012; Li, Whited and Wu, 2016), bankruptcy distress (Almeida and Philippon, 2007), and crowding-out effects of sovereign bonds (Graham, Leary and Roberts, 2015) as potential explanations for changes in leverage. However, at least in the U.S. context, this literature has focused on public firms. The exception is Ivanov, Pettit and Whited (2020), who investigate the impact of tax changes on private firm leverage. They highlight that the higher bankruptcy risks faced by private firms create a negative relationship between leverage and taxes. The reason is that lower taxes make firm profits higher and reduce the likelihood of default. As credit spreads drop, private firms have an incentive to increase leverage. Our paper shares the same insight that private firms' borrowing costs may vary more over time than those of public corporations. While Ivanov, Pettit and Whited (2020) stress the impact of taxes, we highlight the higher sensitivity of private firms to credit supply shocks.

We also contribute to the literature on the long-run economic consequences of the 2008 financial crisis. Giroud and Mueller (2017) show that firms with ex-ante higher leverage are more likely to lay off workers if they are more exposed to a drop in local demand, thus reinforcing the economic downturn. We show that leverage declines, on the other hand, could generate negative long-term consequences on investment among private firms. One implication of our findings is that the rise of alternative financing sources (Kwon, Lowry and Qian, 2020; Davydiuk, Marchuk and Rosen, 2020; Ewens and Farre-Mensa, 2022; Gopal and Schnabl, 2022), including fintech lending and private equity, appears not to have fully maintained the level of private investment that would have obtained had traditional bank lending stayed the same.

1 Background and data description

We study three types of businesses as defined under the U.S. tax code——C corporations, S corporations, and partnerships. C corporations are incorporated firms that are subject to the corporate income tax. Virtually all public companies (i.e., firms with publicly traded equity) are C corporations, but many private firms organize as C corporations as well. S corporations and partnerships, in contrast, are "pass-through" businesses that do not pay corporate income tax. Instead, their business income and deductions "pass through" to their owners and are taxed at the owner level. Virtually all pass-through businesses are privately owned. S corporations are generally owned by individuals and are subject to a number of other requirements: they must be domestic corporations, for example, they may not have more than 100 shareholders, and they must only have one class of stock.[2] Partnerships are unincorporated firms with two or more owners. They may be owned by individuals or other businesses, including international firms. Multi-member limited liability companies are treated as partnerships by default, though they may elect S or C corporation treatment. In this paper, we do not study the other common type of U.S. business, sole proprietorships (i.e., an unincorporated business with one individual owner, including single-member limited liability companies), because their tax filings do not include the information necessary to measure leverage.

Both pass-through businesses and C corporations face a more favorable tax treatment for debt, rather than equity, financing. In particular, interest payments on debt are generally deductible from taxable income, while dividend payments to owners are not. Thus, the tax code consistently incentivizes both private and public firms towards higher leverage throughout our sample period. One important caveat, though, is that since 2018 the interest expense deductions of both pass-through businesses and C corporations have been subject to a cap under Section 163(j) of the Internal Revenue Code. To the extent it is binding, the cap eliminates the tax preference for debt versus equity financing on the margin. However, in our sample, only 12% of C corporations, 4% of S corporations, and 13% of partnerships

[2]Certain trusts and estates may also hold S corporation stock. Some firms are ineligible for S corporation status, including certain financial institutions, insurance firms and domestic international sales corporations.

had their interest expense deductions limited by Section 163(j) in 2018.[3]

By measuring leverage and its trends over time, our research can help policymakers evaluate the soundness of the tax code's continued subsidization of debt financing. Equally important is an understanding of the relationship between leverage and outcomes such as firm investment, a driver of economic growth which we examine. These issues are especially relevant given the recent changes to Section 163(j), as this is an evolving area of tax policy.

1.1 Sample construction

We use a stratified random sample of U.S. corporate and partnership tax returns covering tax years 1994 to 2019. The sample is constructed, cleaned, and edited by the Internal Revenue Service's Statistics of Income (SOI) division each year and we refer to this dataset as the "SOI sample." It is stratified differently by tax form (Statistics of Income, 2013). Form 1120 (the most common form filed by C corporations) is stratified by total assets and so-called "proceeds", defined as the greater of (i) the absolute value of net income and (ii) the sum of net income, various depreciation amounts, and depletion.[4] Form 1120S (the form filed by S corporations) is stratified by total assets and ordinary business income. Form 1065 (the most common form filed by partnerships) is stratified by total assets, industry, and an income measure including both ordinary business income and portfolio income (Decarlo and Shumofsky, 2015). For all business types, large businesses are sampled with probability one. For example, in the 2013 sample, Form 1120 filers with at least $50 million of assets or $10 million of proceeds are sampled with certainty, as are Form 1120S filers with at least $50 million of assets or $10 million of ordinary business income.[5]

To construct the analysis sample, we drop any firm-year observation in the SOI sample with nonpositive values for either assets or gross receipts. We exclude foreign firms and publicly traded partnerships. For most of our analyses, we drop tax years prior to 2004. This is the year the Schedule M-3 was first used, which crucially allows us to identify public

[3]Our tabulations using SOI sample weights indicate that the Section 163(j) cap was binding in 2018 for only 1.2% of C corporations, 0.4% of S corporations, and 1.6% of partnerships nationwide. It is more binding in our sample, which skews towards larger firms, in part because Section 163(j) does not apply to firms with little gross receipts.

[4]The SOI sample also includes data from Forms 1120-F, 1120-L, 1120-RIC, 1120-REIT, and 1120-PC.

[5]The thresholds for sampling partnerships with certainty are not made public, nor are the thresholds for corporations beginning with the 2014 sample.

versus private status in the tax data. We also exclude observations in the finance and utilities sectors for most of our analyses, where finance is defined broadly to encompass insurance and real estate.

1.2 Variable construction

To measure leverage, we use firm balance sheet information reported on Schedule L of the Forms 1120, 1120S, and 1065. Instructions for these forms state that "the balance sheets should agree with the corporation's books and records" ("the partnership's books and records" on the Form 1065) and therefore should conform to balance sheet data as reported in financial statements. However, there may be less consolidation in tax data than in financial reporting. A consolidated group for tax purposes must meet an 80 percent ownership threshold, whereas a 50 percent threshold is used for financial reporting.

Here we describe some of our key variables.[6] Total assets are drawn from Schedule L line 15(d). We define total debt as the sum of short- and long-term debt (Schedule L lines 17 and 20). We define liabilities as the sum of total debt, other current liabilities (Schedule L line 18), loans from shareholders (Schedule L line 19), and other liabilities (Schedule L line 21). Equity is defined as total assets less liabilities. Capital is defined as the sum of total debt and equity. Our primary two leverage measures are the ratios liabilities-to-assets and debt-to-capital. We censor both at zero and one at the firm-year observation level, and we code debt-to-capital as one whenever capital is nonpositive.[7]

Data on firm sales, profitability and age are sourced from the main pages of business tax returns. Total sales are defined as gross receipts net of returns and allowances (line 1c). We define profitability as earnings before interest, taxes and depreciation (EBITDA) following Zwick (2021): taxable income before net operating loss deductions and special deductions (line 28) plus interest (line 18) plus depreciation (line 20) plus depletion (line 21) plus the domestic production activities deduction (line 25) plus compensation of officers (line 12) plus charitable contributions (line 19). We calculate age as the difference between the current tax year and year of the firm's date of incorporation, as reported in Box C. We define industry

[6] A full accounting of our variable construction is given in Appendix A. We report variable definitions using Form 1120 line numbers here; references to line numbers for other forms are available in Appendix A.

[7] Assets are always positive according to our sample restrictions.

using the first two digits of the firm's self-reported NAICS code.

We use data on capital investment from Form 4562 (the depreciation and amortization schedule), data on research and development investment from Form 6765 (the form relevant to claiming the research and experimentation tax credit), and data on property plant and equipment from Schedule L. We define investment as the sum the values of assets placed in service for 3-, 5-, 7-, 10-, 15-, 20- and 25-year property; residential and nonresidential real property (lines 19(a) to 19(i), column (c)); assets placed in service under the alternative depreciation system (lines 20(a) to 20(c), column (d)); special depreciation allowance (line 14); property subject to section 168(f)(1) (line 15); and other depreciation (line 16). We define R&D investment as the maximum of the value reported on line 9 and reported on line 28. We utilize data on net property plant and equipment as reported line 19b (column (d)).

Finally, to identify private or public status, we first code all pass-through firm observations as privately owned.[8] Next, for C corporations, we use data from Schedule M-3. An observation is coded as publicly traded if there is a stock ticker symbol (line 3b) or if the firm indicates filing SEC Form 10-K (line 1a). Firms that do not attach Schedule M-3 are coded as privately owned, which introduces some measurement error, as the schedule is required only for firms with at least $10 million in assets, and some firms below this threshold are in fact publicly traded. However, based on Compustat data, we estimate that only 0.3 percent of firms that do not attach Schedule M-3 are misclassified as private.[9]

1.3 Summary statistics

Table 1 displays summary statistics describing our sample over years 2004 to 2018, excluding observations in the finance industry. We have 1.1 million firm-year observations for private firms over the period, and 47 thousand firm-year observations for public firms. On average, leverage is slightly greater for private than for public firms, with a wider standard deviation in leverage for private firms as well. This holds for both of our leverage measures: liabilities-to-assets and debt-to-capital. Private firms are considerably smaller on average than public firms, with average assets of $174 million compared to $6.2 billion for public firms. Private

[8] A few partnerships are publicly traded; we discard them from our data.

[9] To estimate this fraction, we limit our data to 2004-2015 and merge on EIN with the public/private indicator constructed by Feldman et al. (2021). We thank the authors for sharing these data.

firms in our sample are also younger, with an average age of 19 years compared to 26 years for public firms. Profitability (EBITDA-to-assets) and asset tangibility are also higher for private firms than public firms over the sample, though sales growth is higher for public firms.

2 Findings

Using the data described above, we now turn to documenting trends in nonfinancial public and private firm leverage. We begin with graphical analysis, documenting trends in average leverage across all firms and examining whether the trends we observe can be explained by changes in the distribution of firm size, age, industry, geography, or standard variables that have been shown to drive firm leverage in the literature (e.g., profitability or asset tangibility). Next, we test whether the trends hold in a regression framework after including firm and year fixed effects and standard explanatory variable and we test whether firm characteristics observed early in the sample can predict observed firm leverage later in the sample. Finally we consider leverage in the aggregate, showing how patterns in leverage within firms translate to the scale of the economy.

2.1 Overall leverage trends

Figure 1 shows trends in average leverage for private and public U.S. firms in our sample. Panels (a) and (b) show average ratios of liabilities to assets and debt to capital, respectively. Panels (c) and (d) give trends in the same respective measures, but use IRS sample weights (i.e., the inverse of the probability that a given firm-year observation is sampled) to reflect the full population of U.S. firms.

Among public firms, we see a general upward trend in average liabilities-to-assets and debt-to-assets over the sample window, with local peaks reached in 2008 during the global financial crisis, and with the series reaching their highest levels in 2016. From 2004 to 2018, the average liabilities-to-assets ratio among public firms rose from 0.42 to about 0.46, while debt-to-capital rose from about 0.28 to about 0.32. We observe broadly similar patterns in the population weighted-average measures of leverage. This general upward trend in public

firm leverage since the mid-2000s echoes results presented in policy documents based on Compustat data (Federal Reserve, 2021).[10]

Among private firms, we see a different trend over the sample period. Both liabilities-to-assets and debt-to-capital decline for private firms. The average liabilities-to-assets ratio for private firms hovered around 0.49 from 2004 to 2008, then declined to about 0.46 by 2012, and remained nearly flat thereafter. The pattern in average debt-to-capital is similar, though from 2012 to 2018, there was a modest decline in this leverage measure. We also see that private firms altered their leverage less than public firms in response to the 2008 financial crisis.

Looking at the average leverage measures reflective of the population trend, we see a larger and more steady decline in private firm leverage. Population weighted-average liabilities-to-assets dropped from about 0.55 in 2004 to about 0.46 in 2018 and population weighted-average debt-to-capital dropped from about 0.44 to about 0.35 over the same time horizon. This decline, along with the increase in leverage by public firms, results in a near convergence in average leverage between public and private firms at the end of our sample period.[11]

To examine how the leverage patterns are affected by their relative components, we present trends over time for firm liabilities, debt, assets, and capital in Figure 3, with all series indexed to one in 2004. Similar to Figure 1, panels (a) and (b) show unweighted averages, while panels (c) and (d) use the IRS sample weights to reflect the U.S. population of firms. Among public firms, liabilities, debt, assets, and capital all show strong growth over the sample period, but growth in liabilities outpaces assets, and growth in debt outpaces capital. For private firms, the story is different depending on whether we focus on our unweighted sample (which emphasizes larger firms) or the population weighted sample (which is nationally representative). In the unweighted sample, growth in leverage components for private firms keeps pace with public firms' growth up until the financial crisis. After that point, only growth in capital keeps pace with public firms, while growth in assets, liabilities, and debt fall behind. In the population weighted sample, by contrast, growth in all four

[10] In Appendix B, we use Compustat data and show that the pattern in average liabilities-to-assets among public firms in our sample closely mirrors the pattern among Compustat firms.

[11] In Appendix B, when we decompose private firms into C corporations, S corporations and partnerships, we observe a similar downward trend in leverage from 2004 to 2018 for each of these groups, with the exception of a small uptick in leverage among partnerships at the tail end of our sample.

leverage components for private firms lagged behind that of public firms over the full sample period.

2.2 Leverage trends by firm size, age, industry, and geography

How widespread are these trends across different types of firms? We investigate cross-sectional variation in leverage trends beginning with patterns by firm size, measured by sales. We split firms into quintiles based on size, pooling across all years and calculating cutoffs separately for public and private firms. Results are shown in Figure 4, with private firms in panel (a) and public firms in panel (b).

For private firms, we find that leverage ratios trended down among all firm size groups from 2004 to 2018, with the largest declines occurring for the smallest set of firms. We observe a difference in trends, though, before and after the global financial crisis. From 2004 to 2008, for most groups of private firms, the liabilities-to-assets ratio was fairly flat. It is after the financial crisis that leverage begins to turn down notably. Among the smallest quintile, the liabilities-to-assets ratio declined steadily from about 0.52 in 2009 to about 0.47 in 2018. Firms in the other size quintiles, in contrast, show the sharpest declines in leverage in the first few years following the crisis–from 2008 to 2012 particularly. After 2012, leverage flattens out for firms in most size categories. Across the entire sample period, the trends for leverage measures of the full U.S. population of firms are affected notably by the firms with the least sales.

Looking at public firm leverage by firm size, we see that the upward trend in leverage is consistent across most, but not all, size quintiles. For the largest set of firms (the 5th quintile) and the smallest sets (the 1st and 2nd quintiles) we observe an increase in leverage from 2004 to 2018. For firms in the middle of the size distribution, interestingly, we observe that leverage was either about flat (firms in the 4th quintile) or declined slightly (firms in the 3rd quintile).

Since the firm size profile of public and private firms are so different, we next investigate trends in leverage of public and private firms of similar sizes. Figure 5 panel (a) shows trends in assets-to-liabilities for the top five percent largest private firms (measured again by sales) each year and for public firms with sales limited to the same range as these private

firms. Panel (b) shows trends for the very largest private firms—those in the top one percent by sales—and for public firms with sales in the same range.[12] The 95th percentile of sales among private firms varies by year, ranging from $5 to $10 million during our sample period, while the 99th percentile of sales among private firms ranges from $35 to $50 million. Figure 5 shows that, among large private firms, we see essentially the same pattern as for private firms in the top size quintile and overall: a leverage ratio that is about flat from 2004 to 2008, followed by a sharp decline through 2011 or 2012 and then some flattening out or trending upwards a bit thereafter, through 2018. Except for the local peak in leverage in 2008 during the height of the financial crisis, the trends for similarly sized public firms are quite different.

2.2.1 Leverage trends by age

We examine trends by firm age next in Figure 6, with results for the liabilities-to-asset ratios of private and public firms by age quintile presented in panels (a) and (b), respectively. In these figures, quintile thresholds are calculated separately for public and private firms after pooling across all years. The first quintile is the youngest set of firms (private firms ages 4 and below; public firms ages 9 and below) and the fifth is the oldest (private firms more than 32 years of age; public firms more than 37 years of age).

Private firm leverage declines across all age quintiles and we observe fairly similar patterns across the different groups. From 2004 to 2008, leverage was about flat for all quintiles except for the youngest firms; these firms showed some increase in leverage over this period. Following the financial crisis, leverage declines through about 2011 or 2012 for each age category, with the sharpest declines for the youngest firms, and then leverage flattens out for the most part for each group through 2018. We also observe a monotonic pattern in the level of leverage across firms for the private firm sample, with the youngest firms having the highest levels of leverage over the sample period and the oldest firms having the lowest levels of leverage.

For public firms by age groups, we also observe that the youngest firms have the highest leverage levels over the sample period, though leverage levels are not monotonic across the

[12] In both panels, we exclude any public firm observations with more sales than the largest private firm that year.

other age categories. The youngest firms also had the largest increase in leverage from 2004 to 2018. Each age quintile of public firms saw a rise in leverage over the time period.

While the smallest and youngest set of private firms appear on inspection to have the largest declines in leverage, it is possible that these results are driven by composition effects to the extent that firms move between different age or size quintiles over time. In Section 3, however, we show a similar pattern in within-firm changes in leverage between 2004 and 2018: the smallest and youngest private firms (measured in 2004) experience the largest long-run declines in leverage.

2.2.2 Leverage trends by industry

Next, to study leverage by industry in Figure 7, we use self-reported two-digit industry codes from firm tax filings, which generally correspond to two-digit NAICS codes.[13] The figure shows that divergent trends in public and private firm leverage are found across most industries.

For public firms, seven of the ten nonfinancial industries saw leverage increase over the sample period. Industries with the largest increases in leverage included accommodation and food (Panel h, about a 10 percentage point increase from 2004 to 2018), fossil fuels (Panel i, also about 10 percentage points), and retail trade (Panel e, about a 7 percentage point increase). The other three nonfinancial industries saw a decline in public firm leverage: agriculture and mining (Panel a); construction (Panel b); and transportation and warehousing (Panel f).

In contrast, the bulk of private sector industries saw a decline in average firm leverage over the sample period, though several sectors exhibit different trends pre- and post-financial crisis. From 2004 to 2008, for example, leverage ratios increased or were generally flat for private firms in agriculture and mining (Panel a), construction (Panel b), manufacturing (Panel c), wholesale trade (Panel d), information (Panel g), accommodation and food (Panel h), fossil fuels (Panel i), and other industries (Panel j).[14] In most of these industries, private firm leverage declined significantly in the first few years following the financial crisis and then

[13]While firm tax filings report one industry, in reality some firm activities span multiple industries. For these firms, the industry measure is somewhat arbitrary.

[14]The "other" category includes the 0.9 percent of observations with a missing or invalid 2-digit NAICS code.

stabilized between about 2012 and 2018. Overall, private firm leverage declined between 2004 and 2018 in nine of the ten nonfinancial industries, with the exception being fossil fuels (Panel i).

In Panels k, l, and m, we consider financial firms (inclusive of the real estate and insurance industries) and utilities. Throughout the rest of the paper, we will exclude these industries, as the incentives and policies affecting their leverage are markedly different from the rest of the economy. Both public and private financial firms saw an overall decrease in leverage over the period (Panel k), though the decline was steeper after the financial crisis. For public financial firms, the decline was more muted when excluding commercial banks (Panel l). For public utilities (Panel m), leverage increased slightly over time, but for private utilities leverage dropped off notably toward the end of the sample.

In terms of leverage levels, we see considerable heterogeneity across industries and across private and public firms. For the full sample of firms, we saw that average private firm leverage was considerably above public firm leverage at the beginning of the sample, but that leverage levels converged near the end of the sample for public and private firms.

2.2.3 Leverage trends by geography

We next investigate geographic patterns in the change in leverage for public and private firms in Figure 8, using data on firm headquarters location (regardless of state of incorporation) as reported on tax filings. Panels a and b show changes in average liabilities-to-assets within states for private and public firms, respectively. We classify states by whether they experienced an increase or decrease in leverage between 2004 and 2018. Panels c and d also show within-state changes in leverage, but classify states by whether they saw an increase or decrease in leverage of greater than 10 percentage points, 5 to 10 percentage points, or between 5 percentage points and zero.

Virtually all states saw a decline in private firm leverage. Most saw an average decline in private firm leverage of less than five percentage points (in the same range as the national average decline), with 14 states seeing an average decline of greater than 5 percentage points. Private firms saw an increase in average leverage from 2004 to 2018 in only two states: Vermont and Rhode Island.

In contrast, the geographic pattern of public firm leverage is more mixed. Public firms in a majority of states saw an increase in leverage over the sample period, but a sizeable minority saw a decline. Of states with public firm leverage increases, most saw moderate average increases of between zero and ten percentage points—including New York, Massachusetts, Texas and Ohio. States with particularly large increases—greater than 10 percentage points– include California and Rhode Island. Of states that saw a decline in average leverage for public firms, many of these states tend to be home to a relatively small number of public companies—states like Pennsylvania, Louisiana, Indiana, South Dakota, and West Virginia.

2.2.4 Leverage predictors

To analyze whether trends in standard drivers of firm leverage highlighted in the literature are likely to explain the differential trends we observe in public versus private firm leverage, we present four key variables in Figure 9: average firm size (natural log of total sales; Panel a), profitability (EBITDA-to-assets ratio; Panel b), asset tangibility (Panel c), and sales growth (a proxy variable for investment opportunities; Panel d).

Over the sample period, all of these variables trend similarly among public and private firms. Thus they do not appear to explain the divergence in leverage. Average firm size is much larger for public firms than for private firms in the sample, but both grew at a similar rate between 2004 and 2018. Private firms exhibit higher rates of profitability (by around 15 percentage points) and asset tangibility (by around 3 to 5 percentage points) than public firms. While tangibility declined for both firm types between 2004 and 2018, average profitability remained at similar levels. Both the trend and the level of sales growth track remarkably similarly for public and private firms over the sample period. Sales growth was the highest in the beginning of the sample for both types of firms, with growth for public firms outpacing growth somewhat for private firms. Sales growth slowed considerably during the financial crisis, turning negative briefly in 2009. Sales growth recovered the following year, with average growth trending down somewhat from 2010 to 2016 before picking back up in 2017 and 2018.

2.3 Regression analyses

Taken together, the graphical evidence thus far suggests that the leverage decline for private firms is robust across the sample window for firms of different size and age categories, of various industries, and across U.S. geographies. We next investigate whether the trends hold in a regression framework. This allows us to evaluate the statistical significance of the time trends we report in the figures, the importance of control variables that might differ across public and private firms, and the extent to which changing sample composition might be affecting our overall conclusions.

We report a number of regression specifications that all include firm fixed effects in Table 2, with results for the private firm sample in the first three columns and results for the public firm sample in the second three columns. The dependent variable is liabilities-to-assets and we present results for debt-to-capital as robustness in Appendix Table C1. The main regressors of interest are year dummies, whose coefficients should be interpreted relative to the omitted year of 2004. For example, in the first column, we see that private firm leverage was 3.3 percentage points lower in 2019 than it was in 2004, controlling for firm fixed effects. In the second column, we add four traditional predictors of leverage as control variables: size (log sales), sales growth (a proxy for investment opportunities), profitability (EBITDA-to-assets), and asset tangibility. These have little effect on the time trend. For example, the 2019 coefficient continues to indicate a decline in private firm leverage of over 3 percentage points. Finally, the third column we add control variables for alternative methods of financing: equity financing and the cash-to-assets ratio. With the addition of these variables, the 2019 coefficient becomes a little larger, at 3.6 percentage points.

Overall, the table confirms that the trends plotted in Figure 1 remain similar, and are statistically significant, when including control variables and firm fixed effects. The estimated effect of the time trend is large. The average liabilities-to-assets ratio in our sample is 47%. As seen in Table 2 column 1, from 2004 to 2019, private firms reduce leverage by 3.3 percentage points – 7.0% of the sample average. In contrast, in column 4 we see that public firms increased leverage by 12.0 percentage points – 25.5% of the sample average. By including fixed effects, the regression coefficients are interpreted "within" firm, and therefore rule out compositional sample changes as fully explaining the decline in private firm leverage.

It is also worth putting the magnitude of this time trend in context relative to other factors that might matter for leverage. For example, firms with more tangible assets are hypothesized to have better collateral for lenders, and therefore have higher debt capacity. We see this relationship in our estimated coefficient on tangibility, which is positive and statistically significant for both private and public firms, directionally consistent with existing literature studying public firms (Graham, Leary and Roberts, 2015). Our estimate implies that a one standard deviation increase in asset tangibility by a private firm results in a leverage increase of 0.053, thus the time trend effect of -0.031 is roughly 58% of the effect of a one standard deviation decrease in asset tangibility. Estimating the same relative comparison on profitability we find that -0.031 is 116% of the effect of a one standard deviation increase in profitability. Lastly, we estimate that -0.031 is 310% of the effect of a one standard deviation decrease in firm size. These results suggest that the time trend identified in the dummy variables is of a similar order of magnitude as any of the first-order predictors of leverage that existing literature has documented.

An alternative way to assess whether the time trend we identify is linked with firm characteristics is to estimate predictive regressions based on those characteristics. In Figure 10, we examine how well standard predictive regressions of leverage ratios can explain trends in leverage over the sample window. To construct the predictions, we regress leverage on firm-year-level variables including the log of sales, profitability, asset tangibility, and sales growth (reflective of investment opportunities) as well as firm fixed effects, restricting the data to 2004 to 2007. Then we use the regression coefficients to predict leverage in every subsequent year given the observed characteristics in that year, excluding firm fixed effects. Panels a and b present observed (solid line) and predicted (dashed line) average liabilities-to-assets and debt-to-capital, respectively.

We find that the predictive regressions generally do poorly in explaining leverage trends for either public firms or private firms over our sample window. For public firms, the regressions predict an upward trend over the full window, but the predicted upward trend is quite slight compared to the observed trend and observed leverage is much higher than predicted leverage in almost all sample years. This pattern holds true for both liabilities-to-assets and for debt-to-capital. For private firms, the predictive regressions fit fairly well for one year

outside of the regression window—in 2008—but do not capture the subsequent decline. The regressions do predict a bit of a downward trend in the debt-to-capital measure of leverage over the sample window—though the trend is much less pronounced than the observed trend—and the regressions predict a small upward trend in liabilities-to-assets. By 2018, observed leverage is notably lower than predicted leverage for private firms.

2.4 Leverage in the aggregate

Finally, we present trends in economy-wide leverage measures in Figure B5, using SOI sample weights to reflect the population of U.S. firms. Panels a and b show trends in the ratios of aggregate liabilities to aggregate assets and aggregate debt to aggregate capital, respectively. Panels c and d show trends in aggregate liabilities and aggregate debt, respectively, relative to U.S. gross domestic product (GDP).

For private firms, we observe that for each measure, aggregate leverage increased somewhat early in the period—from 2005 to 2008 or 2009–and dipped in the several years following the financial crisis. Then we see some divergence in trends according to the leverage measure used. The ratio of aggregate liabilities to aggregate assets trended down through the end of the sample period for private firms, as did the ratio of aggregate debt to aggregate capital. In contrast, the ratio of aggregate debt to GDP for private firms was about flat from 2011 to 2014 and then showed a bit of an upward trend in the last years of the sample. The ratio of aggregate liabilities to GDP was a bit more volatile after the financial crisis; after declining somewhat from 2012 to 2015, this series ticked up from 2015 to 2016 and then ticked back down from 2017 to 2018. In contrast, for public firms, we see an increase in leverage across all measures from the beginning of the sample to the end of the sample. The increase is largest for the measures with liabilities in the numerator, in panels a and c.

3 Discussion

We have shown that leverage among private firms has declined between 2004 and 2018. Why has this occurred, and what are the consequences? We find that leverage declines among private firms cannot be fully explained by differences in firm characteristics or firm

composition. Moreover, our results hold when including firm level controls and fixed effects. However, several of our figures do suggest at least one potential explanation. Specifically, as we show in Figures 4 and 6, the decline in leverage is largest among small firms and young firms.

We cannot observe the specific financial institutions that make the loans to small private firms, but data from Community Reinvestment Act reporting, as shown in Figure 2, provides some high-level trends in the provision of credit to these types of firms. The dollar value of credit provisioned to companies with sales under $1 million has fallen by 38% since the financial crisis. Recent research has hypothesized that fintech firms have stepped in to fill a portion of the credit that banks have pulled back from providing (Gopal and Schnabl, 2022). Using administrative tax records, we show that leverage has declined relative to assets (though the level of debt has increased). Extant literature has also hypothesized that small and young firms are most likely to face binding credit constraints (Hadlock and Pierce, 2010). We test for these dynamics specifically in Table 3, estimating the change in leverage for different size and age quintiles. We estimate these regressions without an intercept in order to compare statistical significance across each quintile. The sample is composed of firms that exist at both the beginning and end of our sample (2004 and 2018), so the observation count is reduced. In Panel A column 1, leverage (liabilities-to-assets) declines by 7.6 percentage points for the youngest private firms – 16.2% relative to the private firm mean. The oldest private firms experience a long-run leverage decline of only 1.7 percentage points – 3.6% relative to the private firm mean. In contrast, younger public firms experience the largest long-run *increase* in leverage between 2004 and 2018. These patterns are quite similar when measuring leverage as debt-to-capital in columns 3 and 4.

Turning to Panel B, we see that the smallest private firms saw the largest long-run reduction in leverage: 6.1 percentage points (column 1) or 7.3 percentage points (column 3), depending on the leverage measure used. For public firms, the long-run increase in leverage is fairly large across all size quintiles when measuring leverage as liabilities-to-assets, ranging from 5.8 to 7.8 percentage points. However, for the debt-to-capital leverage measure, the increases are more varied, and the largest increase occurs among the largest public firms.

3.1 Leverage and investment

If private firms borrow less, do they invest less? We address this question in Table 4, studying the relationship between investment intensity and leverage. We define investment intensity as the ratio of the sum of capital investment and research and development investment to the prior year's net property, plant, and equipment. Panel A presents results for regressions that include firm and year fixed effects, while Panel B presents results of regressions that additionally include the same control variables as in the predictive regressions.

Consistent with prior literature (Lang, Ofek and Stulz, 1996; Stein, 2003), leverage and investment for public firms is negatively correlated in both Panels A and B. However, for private firms we find a positive correlation. Specifically, a one standard deviation decrease in liabilities-to-assets is associated with investment intensity declining by 0.5 percentage points (using the coefficient 0.014 from Panel B). This is more than a quarter of the effect of a standard deviation change in profitability on investment. These coefficients represent correlations, not necessarily causal relationships, as we do not have an instrument. Nonetheless, we believe these relationships are informative as to how the deleveraging of private firms may be affecting investment in the economy.

3.2 Capital requirements and leverage

One of the most consistent trends we observe is that the steepest decline in private-firm leverage occurred following the GFC. In this section, we evaluate whether a shock to bank credit supply after the crisis can explain this decline. One statutory change of note—enacted as part of the Dodd-Frank Act in 2010—required banks to hold more capital against risky assets on the balance sheet. Banks needing to boost capital holdings may have reduced business lending to do so, in line with findings by Gropp et al. (2019), and therefore we hypothesize that the capital requirements change could have been a factor reducing private firm leverage. As public firms have easier access to public debt and syndicated loan markets, we would not expect the same effect for public firms.

To examine this potential channel, we study the association between changes in local bank capital ratios (LBCRs), which are calculated at the county level, and changes in leverage of private firms. We estimate the following regression specification, which is similar to Buchak

et al. (2018), but uses data for 2007 and 2016 as in Gopal and Schnabl (2022):

$$\Delta \textit{liabilities-to-assets}_{ic} = \alpha + \beta \Delta LBCR_c + X_c + \delta_s + \epsilon_i. \tag{1}$$

The change in the LBCR is constructed by first calculating each bank b's Tier 1 risk-based capital ratio ($T1RBC\%_b$) change from 2007 to 2016: $\Delta CapitalRatio_b = T1RBC\%_{b2016} - T1RBC\%_{b2007}$. Next we aggregate banks to a county-level exposure c, weighting banks by their share of total mortgage originations in the county in 2007:

$$\Delta LBCR_c = 100 \ \times \ \sum_{b \in c} \Delta CapitalRatio_b \frac{MortOriginations_{bc2007}}{\sum_{d \in c} MortOriginations_{dc2007}} \tag{2}$$

We classify a firm i in county c based on the address recorded on the tax return, which represents the "principal office or place of business" according to IRS instructions. In this analysis, we focus on firms in the smallest two size quintiles in 2007, as measured by firm sales, as small firms are the most likely to have lending relationships with banks in the same county as the firm's location—the variation we utilize in this specification. Regressions include a set of county-level economic controls X_c in line with Gopal and Schnabl (2022) and results are presented with and without state fixed effects δ_s as well. Standard errors are clustered at the county level.

The regression results in presented in Table **??** indicate that a significant portion of private firms' decrease in leverage from 2007 to 2016 is associated with the change in the LBCR. The average change in the LBCR over this period in two smallest of private firms is +1.01. The Panel A coefficient of -0.007 (column 2, which includes state fixed effects) thus implies a 70 basis point decrease in leverage (assets-to-liabilities) from 2007 to 2016—explaining about 20% of the overall leverage decline (338 basis points) for these firms.

Observing this relationship between leverage and the increase in bank capital requirements raises the question: are firms simply substituting equity issuance for leverage as a result? A growing literature studies the growth in non-traditional (i.e., non-bank) sources of business capital for private firms over the past several decades, with some work demonstrating that these alternative capital sources have stepped in to provide financing as bank lending to private firms declined following the Global Financial Crisis (GFC) (Kwon, Lowry and Qian, 2020; Davydiuk, Marchuk and Rosen, 2020; Ewens and Farre-Mensa, 2022; Gopal

and Schnabl, 2022; Fonseca and Wang, 2022).

We investigate this question by studying the relationship between the capital requirement change and the intensive and extensive margin of post-Dodd-Frank Act equity issuance. Panel B of Table **??** presents results from estimating Equation (2) with two equity issuance variables: 1) the natural log of equity issuance in 2016 as the dependent variable (columns 1 and 2)—the intensive margin of issuance, and 2) and an indicator variable for positive equity issuance in 2016 (columns 3 and 4)—the extensive margin of issuance. The sample of firms is again those in the smallest two size quintiles.

On the intensive margin of issuance, we observe some negative relationship between the bank capital ratio change and issuance in column 1. We note, however, that the number of observations included in the regressions are quite small as positive equity issuance is not common and that the results are not particularly robust—we observe no significant effect after including state fixed effects in the regression.[15] On the extensive margin of issuance, we observe a weak positive result. Including state fixed effects, a one percentage point increase in the bank capital area is weakly associated with a 0.4 percentage point higher probability of equity issuance. Compared to the mean equity issuance probability of 7.5 percent in the sample in 2016, this represents about a 5 percent increase. On the whole, we do not find an specially strong relationship between post-Dodd-Frank Act capital requirement changes and the equity issuance of small firms.

3.3 Capital requirements and investment

Finally, we study the investment effects of bank capital requirement changes. If small businesses are simply substituting debt financing for equity financing after the financial crisis, we would observe little effect on investment overall. But if the decline in leverage indicates that firms have become more financially constrained, firm investment may have declined as a result of the regulatory changes. Panel C of Table **??** presents results from estimating Equation (2) for sample of the smallest two size quintiles of firms on post-GFC measures of the intensive and extensive margin of investment: the natural log of firm investment in

[15]Note that the number of observations included in this specification is different than in Panel A because we require data for 2015 and 2016 to calculate issuance in 2016.

2016 (columns 1 and 2) and an indicator variable for investment in 2016 (columns 3 and 4), respectively.

We find that the capital ratio increase is associated with a decrease in the intensive margin of investment for small firms. The coefficient in the natural log specification is interpreted as a semi-elasticity, whereby a one percentage point increase in the local area bank capital ratio is associated with 7 percent lower firm investment in 2016 (column 2, specification including state fixed effects). In contrast, we find no significant effect on the extensive margin of investment. While the rise in non-traditional financing sources post-GFC has been well documented, these results suggest that private firms may have remained financially constrained over the sample period and that alternative sources of capital have not filled the full gap in post-GFC bank lending to private firms.

4 Conclusion

In this paper, we utilize a sample of U.S. public and private firms drawn from corporate and noncorporate business tax returns to document a sizeable decline in private firm leverage from 2004 to 2019. In striking contrast, public firms have experienced an upward trend in leverage over the same period. We show that these leverage trends are robust across private and public firms of different sizes, ages, industries, and geographies, and the trends are not explained by standard predictive regressions using firm-level characteristics. Lastly, we document that the deleveraging of private firms is strongly related to a bank lending supply shock and linked with reduced investment.

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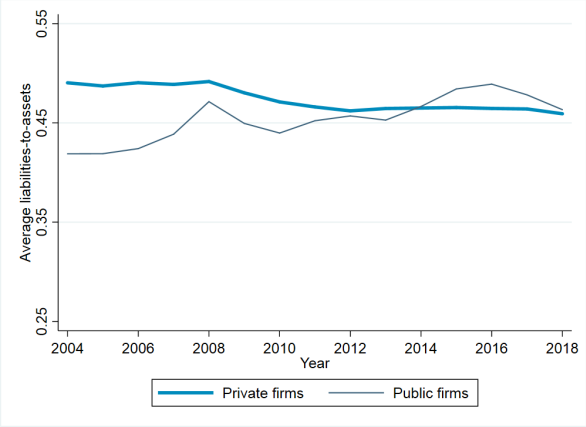
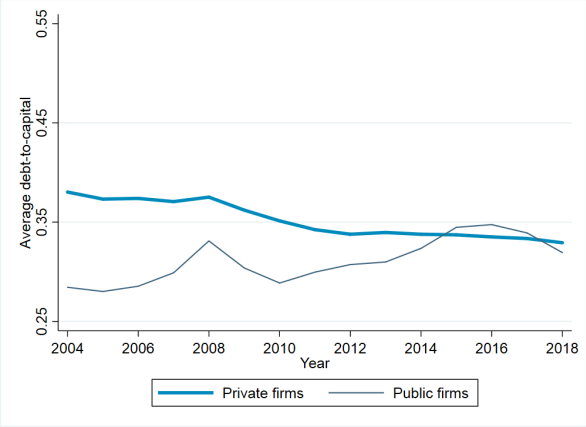
Figures

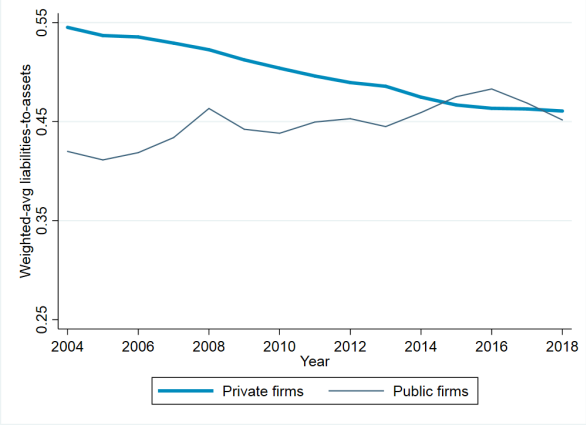
Figure 1: Average leverage



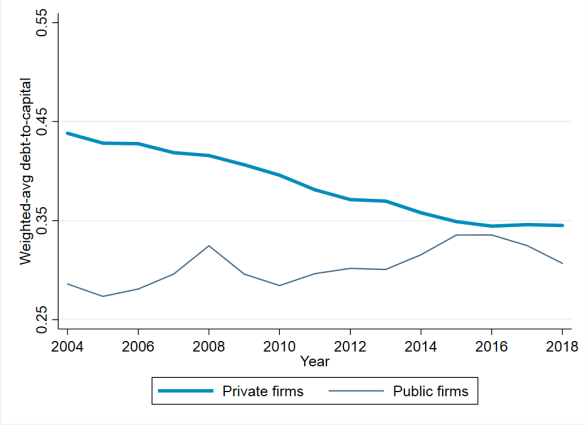
(a) Liabilities-to-assets



(b) Debt-to-capital



(c) Liabilities-to-assets (SOI weights)

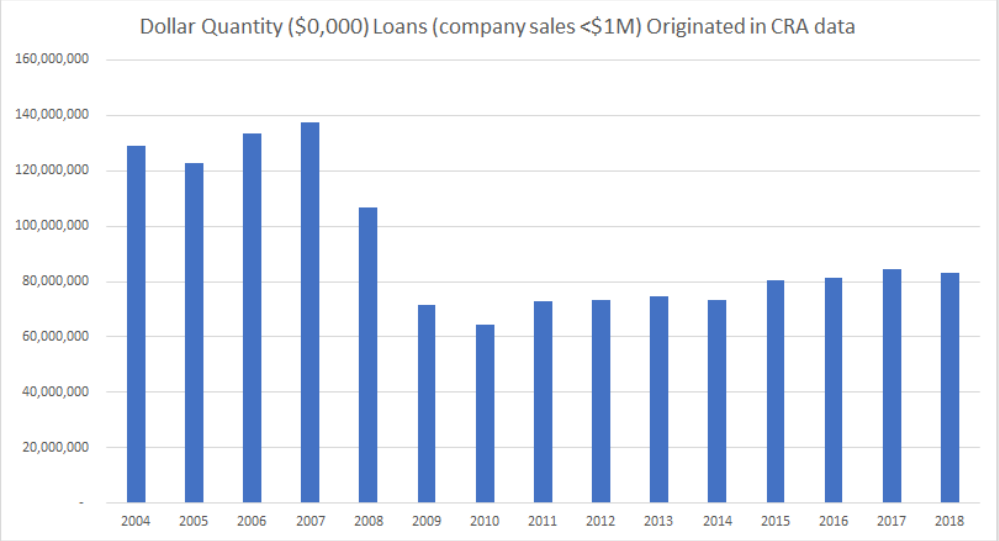


(d) Debt-to-capital (SOI weights)

Panels a and b present trends in means of the ratios liabilities-to-assets and debt-to-capital, respectively, for public and private firms included in our sample. Panels c and d present weighted averages of the same measures using IRS sampling weights. Both ratios are censored at zero and one before calculating means. Observations in the finance and utilities industries are excluded. All panels were created by the authors using cleaned and edited data from the IRS.

Figure 2: Small business lending

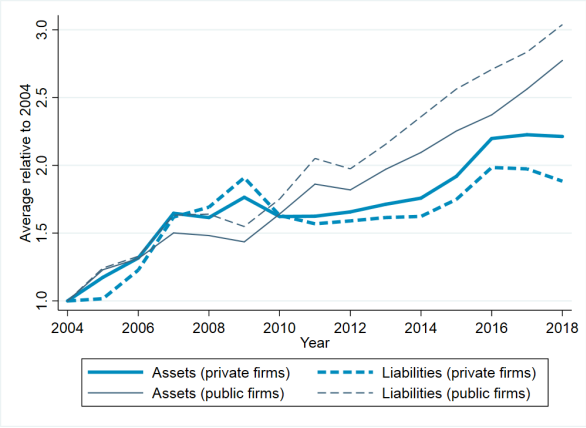
(a) Number of small business loans



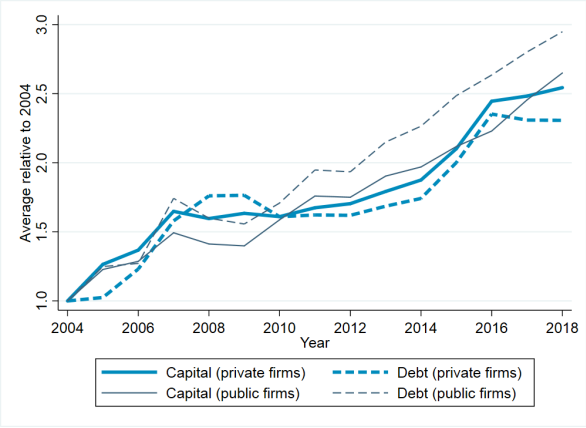
(b) Dollar quantity of small business loans

Panels a and b report lending behavior from Community Reinvestment Act (CRA) loan data. Panel a reports the number of small business loans made in a given year to businesses with less than $1 million in sales, while Panel b reports the dollar quantity of loans made to small businesses.

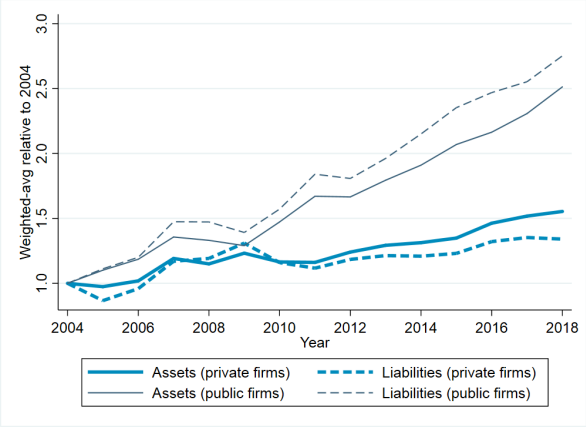
Figure 3: Relative growth in leverage components



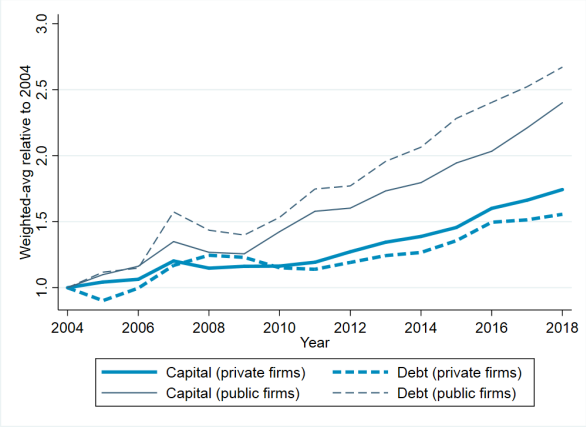
(a) Average liabilities and assets



(b) Average debt and capital



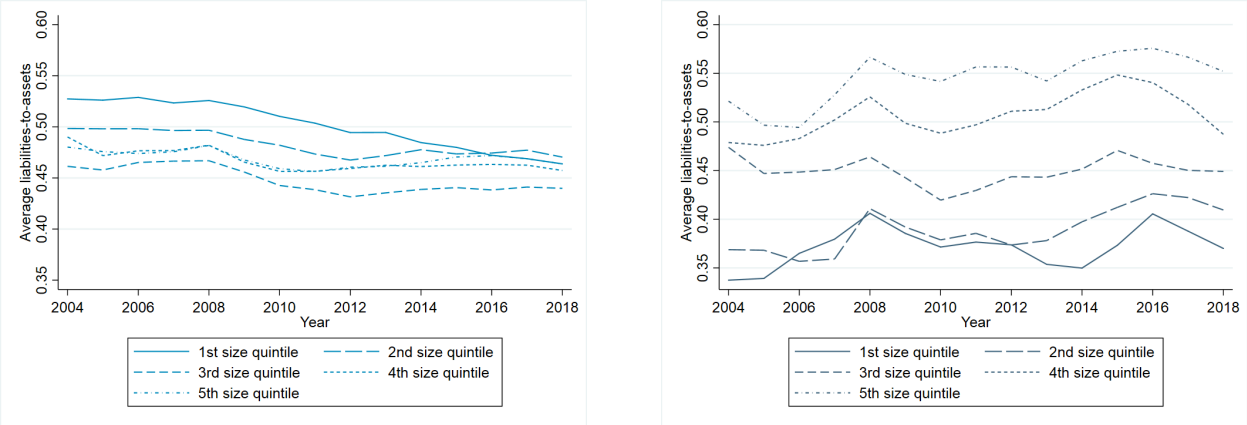
(c) Average liabilities and assets (SOI weights)



(d) Average debt and capital (SOI weights)

This figure presents trends in leverage components for public and private firms included in our sample, with and without sample weights. Panel a shows average liabilities and average assets divided by the 2004 average (computed separately for public and private firms). Panel b shows average debt and capital divided by the 2004 average (again computed separately for public and private firms). Panels c and d are analogous to Panels a and b but use sample weights to calculate weighted average values in all years. Observations in the finance and utilities industries are excluded. All panels were created by the authors using cleaned and edited data from the IRS.

Figure 4: Leverage by size

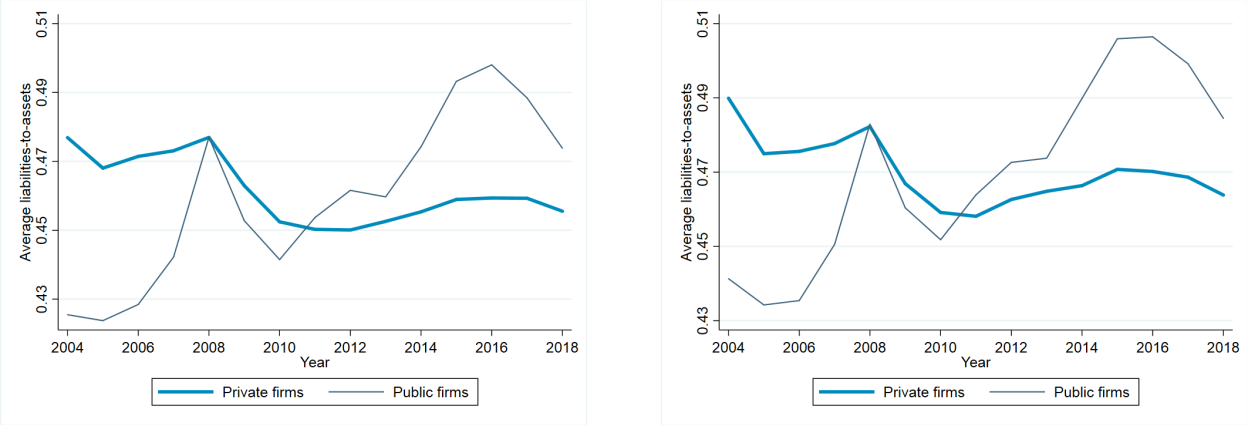


(a) Private firms

(b) Public firms

This figure presents trends in average leverage (liabilities-to-assets) for public and private firms included in our sample, by firm size quintile. The leverage measure is censored at zero and one before calculating means. Size is measured by sales, and quintile thresholds are defined separately for public and private firms, pooling across all years. The first quintile is the smallest. Observations in the finance and utilities industries are excluded. The (blurred) quintile cutoff points for private firms are $1.2, $7.4, $29.1, and $89.9 million; for public firms they are $55.9, $209.2, $614.5, and $2,008.3 million. All panels were created by the authors using cleaned and edited data from the IRS.

Figure 5: Leverage in the largest private firms

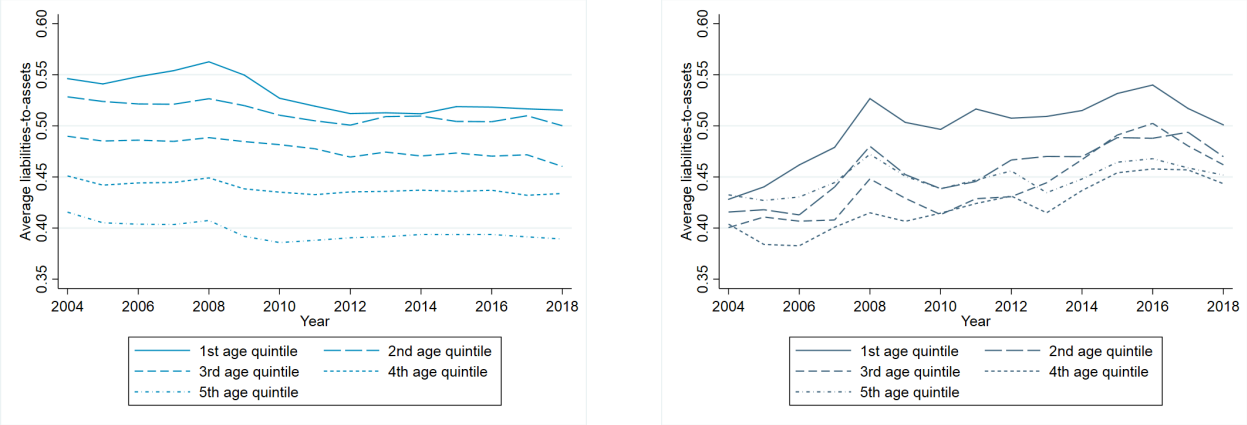


(a) Top-five-percent largest private firms

(b) Top-one-percent largest private firms

This figure presents trends in average leverage (liabilities-to-assets) for the largest private firms included in our sample as well as public firms in the same size range. In panel a the samples of public and private firms are both restricted to firms whose size, as measured by sales, would put them in the top five percent of private firms. In panel b we limit to firms whose size would put them in the top one percent of private firms. In both panels, we define the percentile cutoffs (using sample weights) separately each year and we exclude firms larger than the largest private firm. The leverage measure is censored at zero and one before calculating means. Observations in the finance and utilities industries are excluded. All panels were created by the authors using cleaned and edited data from the IRS.

Figure 6: Leverage by age

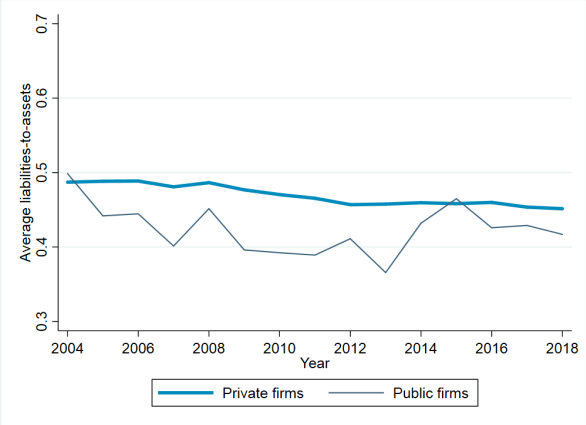


(a) Private firms

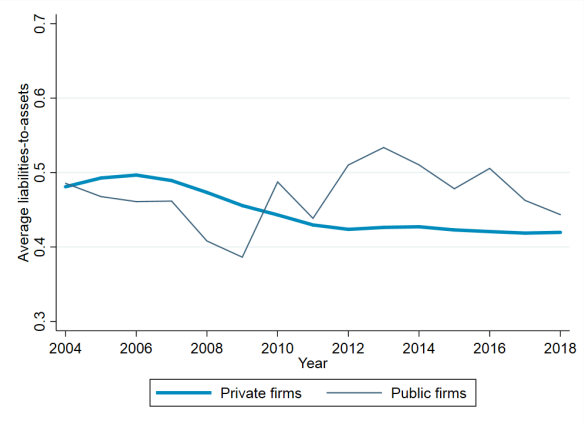
(b) Public firms

This figure presents trends in average leverage (liabilities-to-assets) for public and private firms included in our sample, by firm age quintile. The leverage measure is censored at zero and one before calculating means. Quintile thresholds are defined separately for public and private firms, pooling across all years. The first quintile is the youngest. Observations in the finance and utilities industries are excluded. The (blurred) quintile cutoff points for private firms are 4, 10, 19, and 32 years of age; for public firms they are 9, 15, 23, and 37 years of age. All panels were created by the authors using cleaned and edited data from the IRS.

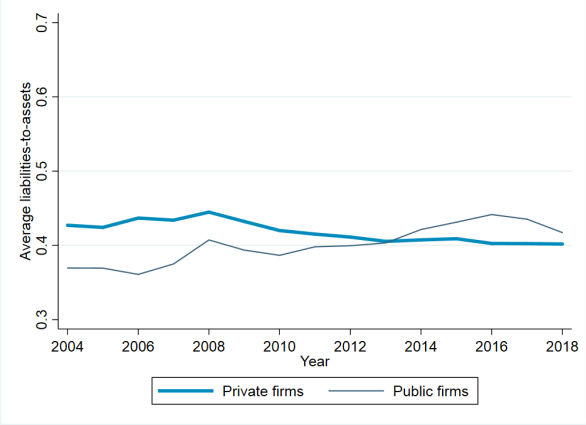
Figure 7: Leverage by industry



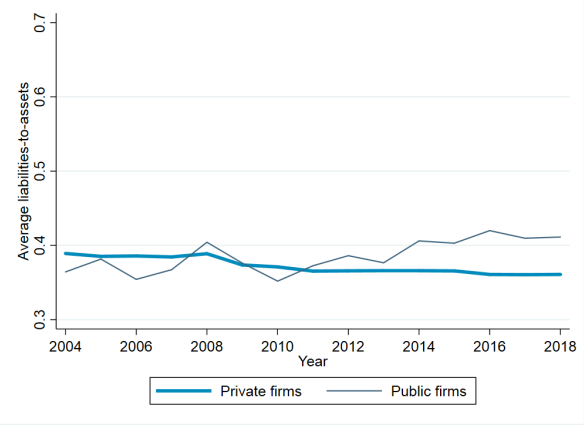
(a) Agriculture and mining



(b) Construction



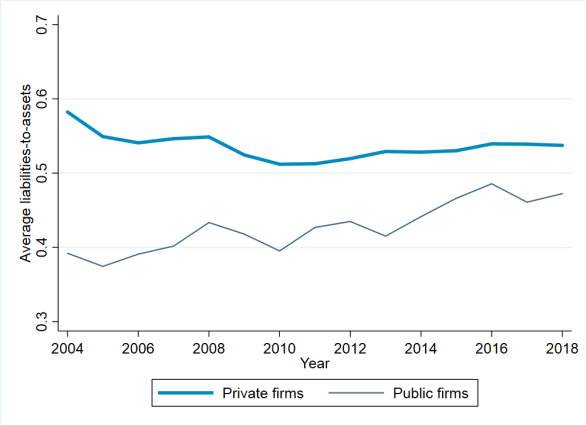
(c) Manufacturing



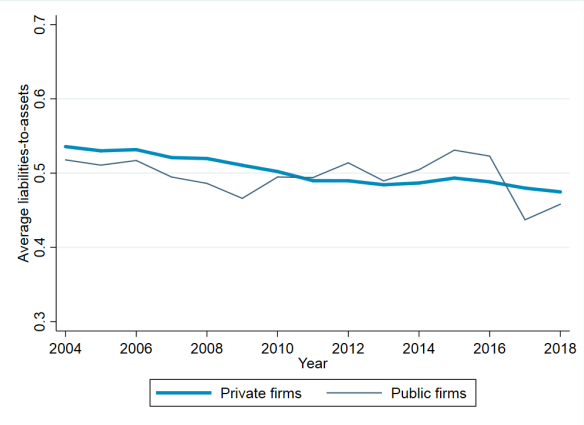
(d) Wholesale trade

This figure presents industry-specific trends in average leverage (liabilities-to-assets) for public and private firms included in our sample. The leverage measure is censored at zero and one before calculating means. The finance industry includes insurance and real estate. Fossil fuel firms are excluded from Panels a and c—agriculture/mining and manufacturing, respectively. Panel j presents all firms not contained in Panels a through i and not contained in Panels k or m. All panels were created by the authors using cleaned and edited data from the IRS. The figure has thirteen panels and continues on subsequent pages.

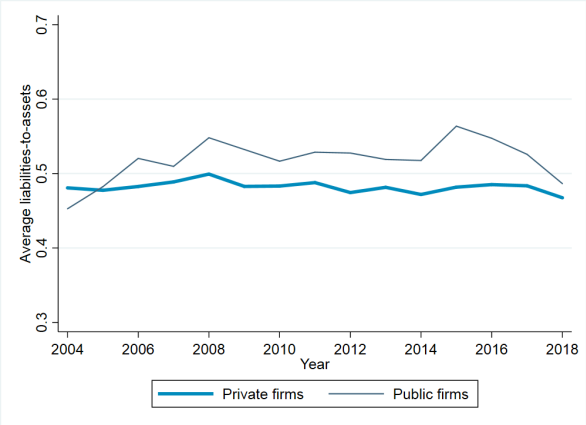
Figure 7: Leverage by industry (continued)



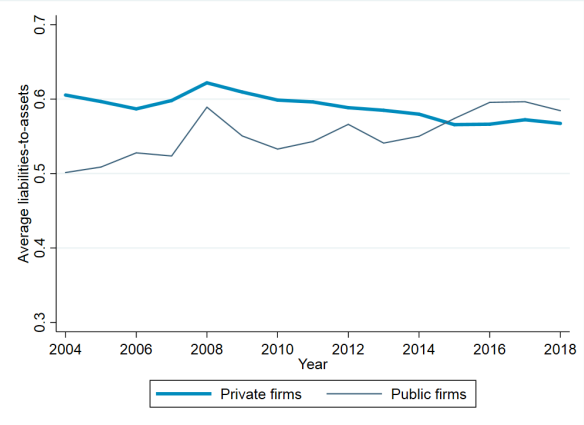
(e) Retail trade



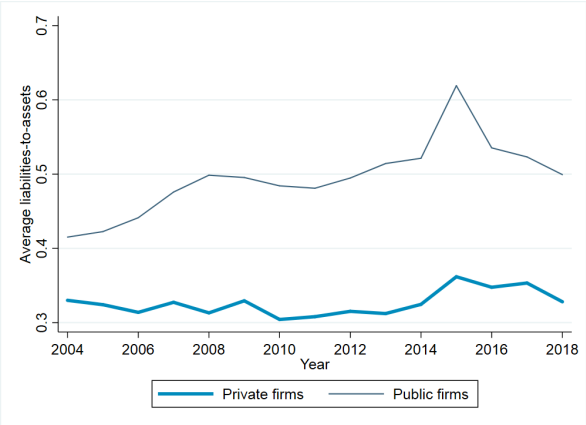
(f) Transportation and warehousing



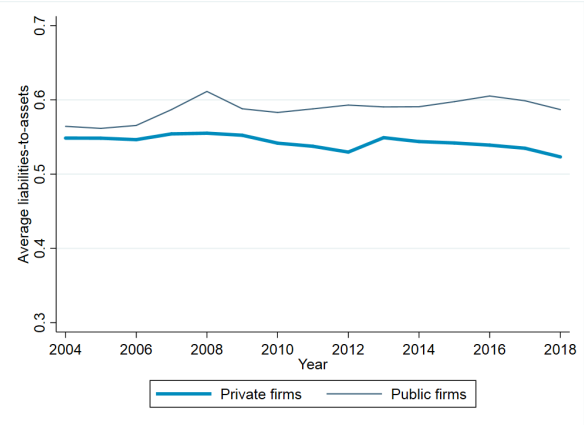
(g) Information



(h) Accommodation and food

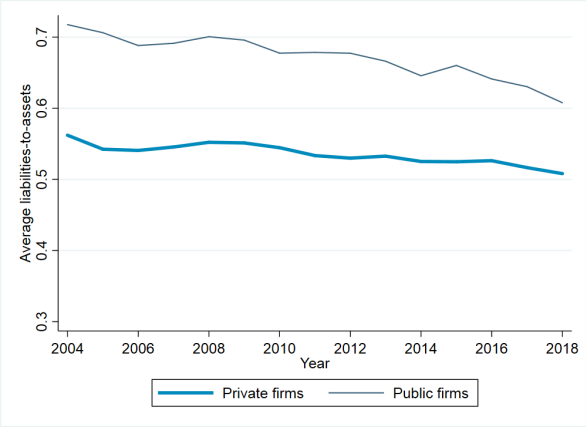


(i) Fossil fuels

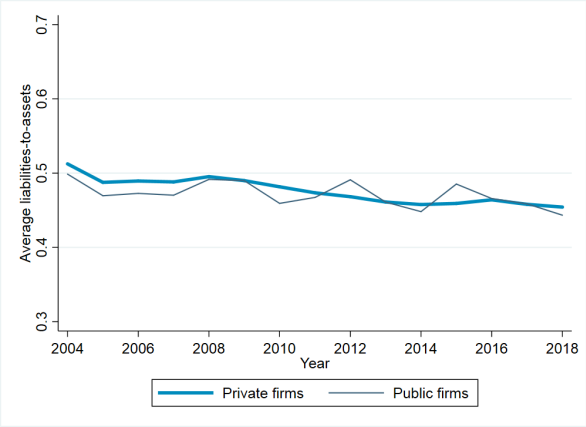


(j) Other

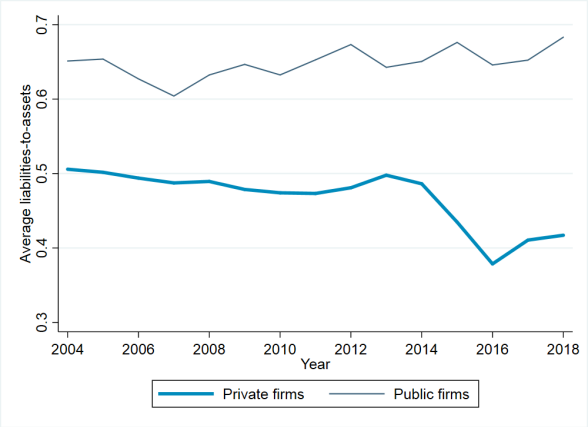
Figure 7: Leverage by industry (continued)



(k) Finance

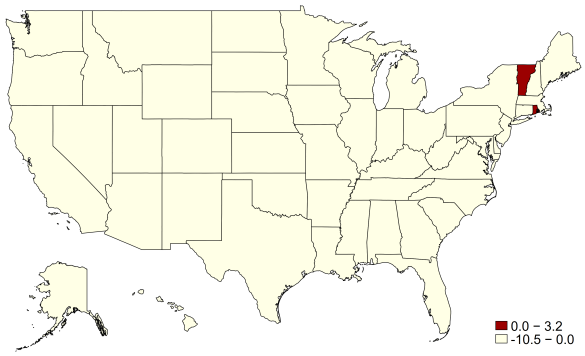


(l) Finance excluding banks

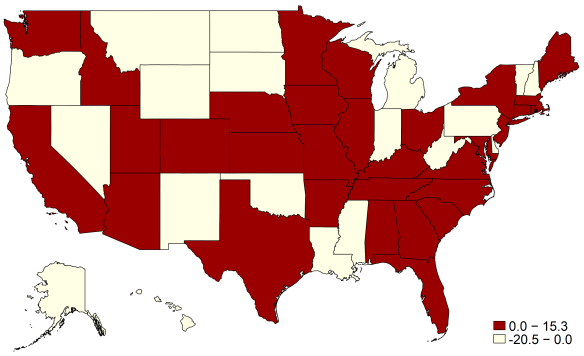


(m) Utilities

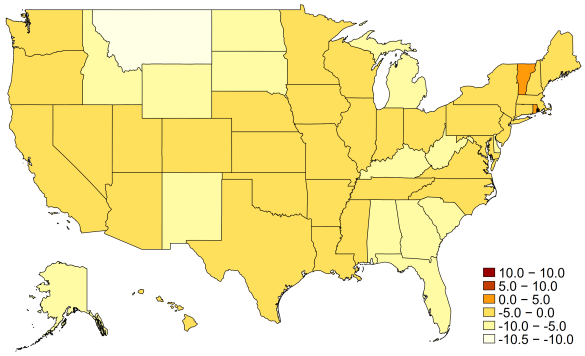
Figure 8: Change in leverage by state



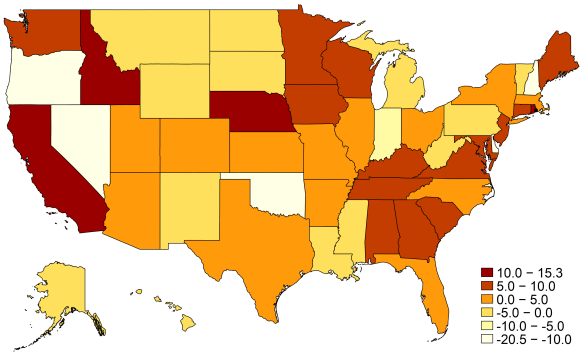
(a) Private firms



(b) Public firms



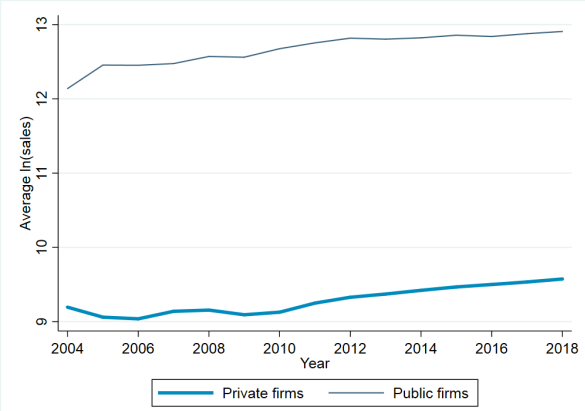
(c) Private firms



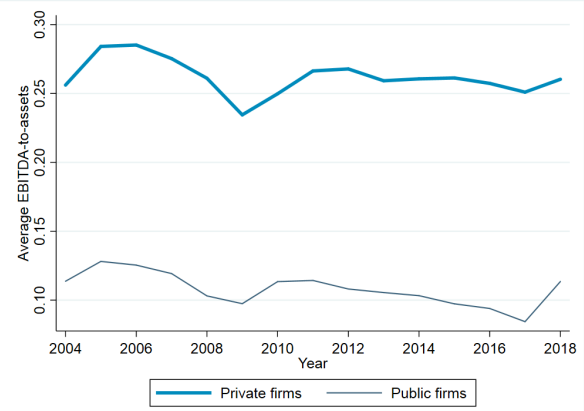
(d) Public firms

The figure classifies states based on the percentage-point change in average leverage (liabilities-to-assets) between 2004 and 2018 among public and private firms included in our sample. Panels a and c classify states by changes in private firms' leverage, while Panels b and d focus on public firms. Panels a and b classify states by whether leverage increased or decreased. Panels c and d classify states into one of six categories: positive or negative changes between (i) zero to five, (ii) five to ten, or (iii) more than ten percentage points. Leverage ratios are censored at zero and one at the firm-year observation level. Observations in the finance and utilities industries are excluded. All calculations are performed using at least ten data observations. To protect taxpayer privacy, we blur changes in leverage in the ten states that have less than ten observations of public firms. For these states, in Panels b and d we calculate the average change in leverage by pooling data across all ten states. All panels were created by the authors using cleaned and edited data from the IRS.

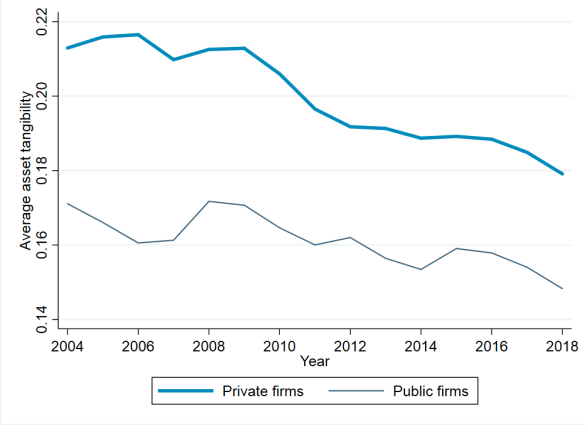
Figure 9: Firm size, profits, asset tangibility, and sales growth



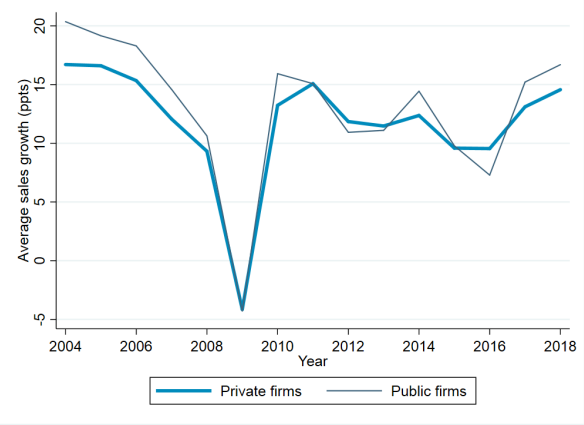
(a) Average size



(b) Average profitability



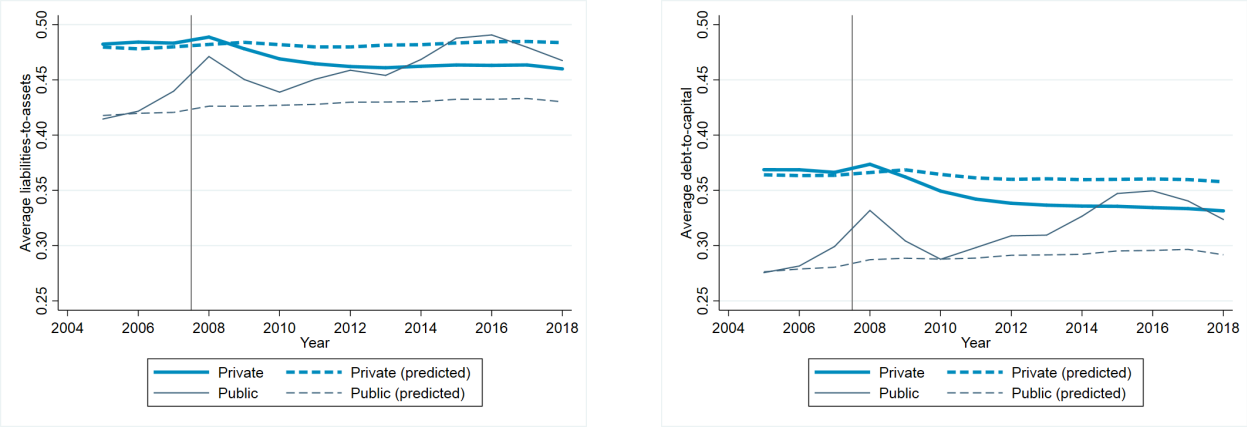
(c) Average asset tangibility



(d) Average sales growth

The figure presents trends in the means of various outcomes for public and private firms included in our sample. Panel a shows size (natural log of sales), Panel b shows profitability (the ratio of EBITDA to beginning-of-year assets), Panel c shows asset tangibility (the ratio of tangible assets to total assets), and Panel d shows sales growth (percent). EBITDA is earnings before interest, taxes, depreciation, and amortization. Before calculating means, asset tangibility ratios are censored at 0 and 1, profitability ratios are censored at -1 and 1, and sales growth is censored at 200 percent. Observations in the finance and utilities industries are excluded. All panels were created by the authors using cleaned and edited data from the IRS.

Figure 10: Predicted leverage

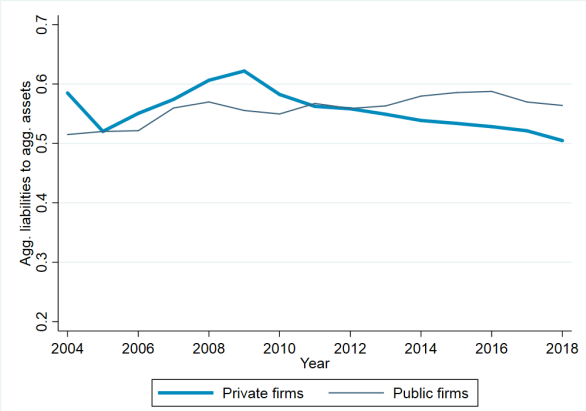


(a) Liabilities-to-assets

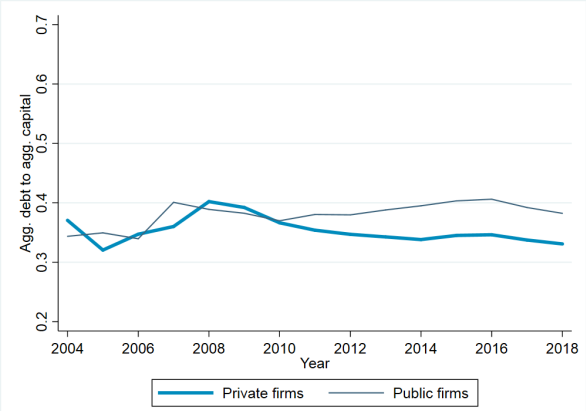
(b) Debt-to-capital

The figure shows actual and predicted leverage between 2004 and 2018 among public and private firms included in our sample. Panel a measures leverage as liabilities-to-assets, while Panel b measures it as debt-to-capital. In both panels, averages of actual and predicted leverage are shown. The predictions are constructed by first regressing leverage on various firm characteristics (including firm fixed effects) using data from 2004 to 2007. The regression coefficients are then used to predict leverage in all years given the observed characteristics in that year (discarding firm fixed effects). Regressors include ln(assets), ln(sales), asset tangibility, profitability (the ratio of EBITDA to beginning-of-year assets), and sales growth (percent). EBITDA denotes earnings before interest, taxes, depreciation, and amortization. All ratios (leverage, asset tangibility, and profitability) are censored at zero and one, and sales growth is censored at 200 percent. Censoring occurs at the firm observation level. Observations in the finance and utilities industries are excluded. All panels were created by the authors using cleaned and edited data from the IRS.

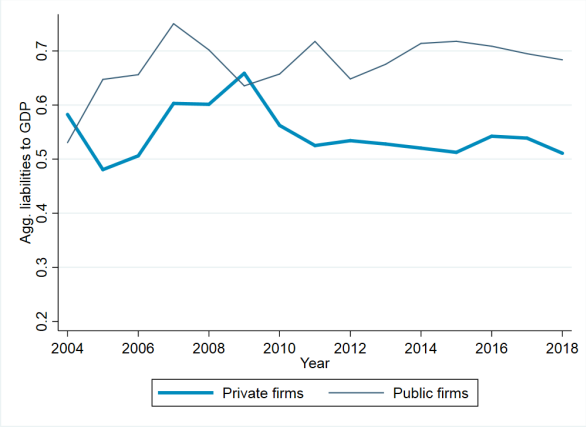
Figure 11: Leverage in the aggregate



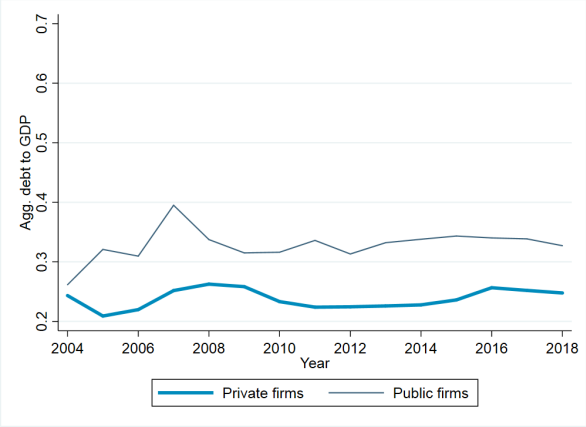
(a) Aggregate liabilities to aggregate assets



(b) Aggregate debt to aggregate capital



(c) Aggregate liabilities to U.S. GDP



(d) Aggregate debt to U.S. GDP

The figure presents trends in leverage measured in the aggregate. In Panels a and c, the numerator is aggregate liabilities, while in Panels b and b it is aggregate debt. In Panel a the denominator is aggregate assets, in Panel b it is aggregate capital, and in Panels c and d it is U.S. gross domestic product (GDP). Aggregate debt, liabilities, assets, and capital are calculated using SOI sample weights and therefore are nationally representative. In all panels, firms in the finance and utilities industries are excluded from all calculations except GDP. All panels were created by the authors using cleaned and edited data from the IRS and GDP estimates from the Bureau of Economic Analysis.

Tables

Table 1: Summary statistics (2004-2018)

	Observations	Mean	Standard deviation	25th percentile	Median	75th percentile
Private firms						
Liabilities-to-assets	1,122,143	0.47	0.34	0.16	0.44	0.78
Debt-to-capital	1,122,143	0.35	0.37	0.00	0.21	0.67
Assets (millions)	1,122,143	174	3,557	1	10	42
Sales (millions)	1,122,143	137	1,646	2	15	67
ln(sales)	1,122,143	9.3	2.5	7.6	9.6	11.1
Age	1,122,143	19	19	6	14	28
EDITDA-to-assets	1,122,143	0.26	0.32	0.02	0.13	0.34
Asset tangibility	1,122,143	0.20	0.24	0.02	0.10	0.30
Investment intensity	1,122,143	0.17	0.29	0.00	0.00	0.20
Sales growth (percent)	928,806	11.9	46.6	-7.2	4.5	18.7
Public firms						
Liabilities-to-assets	46,968	0.45	0.28	0.22	0.42	0.65
Debt-to-capital	46,968	0.31	0.31	0.01	0.23	0.50
Assets (millions)	46,968	6,216	36,544	124	507	2,119
Sales (millions)	46,968	2,924	14,167	81	367	1,442
ln(sales)	46,968	12.6	2.4	11.3	12.8	14.2
Age	46,968	26	24	10	19	32
EDITDA-to-assets	46,968	0.11	0.13	0.01	0.08	0.15
Asset tangibility	46,968	0.16	0.18	0.03	0.09	0.22
Investment intensity	46,968	0.41	0.36	0.11	0.28	0.71
Sales growth (percent)	44,429	13.2	44.0	-4.6	5.8	19.4
All firms						
Liabilities-to-assets	1,169,111	0.47	0.34	0.16	0.44	0.77
Debt-to-capital	1,169,111	0.35	0.37	0.00	0.22	0.66
Assets (millions)	1,169,111	417	8,198	1	11	50
Sales (millions)	1,169,111	249	3,311	2	17	75
ln(sales)	1,169,111	9.4	2.6	7.7	9.8	11.2
Age	1,169,111	20	19	6	14	28
EDITDA-to-assets	1,169,111	0.26	0.32	0.02	0.13	0.33
Asset tangibility	1,169,111	0.20	0.24	0.02	0.10	0.30
Investment intensity	1,169,111	0.18	0.30	0.00	0.01	0.22
Sales growth (percent)	973,235	12.0	46.5	-7.0	4.5	18.7

The table presents summary statistics describing our data for years 2004 to 2018. Medians as well as 25th and 75th percentiles are blurred statistics; we show the average of ten observations surrounding the relevant percentile after sorting on the variable. We censor several variables at the firm level: liabilities-to-assets, debt-to-capital, asset tangibility, and investment intensity are censored at 0 and 1; EBITDA-to-assets is censored at -1 and 1 (beginning-of-year assets are used for this measure); and sales growth is censored at 200 percent. EBITDA is earnings before interest, taxes, depreciation, and amortization. Observations in the finance industry are excluded. The table was created by the authors using cleaned and edited data from the IRS.

Table 2: Listing status and leverage trends over time

	Dependent variable: liabilities-to-assets					
	Private firms			Public firms		
2005 dummy	-0.004***	-0.002**	-0.002***	-0.001	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
2007 dummy	-0.007***	-0.005***	-0.005***	0.028***	0.028***	0.025***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.004)
2009 dummy	-0.011***	-0.012***	-0.010***	0.045***	0.041***	0.038***
	(0.001)	(0.001)	(0.001)	(0.005)	(0.005)	(0.005)
2011 dummy	-0.020***	-0.015***	-0.016***	0.050***	0.047***	0.042***
	(0.001)	(0.001)	(0.001)	(0.005)	(0.005)	(0.005)
2013 dummy	-0.024***	-0.021***	-0.021***	0.059***	0.054***	0.049***
	(0.001)	(0.001)	(0.001)	(0.005)	(0.006)	(0.005)
2015 dummy	-0.028***	-0.026***	-0.026***	0.094***	0.088***	0.082***
	(0.001)	(0.002)	(0.002)	(0.006)	(0.006)	(0.006)
2017 dummy	-0.032***	-0.030***	-0.033***	0.096***	0.088***	0.081***
	(0.001)	(0.002)	(0.002)	(0.006)	(0.006)	(0.006)
2019 dummy	-0.033***	-0.030***	-0.036***	0.120***	0.111***	0.103***
	(0.002)	(0.002)	(0.002)	(0.006)	(0.007)	(0.007)
Size		0.004***	0.010***		0.012***	0.012***
		(0.001)	(0.001)		(0.003)	(0.003)
Sales growth		0.000*	0.000***		-0.000	-0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Profitability		-0.084***	-0.063***		-0.072***	-0.067***
		(0.002)	(0.002)		(0.013)	(0.013)
Tangibility		0.225***	0.179***		0.270***	0.239***
		(0.004)	(0.005)		(0.025)	(0.025)
Equity financing			-0.084***			-0.033***
			(0.003)			(0.006)
Cash-to-assets			-0.150***			-0.058***
			(0.004)			(0.014)
R^2	0.00	0.04	0.07	0.01	0.08	0.09
Observations	1,195,668	989,771	743,301	50,616	47,711	47,122

The table reports regressions that estimate the relationship between leverage and year indicators. The dependent variable is liabilities-to-assets. Explanatory variables include time dummies (whose coefficients should be interpreted relative to the omitted year of 2004) in all columns; however, only the odd-year coefficients are displayed, for brevity. All columns also include firm fixed effects. In columns two, three, five, and six we include classical predictors of firm leverage: size (natural log of sales), sales growth (percent), profitability (the ratio of EBITDA to beginning-of-year assets), and asset tangibility (the ratio of tangible assets to all assets). In columns three and six we also include ratios of equity issuance to capital (equity financing) and cash-to-assets. The unit of observation is at the firm-year level. EBITDA is earnings before interest, taxes, depreciation, and amortization. Standard errors are clustered at the firm level and are reported in parentheses below the coefficient estimates. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively. Observations in the finance industry are excluded. The table was created by the authors using cleaned and edited data from the IRS.

Table 3: Size, age, and long-run leverage changes

Panel A	Dependent variable: Δliabilities-to-assets		Dependent variable: Δdebt-to-capital	
	Private	Public	Private	Public
1st age quintile	-0.076***	0.087***	-0.090***	0.094***
	(0.005)	(0.018)	(0.006)	(0.021)
2nd age quintile	-0.049***	0.056***	-0.059***	0.070***
	(0.005)	(0.021)	(0.005)	(0.024)
3rd age quintile	-0.044***	0.075***	-0.057***	0.088***
	(0.004)	(0.019)	(0.005)	(0.022)
4th age quintile	-0.026***	0.061***	-0.038***	0.058***
	(0.004)	(0.018)	(0.004)	(0.018)
5th age quintile	-0.017***	0.036**	-0.028***	0.068***
	(0.003)	(0.016)	(0.004)	(0.017)
R^2	0.02	0.06	0.03	0.06
Observations	25,012	1,050	25,012	1,050

Panel B	Dependent variable: Δliabilities-to-assets		Dependent variable: Δdebt-to-capital	
	Private	Public	Private	Public
1st size quintile	-0.061***	0.078***	-0.073***	0.072***
	(0.006)	(0.022)	(0.007)	(0.023)
2nd size quintile	-0.037***	0.054***	-0.046***	0.046**
	(0.005)	(0.019)	(0.005)	(0.020)
3rd size quintile	-0.046***	0.063***	-0.062***	0.078***
	(0.004)	(0.019)	(0.004)	(0.022)
4th size quintile	-0.034***	0.058***	-0.050***	0.080***
	(0.003)	(0.017)	(0.004)	(0.020)
5th size quintile	-0.038***	0.061***	-0.046***	0.103***
	(0.004)	(0.016)	(0.004)	(0.018)
R^2	0.02	0.05	0.03	0.06
Observations	25,012	1,050	25,012	1,050

The table reports regressions that estimate the relationship between leverage and size or age. The dependent variable is the change in leverage (either liabilities-to-assets or debt-to-capital) between 2004 and 2018. In Panel A (B), the explanatory variables are age (size) quintile indicators based on 2004 data. The unit of observation is at the firm level; all firms in the regression exist in the data in both 2004 and 2018. Standard errors are reported in parentheses below the coefficient estimates. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively. Observations in the finance industry are excluded. The table was created by the authors using cleaned and edited data from the IRS.

Table 4: Listing status, leverage, and investment

Panel A	Dependent variable: investment intensity			
	Private firms		Public firms	
Liabilities-to-assets	0.036***		-0.053***	
	(0.002)		(0.011)	
Debt-to-capital		0.029***		-0.042***
		(0.002)		(0.009)
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
R^2	0.01	0.01	0.03	0.03
Observations	1,122,143	1,122,143	46,968	46,968

Panel B	Dependent variable: investment intensity			
	Private firms		Public firms	
Liabilities-to-assets	0.014***		-0.055***	
	(0.002)		(0.011)	
Debt-to-capital		0.011***		-0.037***
		(0.002)		(0.009)
Size	0.018***	0.018***	-0.002	-0.002
	(0.001)	(0.001)	(0.003)	(0.003)
Sales growth	0.000***	0.000***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Profitability	0.059***	0.059***	0.196***	0.196***
	(0.002)	(0.002)	(0.017)	(0.017)
Asset tangibility	0.201***	0.201***	-0.129***	-0.134***
	(0.004)	(0.004)	(0.025)	(0.025)
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
R^2	0.02	0.02	0.13	0.13
Observations	928,806	928,806	44,429	44,429

This table reports regressions that estimate the relationship between leverage and investment intensity. The dependent variable is the ratio of capital expenditures to assets. The main explanatory variables are two measures of leverage: liabilities-to-assets and debt-to-capital. The unit of observation is at the firm-year level. Panel A only controls for year and firm fixed effects, while Panel B additionally controls for size (natural log of sales), sales growth (percent), profitability (the ratio of EBITDA to beginning-of-year assets), and asset tangibility (the ratio of tangible assets to all assets). Standard errors are clustered at the firm level and are reported in parentheses below the coefficient estimates. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively. Observations in the finance industry are excluded. The table was created by the authors using cleaned and edited data from the IRS.

Table 5: Capital requirements and post-financial crisis investment

Panel A: Leverage

Dep. Variable:	Δ Liabilities-to-assets	
	(1)	(2)
Δ Local bank capital ratio	-0.008***	-0.007**
	[-0.003]	[-0.003]
State FE		
Controls		
R^2	0.002	0.005
Observations	10,222	10,222

Panel B: Equity Issuance

Dep. Variable:	$\ln(\text{Equity issuance})_{2016}$		$\mathbf{1}\cdot(\text{Equity issuance}>0)_{2016}$	
	(1)	(2)	(3)	(4)
Δ Local bank capital ratio	-0.494**	-0.32	0.000	0.004*
	[0.205]	[-0.221]	[-0.003]	[-0.002]
State FE		✓		✓
Controls	✓	✓	✓	✓
R^2	0.075	0.15	0.008	0.017
Observations	675	674	8,942	8,942

Panel C: Investment

Dep. Variable:	$\ln(\text{Investment})_{2016}$		$\mathbf{1}\cdot(\text{Investment}>0)_{2016}$	
	(1)	(2)	(3)	(4)
Δ Local bank capital ratio	-0.103***	-0.070**	-0.008	-0.005
	[0.032]	[-0.033]	[-0.005]	[-0.006]
State FE		✓		✓
Controls	✓	✓	✓	✓
R^2	0.017	0.034	0.016	0.025
Observations	4,050	4,050	10,222	10,222

This table reports regressions estimating the relationship between the change in bank capital ratios following passage of the Dodd-Frank Act and the change in firm leverage pre- and post-Global Financial Crisis (GFC), the post-GFC level of firm equity issuance, and the post-GFC level of firm capital investment. The sample included in each regression is private firms in the two smallest size quintiles in 2007, measured by firm sales. The main independent variable in each panel is the change in the local bank capital ratio from 2007 to 2016. In Panel A, the dependent variable is the change in firm liabilities-to-assets between 2007 and 2016. In Panel B, the dependent variables are the natural log of equity issuance in 2016 (columns 1 and 2) and an indicator variable equal to one if equity issuance is greater than zero (columns 3 and 4). In Panel C the dependent variables are the natural log of investment in 2016 (columns 1 and 2) and an indicator variable equal to one if investment is greater than zero (columns 3 and 4). Control variables include the 2005 unemployment rate, labor force participation rate, average wage, and natural logarithm of the population, and the 2002-to-2006 change in the unemployment rate, labor force participation rate, number of establishments, and wage growth. Results are presented with (even-number columns) and without (odd-numbered columns) state fixed effects. Standard errors are clustered at the county level. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively. Observations in the finance industry are excluded. Investment data were created by the authors using cleaned and edited data from the IRS.

Appendix A: Variable definitions

Here we provide our variable definitions. Table A1 gives definitions relative to Form 1120 (C corporations). Tables A2 and A3 give definitions relative to Forms 1120S (S corporations) and 1065 (partnerships). All data are sourced from the Internal Revenue Service unless otherwise noted. GDP is sourced from the Bureau of Economic Analysis. We assign a firm's tax year to year t if the majority of the taxable year occurred during the t calendar year.

Table A1: Variable definitions (Form 1120)

Variable	Source
Debt	Form 1120: Schedule L line 17(d) + line 20(d)
Liabilities	*Debt* + Form 1120: Schedule L line 18(d) + line 19(d) + line 21(d)
Assets	Form 1120: Schedule L line 15(d)
Equity	*Assets* minus *Liabilities*
Capital	*Debt* + *Equity*
Liabilities-to-assets	*Liabilities*/*Assets* censored at 0 and 1
Debt-to-capital	*Debt*/*Capital* censored at 0 and 1. Coded as 1 if *Capital*$\leq$ 0.
Sales	Form 1120: line 1c
Sales growth	Percentage point change in *Sales* between prior and current years, censored at 200
EBITDA	Form 1120: line 28 + line 18 + line 20 + line 21 + line 25 + line 12 + line 19
Debt issuance	Change in *Debt* between prior and current years
Equity issuance	Change in the sum of Form 1120: Schedule L lines 22b(d) and 23(d) between prior and current years
Asset tangibility	[Form 1120: Schedule L line 10b(d)]/*Assets* censored at 0 and 1
Age	Tax year minus year of incorporation (Form 1120: box C)
Industry	First two digits of Form 1120: Schedule K, line 2a
Capital investment	Form 4562: sum of lines 19a(c) to line 19i(c) + line 20a(c) + line 20b(c) + line 20c(c) + line 14 + line 15 + line 16
R&D investment	*max*{Form 6765 line 9, Form 6765 line 28}
Net PPE	Form 1120: Schedule L line 10b(d)
Investment intensity	[*Capital investment* + *R&D investment*]/[prior year *Net PPE*] censored at 0 and 1

Table A2: Variable definitions (Form 1120S)

Variable	Source
Debt	Form 1120S: Schedule L line 17(d) + line 20(d)
Liabilities	*Debt* + Form 1120S: Schedule L line 18(d) + line 19(d) + line 21(d)
Assets	Form 1120S: Schedule L line 15(d)
Equity	*Assets* minus *Liabilities*
Capital	*Debt* + *Equity*
Liabilities-to-assets	*Liabilities*/*Assets* censored at 0 and 1
Debt-to-capital	*Debt*/*Capital* censored at 0 and 1. Coded as 1 if *Capital*$\leq$ 0.
Sales	Form 1120S: line 1c
Sales growth	Percentage point change in *Sales* between prior and current years, censored at 200
EBITDA	[undefined]
Debt issuance	Change in *Debt* between prior and current years
Equity issuance	[undefined]
Asset tangibility	[Form 1120S: Schedule L line 10b(d)]/*Assets* censored at 0 and 1
Age	Tax year minus year of incorporation (Form 1120S: box C)
Industry	First two digits of Form 1120S: Schedule K, line 2a
Capital investment	Form 4562: sum of lines 19a(c) to line 19i(c) + line 20a(c) + line 20b(c) + line 20c(c) + line 14 + line 15 + line 16
R&D investment	*max*{Form 6765 line 9, Form 6765 line 28}
Net PPE	Form 1120S: Schedule L line 10b(d)
Investment intensity	[*Capital investment* + *R&D investment*]/[prior year *Net PPE*] censored at 0 and 1

Table A3: Variable definitions (Form 1065)

Variable	Source
Debt	Form 1065: Schedule L line 16(d) + line 19b(d)
Liabilities	*Debt* + Form 1065: Schedule L line 17(d) + line 19a(d) + line 20(d)
Assets	Form 1065: Schedule L line 14(d)
Equity	*Assets* minus *Liabilities*
Capital	*Debt* + *Equity*
Liabilities-to-assets	*Liabilities*/*Assets* censored at 0 and 1
Debt-to-capital	*Debt*/*Capital* censored at 0 and 1. Coded as 1 if *Capital*$\leq$ 0.
Sales	Form 1065: line 1c
Sales growth	Percentage point change in *Sales* between prior and current years, censored at 200
EBITDA	[undefined]
Debt issuance	Change in *Debt* between prior and current years
Equity issuance	[undefined]
Asset tangibility	[Form 1065: Schedule L line 10b(d)]/*Assets* censored at 0 and 1
Age	Tax year minus year business started (Form 1065: box E)
Industry	First two digits of Form 1065: Schedule K, line 2a
Capital investment	Form 4562: sum of lines 19a(c) to line 19i(c) + line 20a(c) + line 20b(c) + line 20c(c) + line 14 + line 15 + line 16
R&D investment	*max*{Form 6765 line 9, Form 6765 line 28}
Net PPE	Form 1065: Schedule L line 9b(d)
Investment intensity	[*Capital investment* + *R&D investment*]/[prior year *Net PPE*] censored at 0 and 1

Appendix B: Additional Figures

Here we present additional figures. Figures B1 and B2 show trends in leverage from 1994 to 2018. The figures also show the share of assets held by different firm types across time. Because we do not observe public vs. private status for C corporations until 2004, in all panels their time series begin that year. In all panels, IRS sampling weights are used to ensure national representativeness.

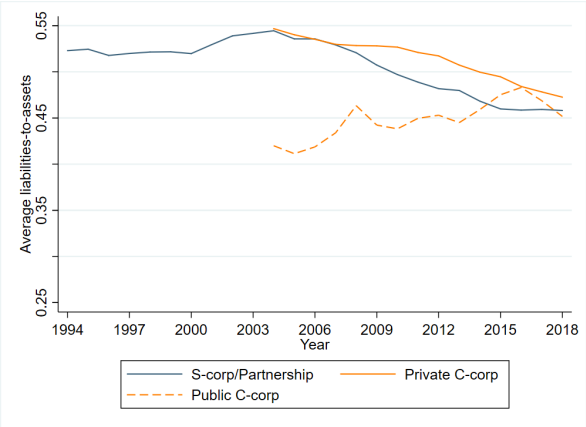
The figures allow us to go further back in time for a subset of private firms: pass-through businesses. For these firms, the decline in leverage we see from 2004 to 2018 represents a departure from leverage trends between 1994 and 2003. In those years, leverage rises over time amongst partnerships and holds relatively constant amongst S corporations.

In Figure B2 panel (c), we see that public firms held between 50% and 60% of total domestic firm assets during the time period we can measure: 2004 to 2018. The share of assets held by private C corporations declined during this period, from about 35 percent in 2004 to just under 30 percent by 2018. In contrast, the share of assets held by S corporations and partnerships has grown over time. For these firms, we can look back to 1994. Since then, both firm types have captured an increasing share of assets, with partnership asset growth outpacing S corporations.

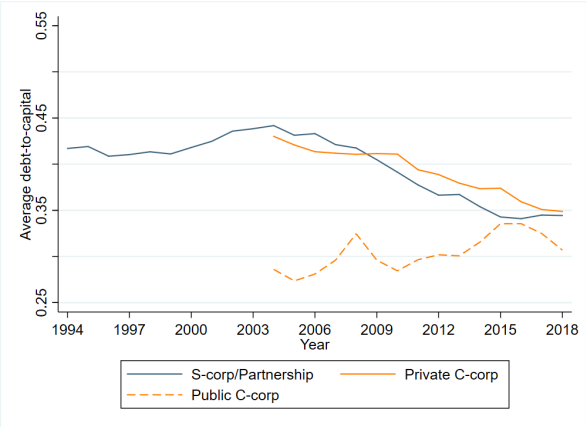
In Figure B3, we compare our measure of leverage using the tax data to an analogous measure using Compustat data. In particular, we show the mean liabilities-to-assets ratio (censored at 0 and 1 before averaging) among public firms in both the tax data and Compustat. We see that leverage is measured as around ten percentage points higher in the Compustat data compared to the tax data each year. This could be due to differing amounts of consolidation in tax filings versus financial reporting. Perhaps more importantly, however, the trends in the data are strikingly similar, with leverage generally increasing across the sample period in both the tax data and in Compustat.

In Figure B4, we re-calculate changes in leverage state-by-state after limiting the sample to private firms with under $10 million of assets. The findings are quite similar to Figure 8, which included large private firms as well. One might have been concerned that the geographic patterns would be different for small firms, who are more likely to operate and borrow locally. We see, however, that this is generally not the case. Small private firms broadly see declines in leverage across the United States, with no clear geographic pattern.

Figure B1: Leverage from 1994 to 2018 (three firm types)



(a) Liabilities-to-assets

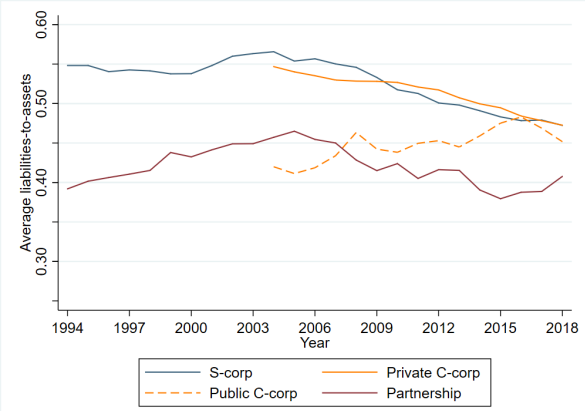


(b) Debt-to-capital

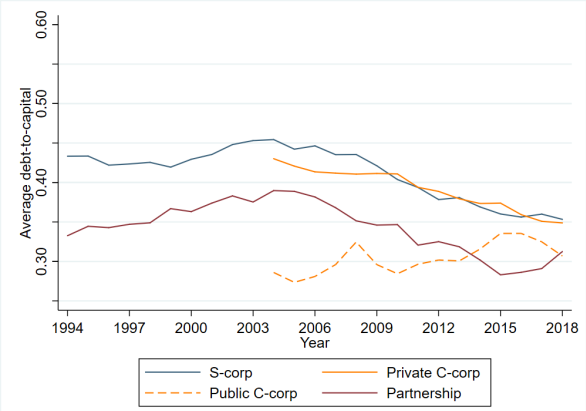
(c) Distribution of assets

The figure presents trends in weighted-average leverage for public and private firms included in our sample. Panel (a) measures leverage as liabilities-to-assets, while panel (b) uses debt-to-capital. Before calculating means, both leverage ratios are censored at 0 and 1. The panels show three types of firms: pass-through businesses (S corporations and partnerships), private C corporations, and public C corporations. In all panels, IRS sampling weights are used to ensure national representativeness. The time series for C corporations begin in 2004 because that is when we can observe public vs. private ownership status. All panels were created by the authors using cleaned and edited data from the IRS. Figure **??** presents the same information but separates partnerships and S corporations.

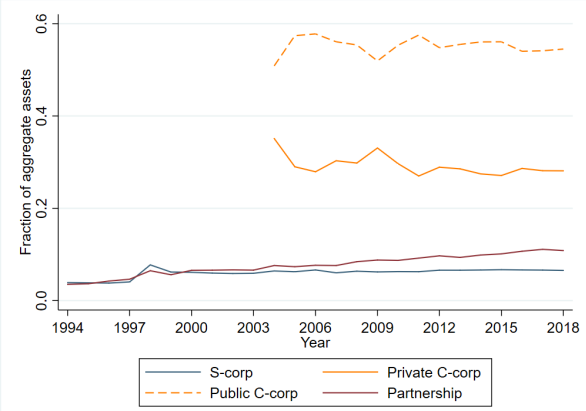
Figure B2: Leverage from 1994 to 2018 (four firm types)



(a) Liabilities-to-assets



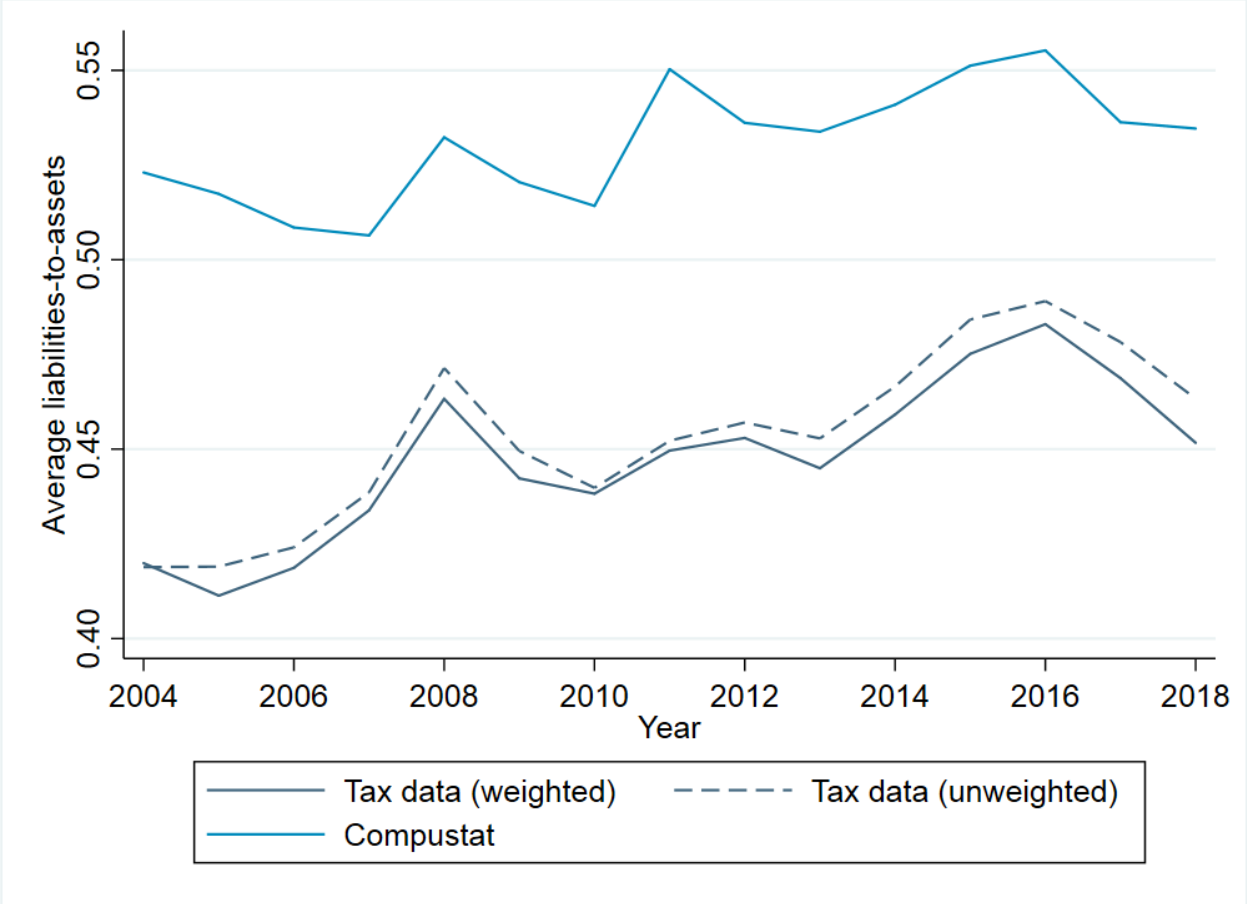
(b) Debt-to-capital



(c) Distribution of assets

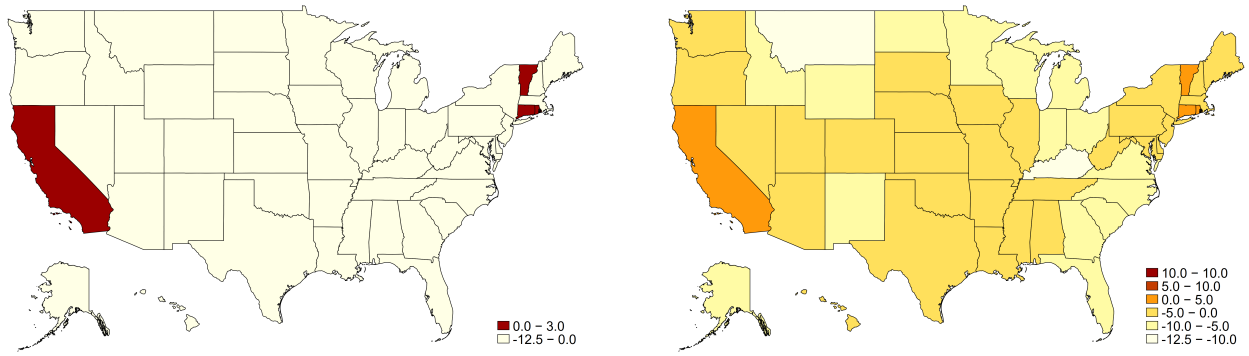
The figure presents trends in weighted-average leverage for public and private firms included in our sample. Panel (a) measures leverage as liabilities-to-assets, while panel (b) uses debt-to-capital. Before calculating means, both leverage ratios are censored at 0 and 1. The panels show four types of firms: S corporations, partnerships, private C corporations, and public C corporations. In all panels, IRS sampling weights are used to ensure national representativeness. The time series for C corporations begin in 2004 because that is when we can observe public vs. private ownership status. All panels were created by the authors using cleaned and edited data from the IRS. Figure B1 presents the same information but combines partnerships and S corporations.

Figure B3: Public firm leverage in tax data vs. Compustat



The figure presents trends in leverage for public firms, as measured using our sample of tax data and using the Compustat sample. Leverage is measured as liabilities-to-assets, censored at 0 and 1 at the firm-year level. The tax data series are shown calculated both with and without the IRS sample weights, which ensure national representativeness. The figure was created by the authors using data from Compustat and cleaned and edited data from the IRS.

Figure B4: Change in leverage by geography

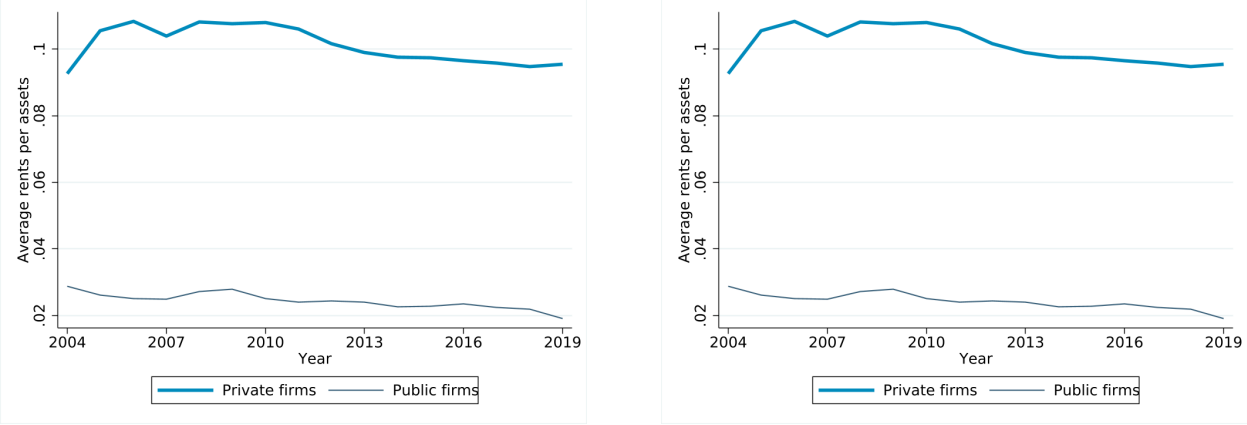


(a) Small private firms – two categories

(b) Small private firms – six categories

The figure classifies states based on the percentage-point change in average leverage (liabilities-to-assets) between 2004 and 2018 among private in our sample with less than $10 million of assets. Panel a classifies states by whether leverage increased or decreased. Panel b classifies states into one of six categories: positive or negative changes between (i) zero to five, (ii) five to ten, or (iii) more than ten percentage points. Leverage ratios are censored at zero and one at the firm-year observation level. Observations in the finance and utilities industries are excluded. All calculations are performed using at least ten data observations. To protect taxpayer privacy, we blur changes in leverage in the set of states that have less than ten observations of small private firms. For these states, we calculate the average change in leverage by pooling data. All panels were created by the authors using cleaned and edited data from the IRS.

Figure B5: Average rents-to-assets



(a) Rents-to-assets

(b) Rents-to-assets (SOI weights)

Panel a presents trends in means of the ratio rents-to-assets for public and private firms included in our sample. Panel b presents weighted averages of the same measure using IRS sampling weights. Observations in the finance and utilities industries are excluded. Rents data are sourced from Form 1120: line 16. All panels were created by the authors using cleaned and edited data from the IRS.

Appendix C: Additional Tables

Here we present additional tables. Table C1 is analogous to Table 2 except measures leverage as debt-to-capital instead of liabilities-to-assets. Results are robust to this change in specification.

Table C1: Listing status and leverage trends over time

	Dependent variable: debt-to-capital					
	Private firms			Public firms		
2005 dummy	-0.007***	-0.004***	-0.005***	-0.005*	-0.003	-0.005
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
2007 dummy	-0.011***	-0.009***	-0.011***	0.023***	0.024***	0.019***
	(0.001)	(0.001)	(0.001)	(0.004)	(0.005)	(0.004)
2009 dummy	-0.012***	-0.015***	-0.019***	0.038***	0.033***	0.028***
	(0.001)	(0.001)	(0.001)	(0.005)	(0.005)	(0.005)
2011 dummy	-0.026***	-0.021***	-0.027***	0.039***	0.036***	0.029***
	(0.001)	(0.002)	(0.001)	(0.005)	(0.006)	(0.006)
2013 dummy	-0.031***	-0.028***	-0.031***	0.057***	0.053***	0.045***
	(0.001)	(0.002)	(0.002)	(0.006)	(0.006)	(0.006)
2015 dummy	-0.036***	-0.033***	-0.038***	0.098***	0.093***	0.084***
	(0.002)	(0.002)	(0.002)	(0.006)	(0.007)	(0.007)
2017 dummy	-0.041***	-0.039***	-0.046***	0.104***	0.097***	0.084***
	(0.002)	(0.002)	(0.002)	(0.007)	(0.007)	(0.007)
2019 dummy	-0.040***	-0.037***	-0.047***	0.134***	0.128***	0.115***
	(0.002)	(0.002)	(0.002)	(0.007)	(0.008)	(0.008)
Size		-0.001	0.008***		0.008**	0.008**
		(0.001)	(0.001)		(0.003)	(0.003)
Sales growth		-0.000***	-0.000**		-0.000	0.000
		(0.000)	(0.000)		(0.000)	(0.000)
Profitability		-0.103***	-0.080***		-0.112***	-0.103***
		(0.002)	(0.002)		(0.016)	(0.015)
Tangibility		0.285***	0.234***		0.266***	0.209***
		(0.005)	(0.006)		(0.029)	(0.028)
Equity financing			-0.088***			-0.052***
			(0.003)			(0.007)
Cash-to-assets			-0.150***			-0.077***
			(0.004)			(0.015)
R^2	0.00	0.06	0.11	0.01	0.06	0.09
Observations	1,195,668	989,771	743,301	50,616	47,711	47,122

The table reports regressions that estimate the relationship between leverage and year indicators. The dependent variable is debt-to-capital. Explanatory variables include time dummies (whose coefficients should be interpreted relative to the omitted year of 2004) in all columns; however, only the odd-year coefficients are displayed, for brevity. All columns include firm fixed effects. In columns two, three, five, and six we include classical predictors of firm leverage: size (natural log of sales), sales growth (percent), profitability (the ratio of EBITDA to beginning-of-year assets), and asset tangibility (the ratio of tangible assets to all assets). In columns three and six we also include ratios of equity issuance to capital (equity financing) and cash-to-assets. The unit of observation is at the firm-year level. EBITDA is earnings before interest, taxes, depreciation, and amortization. Standard errors are clustered at the firm level and are reported in parentheses below the coefficient estimates. Statistical significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively. Observations in the finance industry are excluded. The table was created by the authors using cleaned and edited data from the IRS.