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Pouring Oil on Fire: Interest Deductibility and Corporate Debt

by Pietro Dallari, Nicolas End, Fedor Miryugin, Alexander F. Tieman and Seyed Reza Yousefi

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**Pouring Oil on Fire: Interest Deductibility and Corporate Debt**

**Prepared by Pietro Dallari, Nicolas End, Fedor Miryugin, Alexander F. Tieman and Seyed Reza Yousefi[1]**

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**Abstract**

This paper investigates the role of tax incentives towards debt finance in the buildup of leverage in the nonfinancial corporate (NFC) sector, using a large firm-level dataset. We find that so-called debt bias is a significant driver of leverage, for both small and medium-sized enterprises and larger firms, with its effect accounting for about a quarter of leverage. The strength of this effect differs with firm size, the availability of collateral, income and income volatility, cash flow, and capital intensity. We conclude that leveling the playing field between debt and equity finance through tax policy reform would decrease NFC leverage, reducing economic risks posited by leverage

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**FIGURES**



**TABLES**

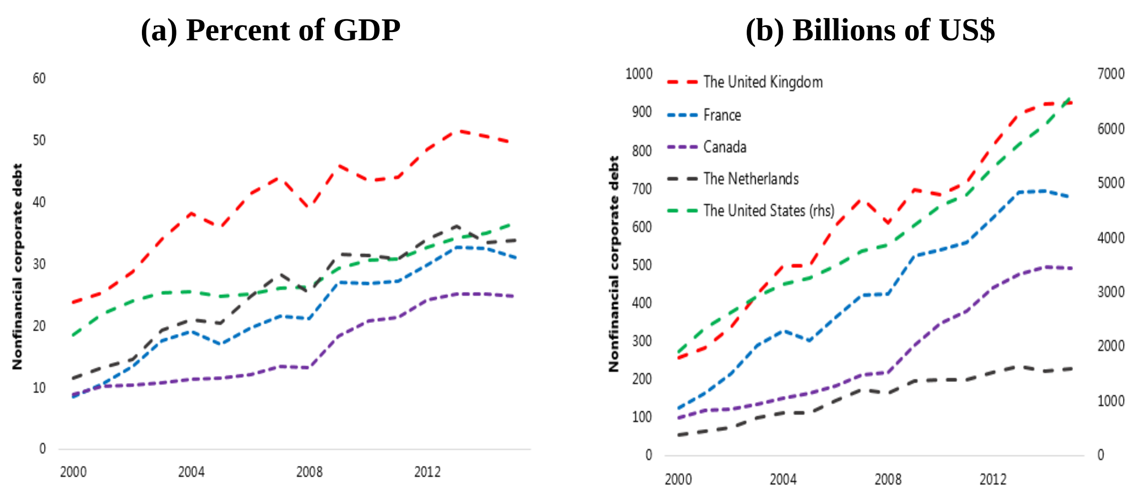
## I. Introduction

Tax bias towards debt finance is pervasive and affects leverage decisions. In most countries, the corporate income tax allows deduction of the interest paid on debt. Distribution of dividends, by contrast, is rarely deductible. The interest deduction is usually justified by a reference to the contractual obligation involved in a debt contract. Payments to equity holders do not involve such a contractual obligation and are hence considered optional. The deduction implies that debt financing is artificially cheaper than equity finance, distorting incentives and violating the principle of neutrality of the source of finance (e.g., Sorensen, 2014, and Weichenrieder and Klautke, 2008). A profit-maximizing firm will thus take on more debt than it would in absence of this incentive. This effect is labeled debt bias.

By encouraging higher leverage, tax policy may indirectly jeopardize macroeconomic and financial stability. Leverage in the nonfinancial corporate (NFC) sector was already high before the global financial crisis (GFC) and has increasingly become an issue during its aftermath. Since the nadir of the crisis, corporate leverage has kept increasing, reaching 50 percent of GDP in some countries (Figure 1).

The crisis has highlighted the far-reaching implications of excessive leverage. Such leverage overhang can dent the long-term growth potential of the economy, as highly-indebted corporations may not be prone to invest. Moreover, it increases risks in several ways. First, corporate distress can cause nonperforming loans in the banking system to spike to levels inhibiting new lending. Second, it can represent a fiscal cost, when corporates are bailed out, because they are deemed systemically important or when the state is a shareholder, a lender or a guarantor. Third, particularly in some emerging markets, a substantial part of corporate leverage is in the form of foreign currency debt, bringing exchange rate and cross-country contagion risks to the fore, especially at a time of monetary policy normalization in advanced economies.

**Figure 1. Evolution of Nonfinancial Corporate Debt in Selected Countries**




*Source:* Dealogic, authors' calculations.

There is extensive evidence of debt bias for large firms and financial corporations. Until the 1990s, many economists were not convinced of the importance of the debt bias (Myers, 1984).

Over the last two decades, however, a significant number of studies have demonstrated the role of debt bias, mostly from a country-specific angle or for large multinational firms.[2] One strand of research looks at debt bias in a single country. For instance, Graham and others (1998), Graham (1999), and Gordon and Lee (2001, 2007) focus on US firms, while Bartholdy and Mateus (2006) and Dwenger and Steiner (2009) employ Portuguese and German firm data respectively. These studies generally find significant effects on long and short-term debt. Cross-country studies of firms with foreign financial interests (subsidiaries or investments) include Moore and Raune (2005), Huizinga and others (2008), Mills and Newberry (2004), Mintz and Weichenrieder (2010), and Ramb and Weichenrieder (2005). While the magnitude of the effects found in these studies varies, debt bias is generally found to be a significant driver of incurred debt. Recently, Feld et al. (2013) presented an empirical meta-analysis, again finding significant impact of taxation on the capital structure choice of firms.

Our paper contributes to this literature by taking the debt bias question beyond large multinational firms to the level of small and medium-sized enterprises (SMEs). To this end, we employ a cross-country dataset from Bureau Van Dijk's Orbis database containing 14 million firm-year observations, almost 99 percent of which are SMEs.[3] Small and medium-sized firms are different in ways that may influence their capital structure. They generally do not have the same level of access to capital market large firms enjoy. Their supply of finance may thus be lower and less diversified; the source of SME finance is generally more bank-based (Ramalho et. al., 2014). Furthermore, SMEs may be less prone to tax planning and thus take less advantage of the CIT incentive toward debt finance than large or listed companies.[4] Therefore, we believe that any results found in our SME-heavy sample can be seen as a lower bound of the effects of debt bias on leverage in the economy as a whole.

We address our research question employing a difference-in-difference approach. We use the interaction between firm characteristics and the corporate income tax rate to gauge the existence of debt bias and estimate its importance. Compared with the literature that relies on panel regressions, this strategy is a more robust identifying strategy. Furthermore, we take account of omitted variable bias at the sector-time, country-time, and country-sector levels as we control for the corresponding fixed effects.

We find that debt bias is a significant driver of leverage even for small firms and identify the role played by firm characteristics. In terms of magnitude, our regressions suggest that debt bias may explain over 5 percentage points of leverage—out of our sample-median leverage of 20 percent of assets. Thus, allowing for interest deductibility unambiguously increases nonfinancial

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[2] De Mooij (2011) provides an overview of recent research and methods employed. Heckemeyer et. al (2017), De Mooij and Keen (2016), and Luca and Tieman (2016) look at debt bias in the financial sector.

[3] Defined as firms with fewer than 250 employees.

[4] Our finding that the impact of debt bias on leverage is non-linear with firm size support this notion.

corporate leverage. Public policies aimed at decreasing corporate vulnerability by containing leverage should therefore consider addressing debt bias.

Our paper confirms for SMEs the results of previous studies about the role of firm-specific factors on leverage. For instance, Thornhill et al. (2004) argue that firms with higher collateral assets have greater access to bank funding. Gungoraydinoglu and Öztekin (2011) find that liquidity, profitability, tangibility, and size are the primary factors affecting the amount of debt firms take on. We illustrate that these firm characteristics play a role for leverage, hence confirming debt bias.

The remainder of this paper is organized as follows. Section II poses the hypotheses underpinning our empirical analysis, based on a stylized theoretical model that explains why we expect tax policy to impact a firm's choice of debt versus equity. Section III presents the data we are using and derives stylized facts. Section IV explains the empirical strategy and discusses findings and robustness checks. Finally, Section VII briefly discusses some policy implications.

## II. Hypotheses Development

This section lays out our main hypotheses regarding leverage and debt bias. We consider a profit-maximizing nonfinancial firm that faces a standard risk-reward tradeoff. The firm receives a fixed equity investment and chooses how much fixed-rate debt to take on in order to invest in assets that provide uncertain returns. The larger the investment, the higher the firm's leverage and hence the higher the risk of a hit to equity in case investment return disappoints. The tradeoff is thus between i) return on equity, through debt-financed investment in a risky asset and ii) the risk of bankruptcy.[5]

We expect that if a specific firm characteristic plays a role in explaining leverage, it also matters for the sensitivity of this leverage to the corporate income tax rate. In other words, we expect firm characteristics to influence debt bias. Building on the existing literature on the determinants of leverage, we thus formulate five hypotheses. The first one sets out the existence of debt bias for nonfinancial corporations. The other four relate to how debt bias varies across firms depending on firm characteristics.

***Hypothesis 1.*** *The higher the corporate income tax rate the firm faces, the more leveraged its balance sheet.*

Corporate income tax deductibility of interest payments lowers the cost of debt finance. In the standard risk-reward tradeoff sketched above, such lower cost of debt finance will thus result in higher leverage. Thus, we would expect to find that the higher the corporate income tax rate a firm faces, the higher the amount of leverage it carries on its balance sheet. Consistently with these priors, Glover et al. (2010) show in a dynamic equilibrium model calibrated to the US economy that leverage ratios are substantially lower the lower the CIT rate. In an empirical study,

[5] A theoretical model illustrating this tradeoff is developed in Appendix A.

Faulkender and Smith (2016) find that countries with higher tax rates on corporate income also have higher corporate leverage ratios. Finally, a similar prediction is derived theoretically in Graham (2006) from the seminal work of Modigliani and Miller (1963).

***Hypothesis 2.*** *The smaller the firm, the less responsive its leverage is to the corporate income tax rate.*

Firm size can influence leverage, hence also the strength of debt bias. Compared to large firms, SMEs generally face a more difficult financing environment. They generally lack direct access to capital markets, lowering credit supply. Thus, *ceteris paribus*, SMEs' balance sheets can be expected to exhibit lower gearing ratios. In addition, SMEs can be expected to be less sophisticated when it comes to tax planning. Thus, they can be thought to take less advantage of tax incentives. Existing empirical evidence largely supports this view.[6] However, Gordon and Lee (2001) find on the contrary a U-shaped relation between a firm's size and the tax responsiveness of its debt, suggesting that both small and large firms are more responsive than medium-sized firms. Like us, they advocate that large firms have access to capital markets but argue that small firms usually arbitrage between internal finance and loans, while medium-sized companies rely more exclusively on bank finance. We believe our paper, which zooms in on smaller firms, sheds new light on the discussion.

***Hypothesis 3.*** *The higher a firm's tangibility, the more responsive its leverage is to the corporate income tax rate.*

Firms with more tangible assets can be expected to have an easier time pledging collateral against debt, making lending to these firms less risky. Therefore, the higher a firm's collateral, the higher the supply of credit it can potentially take advantage of. All else equal, both leverage and debt bias would thus increase with tangibility. Harris and Raviv (1991) first established the empirical regularity between tangibility and leverage for the US, and their work was subsequently extended to G7 economies by Rajan and Zingales (1995). Using financial statement information for firms located in France, Germany and the United Kingdom, Terhaag (2015) finds that asset tangibility positively affects leverage, especially for larger firms. Booth et al. (2001) also argue that tangibility is positively related to leverage.

***Hypothesis 4.*** *The higher a firm's revenue and the higher its revenue volatility, the less responsive its leverage is to the corporate income tax rate.*

Revenue and its volatility may both influence debt bias. Firms with high revenue can self-finance better than peers with lower revenue. Such firms may thus be less sensitive to changes in the tax deductibility of interest expenses. Firms with very volatile revenue may also be less sensitive to CIT changes, as they are less leveraged and the need to smooth their cash-flow, rather than tax

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[6] See, for example, Forte et al. (2013) for Brazil, Requejo (2002) for Spain, as well as Rajan and Zingales (1995) for advanced economies, and Booth et al. (2001) for a group of developing economies.

considerations, will likely drive their external financing requirements. Empirical evidence seems to point in this direction, with Bradley, Jarrell, and Kim (1984) showing that leverage and earnings volatility are negatively correlated while Chen et al. (2014) observe that high volatility firms appear to have more equity and less debt and argue that is a way to contain financial distress risk.

***Hypothesis 5.*** *The higher a firm's capital intensity of production, the less responsive its leverage is to the corporate income tax rate.*

Contrary to firms with high revenue, firms that use lots of capital as inputs have a high need for external finance, as they have high investment needs. Besides, firms with a large stock of relatively safe, physical assets can access cheaper financing, as these fixed assets can be used as collateral (Baker and Martin 2011; Frank and Goyal 2009). Myers (2001) finds a positive correlation between capital intensity and leverage, while the opposite holds for circulating assets. Therefore, such firms can be assumed to exhibit a higher sensitivity to tax deductibility of interest expenses.

## III. Corporate Micro Data: Description of the Data and Stylized Facts

### A. Data

Our firm-level data are from Bureau van Dijk's Orbis database**.** Orbis provides financial stock and flow data for a large number of emerging and advanced economies over three decades. The dataset has a particularly comprehensive coverage of small- and medium-sized, European, unincorporated, nonfinancial firms. Other countries, typically outside Europe, have a more limited coverage. Overall, the total number of individual firms featured in Orbis is around 22.5 million.

Although a very rich dataset, Orbis requires extensive data cleaning and preparation for the purposes of economic analysis and research. For instance, duplicates, misreported values, missing variables, and reporting mistakes need to be purged from the original dataset. We use the version of Orbis database developed by Gal and Hijzen (2016). It combines several vintages of Orbis to create a longer time series and cleans the raw data using steps described in Gal (2013) and Kalemli-Ozcan and others (2015). The sample is restricted to advanced economies (as per the IMF definition) and nonfinancial sectors.[7] In addition, firms must report both their number of employees and operating revenues. Since Gal and Hijzen's (2016) focus is not on financial variables, we impose further restrictions. To discard outliers related to data reporting issues, we truncate the top 1 percent of the distribution for each financial variable, including leverage. To reduce noise from micro- and self-employed units, we drop firms with less than

[7] Gal and Hijzen (2016) further reduce the sample to those countries that have a reasonable number of observations with non-missing employment and revenues, as well as information on product market regulation (PMR). Nonfinancial sectors are defined by industry codes 5 to 82 in NACE Rev. 2 or 10 to 74 in NACE Rev. 1.1.

US$1,000 in assets and those that have fewer than 10 employees from the sample. A comprehensive set of robustness checks is performed on each of these restrictions.

We focus on unconsolidated reports. Orbis classifies company accounts as either consolidated or unconsolidated. Unconsolidated reporting treats subsidiaries as separate entities, while consolidated reports include all subsidiaries consolidated into a single entry. Our sample includes stand-alone firms (i.e., firms without a branch or subsidiary) that have identical unconsolidated and consolidated accounts, as well as all firms that report only one of the two types of accounts. Some firms with subsidiaries report both on a consolidated and unconsolidated basis. For these, we select their unconsolidated accounts, as this allows us to align the effect of tax rates and regulations with that of operations within a country's national borders. This strategy prevents the introduction of measurement error in the tax variable that may occur when foreign subsidiaries are consolidated into parent accounts, even though they are subject to a different corporate income tax rate.[8]

We use the debt-to-asset ratio as our preferred indicator of leverage. In the literature, several leverage indicators are commonly used, including debt-to-equity (also known as the gearing ratio), debt-to-asset, and debt-to-earnings. While the debt-to-equity and debt-to-asset ratios are both ratios of balance sheet stock variables, the debt-to-earnings ratio relates the stock of debt to the flow of earnings. Consequently, debt-to-earnings is more a liquidity risk indicator than a solvency indicator. The debt-to-asset and debt-to-equity measures are similar and often move in tandem, as, in a simplified balance sheet, total assets equal the sum of debt and equity. Both measures can be seen as long-term solvency indicators based on balance sheet stock data. Our preference for debt-to-asset is driven by data quality.[9]

We use several other firm-level data as control variables. We proxy a firm's size by its assets, collateral by tangible assets, turnover and earnings by revenue and cash flow, turnover volatility by the standard deviation of revenue, and a firm's capital intensity by the complement of labor costs, which is more widely available than capital costs. Except for total assets, all series are normalized as a share of total assets to avoid letting large firms dominate the regression results. For the same reason, we use the logarithm of total assets in our regressions.

Our final sample contains more than 14 million observations and covers 24 advanced economies over 1995–2013. The sample is unbalanced along the sector, time, and country dimensions. Therefore, the estimated coefficients will reflect the relative strength of the effect across groups (Angrist and Pischke, 2009). Summary statistics for the firm level variables in our sample can be found in Table 2, whereas the distribution of observations across countries and sectors is detailed in Table 14.

[8] The leverage can still be influenced by debt-shifting strategies, that is by optimization behaviors for firms active in various tax jurisdictions. Yet, this phenomenon is likely to be dominant chiefly for large companies.

[9] A robustness check using debt-to-equity instead yields similar results.

Several caveats apply to our firm-level data. First, firms' balance sheets differ greatly across economic sectors, complicating cross-sectoral comparisons. Second, different definitions of debt and assets are sometimes used in the literature. For example, debt can be defined as total liabilities or as a specific subcategory of liabilities—typically, short- or long-term liabilities. Third, book and market values of assets, liabilities, and equity often differ. In this paper, we rely on total liabilities and assets at nominal value, as market value data are not available in Orbis. Robustness checks in section IV.C address these concerns.

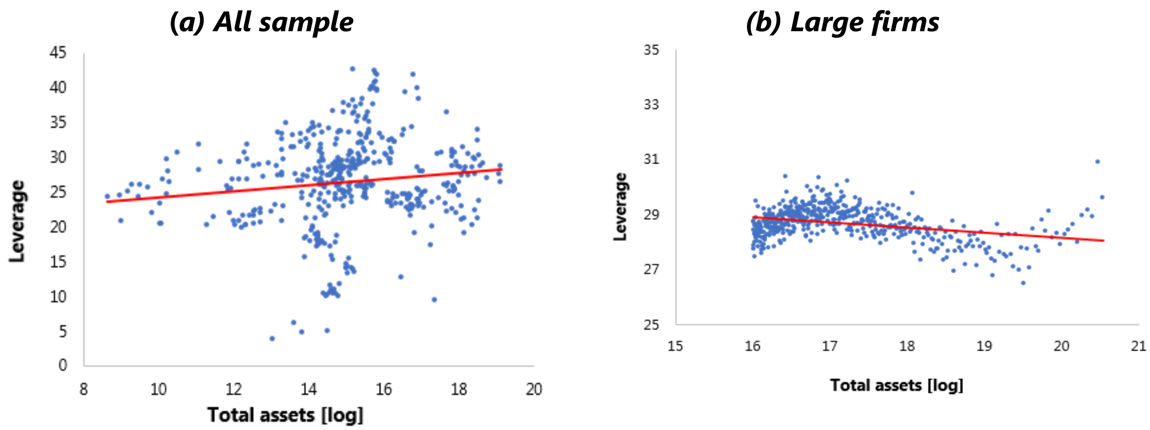
We complement Orbis data with tax policy variables. While the literature employs either the statutory CIT rate or reported average tax rate as the main explanatory variable, we choose the statutory (marginal) rate that the central government levies on the highest tax bracket, as it is most commonly reported and easily comparable across countries. While small firms might benefit from a plethora of tax deductions and exemptions, these are most often anchored to this top statutory rate. The CIT policy rates are taken from an internal IMF's Fiscal Affairs Department database.

## B. Stylized Facts

Several interesting patterns emerge from our data. We first explore the bivariate correlations of leverage with firms' characteristics and the CIT rate. These serve to interpret the role of control and interaction variables when we turn to regression analysis, in the next section.

Leverage increases with firm size, although the relationship is not linear. Larger firms generally have better access to credit markets, hence can borrow more. Large firms also have better access to equity markets and may hence be able to better diversify their liabilities. But in our dataset of mostly unincorporated firms, the first effect dominates: size, as measured by total assets, is positively associated with leverage (Figure 2a). Yet, size does play a different role for the largest companies in the sample, defined as those with total assets in the top quartile of the sample. For these there is a negative correlation between leverage and asset size (Figure 2b). This confirms that firms beyond a certain size, face different credit constraints and motivates us to treat the relationship between size and leverage as nonlinear.

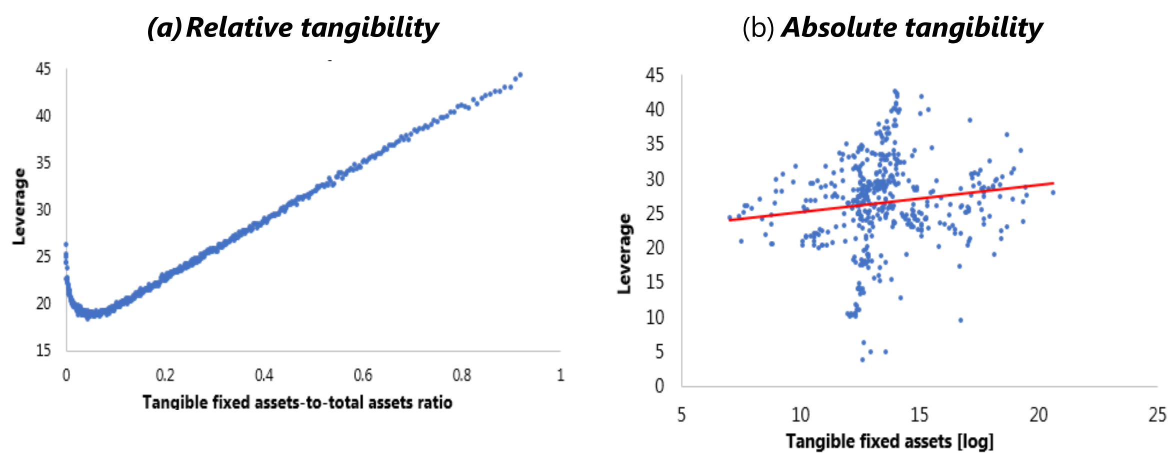
**Figure 2. Leverage and Size** (In percent)




*Notes:* Each dot corresponds to mean leverage and total assets in each country and year. Large firms are defined as the top 25 percentile of asset size (> US$9.4mn) in our sample.

Firms with more collateralizable assets are more leveraged (Figure *3*b). The more collateral a firm can put up in the form of tangible fixed assets, the easier it is to obtain credit. The pattern is similar when considering tangible assets as a share of total assets (a ratio often referred to as a firm's asset tangibility; Figure *3*a).

**Figure 3. Leverage and Tangibility** (In percent)

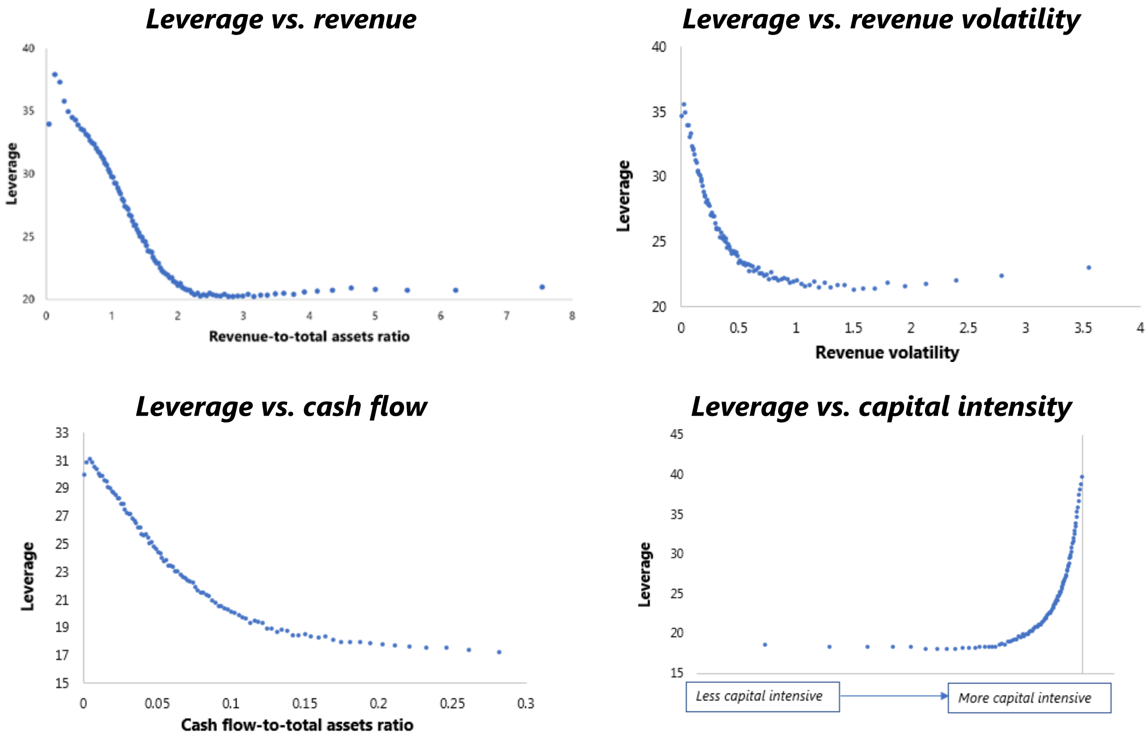



*Notes*: The sample is divided into 500 bins based on tangibility ratio. Within each bin, the average of leverage is computed and plotted.

*Notes*: Each dot corresponds to mean leverage and total fixed assets in each country and year. Tangible fixed assets do not include cash holdings.

We also gauge the effects of the type of business model on external financing needs, therefore on leverage. Figure 4 shows that, in general, more capital-intensive production is associated with higher leverage, while higher cash flows, higher revenue, and higher revenue volatility tend to be associated with lower leverage.

**Figure 4. Revenue, Capital Intensity, Cash Flow, and Leverage** (In percent)

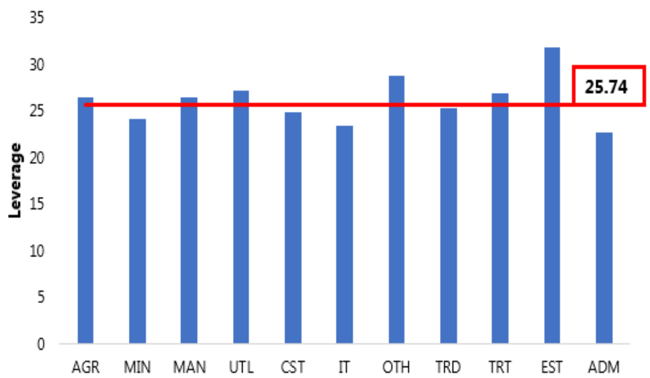



*Note:* The entire sample is divided into percentiles based on the corresponding variable. Within each percentile, average leverage and firms' characteristics are calculated and plotted.

Leverage does not vary much by economic sector (Figure 5). Even though our 11 sectors have distinct business models, with, for instance, manufacturing industries being more capital-intensive, leverage is fairly homogenous across sectors in our sample. We notice that services are slightly less leveraged than industries. The real estate sector stands out somewhat with above-average debt-to-asset ratios. Overall, this suggests that our regression results will not be driven by a single economic sector.

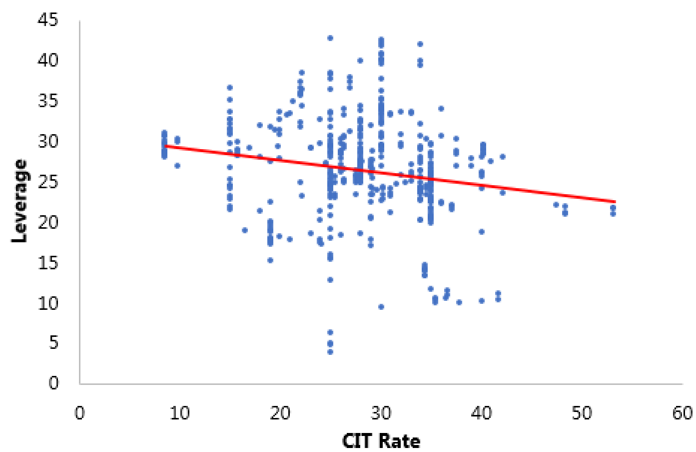
Notably, firms in countries with higher CIT rates are, on average, less leveraged. Figure 6 plots country-year observations, where each dot stands for the median leverage of all firms in a country in a certain year. The plot indicates that leverage decreases slightly with the CIT rate, driven largely by outliers with very high CIT rates. However, the empirical regressions in Section IV will find a clear positive relationship between the CIT rate and leverage, once fixed effects are controlled for.

**Figure 5. Leverage by Economic Sector** (In percent)




*Note:* AGR = agriculture, MIN = mining, MAN = manufacture, UTL = utilities, CST = construction, IT = Information technologies, OTH = other industries, TRD = trade, TRT = transportation, EST = real estate, ADM = administrative services. *Note:* Sectors are displayed in the following order: agriculture, mining, manufacturing, utilities, construction, IT, other, trade and accommodation, transport and storage, real estate, administrative activities. Average leverage per sector is calculated. The horizontal line represents the sample average.

**Figure 6. Leverage and CIT** (In percent)




*Note:* Each dot is a country-year average.

## IV. An Empirical Analysis of the Corporate Debt Bias

### A. Empirical Strategy

Our empirical strategy relies on a difference-in-difference approach *à la* Rajan and Zingales (1998) to capture the impact of the CIT rate on corporate leverage decisions. This approach is well-suited to assess the effect of a slow-moving macroeconomic variable such as CIT rates on firm-level variables, which are both volatile over time and dispersed in a cross-sectional way. Rajan and Zingales (1998) interact sectoral variations with country characteristics, whereas we cross the variations in firm level characteristics and a fiscal policy variable. But the empirical identification is similar.

The logic of our identification strategy is as follows. For each firm-level variable that influences leverage, we estimate an interaction term between that variable and the tax rate. A significant interaction term is then evidence that debt bias plays a role. Implicitly, our methodology differentiates the sample along a firm-level dimension and compares firms with high and low values of this variable, thereby generating a pseudo difference-in-difference.[10]

We use the following specification, where $i$ indexes firms, $s$ sectors, $c$ countries and $t$ years and the dependent variable is the debt-to-asset ratio:

$$D_{i,t,c} = \alpha D_{i,t-1,c} + \beta_1 X_{i,t-1,c} \; + \; \beta_2 \, \tau_{c,t} x_{i,t-1,c} \; + FE_{c,s,t} + \varepsilon_{i,t,c}. \qquad (1)$$

The coefficient of main interest in equation (1) is $\beta_2$, which indicates the interaction between the CIT rate and a selected firm-level variable. As each firm characteristic variable $x$ is also included as a stand-alone control variable in $X$, if the coefficient $\beta_2$ of the interaction term is significant, we can conclude that the CIT rate indeed influences corporate leverage decisions.

We assume that leverage decisions are affected by five main features of the firm: its size, asset structure, cash flow, revenue (and volatility of revenue), and capital intensity of production. The stylized fact presented above, our theoretical framework, as well as related literature (e.g. (Gungoraydinoglu and Öztekin 2011), all indicate that these variables influence leverage. Thus, our statistical model aimed at explaining debt bias includes them. To allow for possible nonlinear effects of firm size, we include both total assets (in logarithms) as well as the square of this measure. We scale the other explanatory regression variables by assets. We add the lagged dependent variable to the specification, since leverage is a persistent stock variable. We also add a large set of fixed effects to reduce omitted variable biases.[11]

The matrix $X_{itc}$ includes total assets (in logarithm) and the square of this measure, the share of tangible assets, as well as flow variables such as cash flow, revenue (volatility), and capital intensity, all expressed as a share of total assets. To prevent multicollinearity and reverse causality, we lag firm-specific variables on the right-hand side of the equation in both the control and the interaction terms.

We use pooled OLS estimators and cluster-robust standard errors. The obvious advantage of using OLS is its simplicity and economy in terms of computing power when it comes to large datasets like ours. Additionally, we believe that possible concerns related to within-panel correlation of the data are relatively minor, as the very nature of firm-level balance sheet information and the extent of missing observations (especially after our substantive data cleaning procedures) reduce the risks that observations strongly correlate. Nonetheless, we

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[10] Our approach differs from Rajan and Zingales (1998) in that we use continuous firm characteristics variables, However, we run a robustness check where we discretize firm characteristics into binary dummies.

[11] We include country-time (C*T), sector-time (S*T), and country-sector (C*S) fixed.

maximize the quality of our statistical inference by clustering the residuals at the country, industry, and year level (C*S+C*T+S*T). We also explored difference and system GMM models, which would in theory eliminate the endogeneity bias completely. However, the moment conditions proved cumbersome given our very large number of observations (and variables).[12]

### B. Evidence of Debt Bias

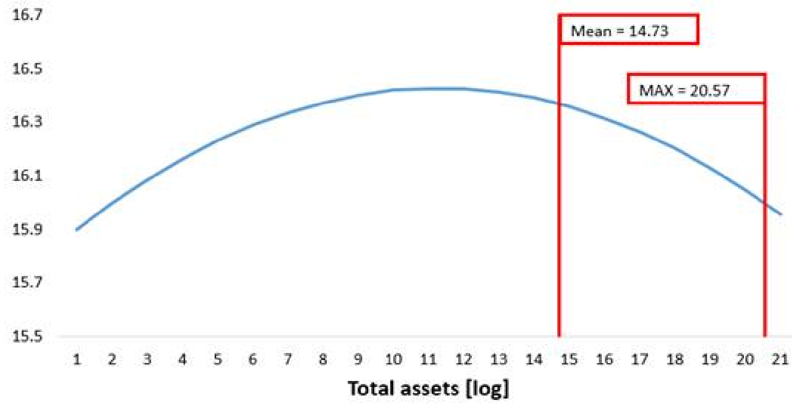
We find strong evidence that corporate taxation exerts a bias on firm leverage decisions. A higher CIT rate implies interest payments are deductible at a higher marginal rate, and hence the implicit subsidy for debt finance is higher. Our results are summarized in Table 3. They indicate that firms respond to tax incentives by increasing leverage, as can be seen from the sizeable and mostly significant interaction coefficients. These results confirm Hypothesis 1.

The results are also aligned with our other hypotheses. We find that debt bias is stronger for larger firms, confirming Hypothesis 2. Larger firms generally devote more resources to tax planning and have access to more financing sources capital markets, while bank loans remain the primary source of external financing for smaller firms. Large firms thereby have more opportunities to take advantage of CIT interest deductibility. We confirm that debt bias is stronger for firms with a higher share of tangible assets, which have more collateral to pledge (Hypothesis 3). We find that debt bias is weaker for firms with volatile or high revenue, in line with Hypothesis 4. Highly volatile revenues imply that intertemporal smoothing considerations dominate tax ones in the determination of the firm's demand for external finance. Credit demand and hence leverage of firms with high revenue volatility may thus be less sensitive to the prevailing CIT rate. Besides, firms with higher revenues are less sensitive to debt bias, as they generally rely more on internal finance and thus respond less to tax incentives to take up more external finance. Lastly, we find that debt bias is stronger for more capital-intensive firms, confirming Hypothesis 5. Capital-intensive forms have higher investment needs, which will be met at least partially with external finance, making them more sensitive to changes in the CIT rate.

Furthermore, we find strong persistence of the dependent variable, as well as significant effects of size, cash flow, and revenue and its volatility, capital intensity, and asset composition on leverage. Overall, these findings are in line with the stylized facts and our hypotheses. In particular, we confirm the nonlinear relationship between size and leverage, although the dominant effect in our sample is positive (Figure 7).

[12] In addition, the unbalanced nature of the data subtracts from the reliability of the GMM estimates. Although we cover a long temporal dimension, each firm in our data has on average only a few observations, which makes instrumenting infeasible—but also confines concerns regarding serial correlation between error terms.

**Figure 7. Contribution to Leverage of the Firm Size Component**



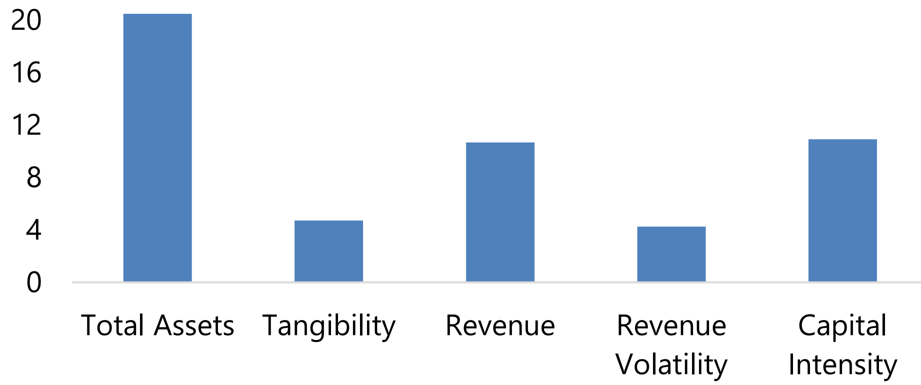

*Note:* Based on the average coefficient estimate of size and size squared across specifications without CIT and size interaction. The size effect is evaluated at median values of all other variables.

The estimated within-sample variation due to debt bias is sizeable. For instance, taking the interaction coefficient on total assets of 0.907 implies that debt bias explains about 20 percentage points of leverage *variations* among firms in the long run (Figure 8).[13] In a similar vein, debt bias explains about 5 percentage points of the variation among firms with different tangible assets. Revenue, revenue volatility, and capital intensity would explain about 11, 4, and 11 percentage point of debt bias variation within firms, respectively. Another way to gauge the magnitude of the debt bias effect is to estimate the long-term effect of debt bias on leverage. For instance, taking the interaction coefficient on total asset of 0.907 at the sample-mean CIT rate of 28 percent implies that debt bias contributes approximately 24 percentage points of leverage in the median firm.[14]

[13] In order to see the variation of the leverage across firms with different sizes and in an average CIT environment, we multiply the long-term effect $\beta_1/(1-\alpha)$ with the average CIT rate (0.28) and the difference between the 1st and 99th percentile of asset tangibility (0.87)—i.e., $\frac{\beta_1}{1-\alpha}.\bar{\tau}.\Delta_{1st}^{99th} = \frac{0.907}{1-0.842} \times 0.28 \times 12.74 = 20.47$.

[14] The long-term effect is $\beta_1/(1-\alpha)$, which we multiply by the average CIT rate in the sample and the average tangibility. That is: $\frac{\beta_1}{1-\alpha}.\bar{\tau}.\bar{x} = \frac{0.907}{1-0.842} \times 0.28 \times 14.85 \; = \; 23.87$.

**Figure 8. Leverage Due to Debt Bias**
Variation in Leverage Explained by Debt Bias

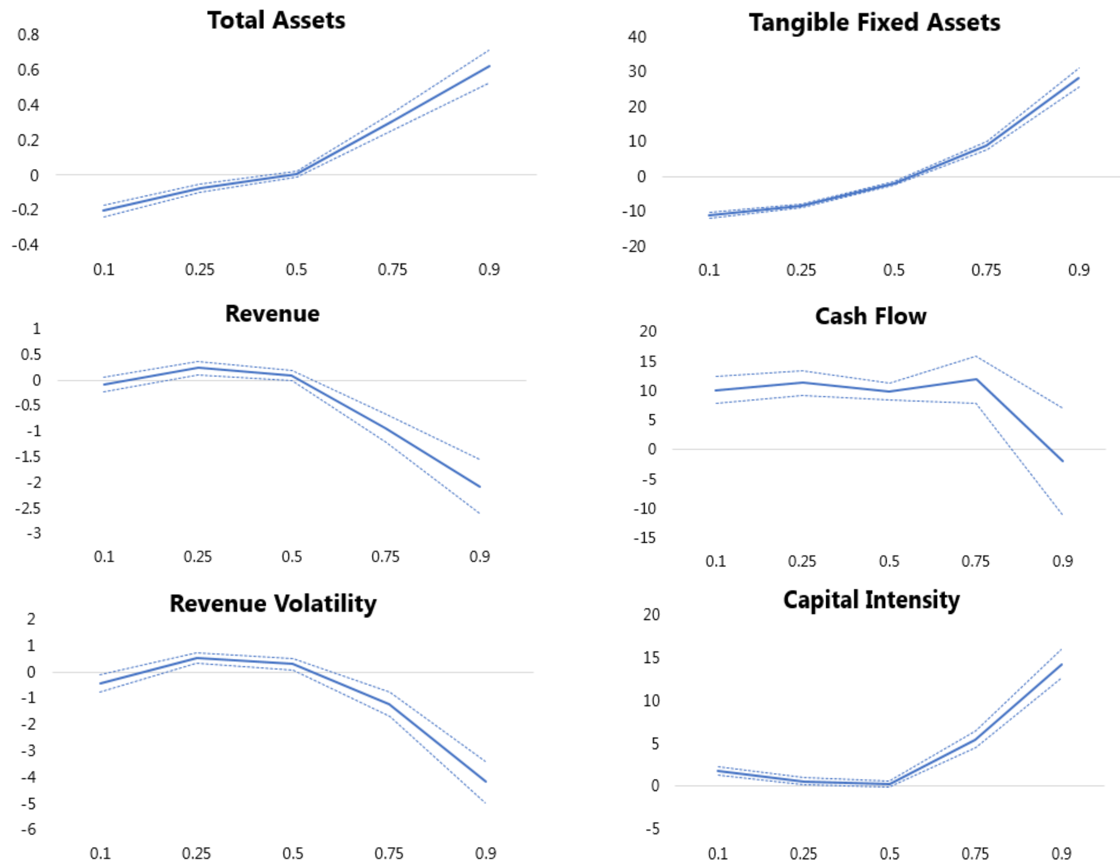



*Note:* Bars on chart represent the absolute value of variation in leverage moving from the 1st to 99th percentiles explained by debt bias (in percentage points). All bars are evaluated at the sample-mean CIT rate of 28 percent.

Quantile regressions indicate that many of these results are particularly pronounced for the most leveraged firms in the sample. To show differences between firms at different points along the leverage distribution, we employ quantile regressions for every decile. We do so using an almost-balanced sample—requiring that firms are present in the sample for 10 consecutive years.[15] Figure *9* shows that the positive relationship between the interaction of the CIT rate with size, tangible assets, and capital intensity is driven by the most leveraged firms. The same holds for the negative relationship between the interaction of the CIT rate and revenue and revenue volatility. In other words, with respect to these variables, debt bias is mostly an issue for the most leveraged firms, while the least leveraged firms often display opposite behavior. By contrast, the quantile regressions for the interaction coefficient of CIT and cash flow shows that the positive (but insignificant) baseline estimate is mainly driven by the least leveraged firms.

[15] This results in a smaller sample of just under 1 million firm-year observations. With the unbalanced sample, quantile regressions proved computationally too complex and unstable.

**Figure 9. Evolution of Interaction Coefficients in Quantile Regressions**




*Note:* dotted lines indicate confidence intervals at the 95 percent level.

### C. Robustness Checks

We examine the sensitivity of our findings through different robustness checks. Our findings may be sensitive to our choices for firm selection, data cleaning, and empirical specifications. Therefore, we run a large set of robustness checks.

First, changing the maturity composition of our dependent variable does not qualitatively change our results. We run the same regressions with long-term debt instead of total debt as the dependent variable (i.e., we exclude loans from our leverage variable). The results in Table 5 are in line with the baseline regressions; most coefficient estimates maintain the same sign and relative size, even though some are significant only at a lower uncertainty level. Overall, we conclude that firms consider debt bias to a larger extent when deciding about long-term financing plans, compared to decisions they make on overall firm financing. In other words, debt bias plays a larger role when firms consider long-term finance. The exception is the interaction coefficient on cash flow, which is negative and significant. The higher a firm's cash flow, the less its decisions on long-term debt could thus be driven by debt bias. Intuitively, cash flow is crucially important for short-term liquidity, hence cash flow may play more of a role when considering short-term debt.

Second, using debt-to-equity as our dependent variable does not alter our findings. While the number of observations increases in this specification, the overall fit of the regression is slightly worse than our baseline (Table 7). Overall, though, our baseline results are confirmed, with two interesting exemptions: i) the role of size as a control variable is diminished; ii) the debt bias coefficient estimates on tangibility is negative and significant, suggesting firms with high collateral lever up their debt-to-equity ratio less in response to debt bias.

Third, looking at a narrower set of countries or firms also confirms our main findings. Table *7* presents regression results for European countries within our dataset. Our set of European countries presents a more homogenous sample. In addition, Orbis data and macro variables for these countries are particularly comprehensive and of good quality (see Table 14a). European firms generally also use more bank financing. Our regression results generally prove robust to this sample restriction. We see the interaction coefficient for cash flow become larger and significant at the 5 percent level. Hence European firms with higher cash flow seem to take more advantage of debt bias. We see the coefficient estimates for the interaction term of the CIT rate with tangible assets become much smaller and therefore no longer significantly different from zero, even as the signs of the estimates remains as before. At the same time the direct effect of collateral on leverage is both larger and significant for this subsample. Together, this seems to indicate that having collateral directly leads European firms to increase leverage, muting the differential effect of debt bias for firms that have high collateral. Table *8* reports estimates for a sample in which the top two (instead of one) percent of data is trimmed. This does not qualitatively change any of our results.

Fourth, we include more small firms in our sample by excluding only single-employee firms instead of setting a threshold of 10 employees. The results in Table *9* are broadly similar to the baseline. However, in this sample, the interaction coefficient on tangible assets is no longer significant, while, in contrast, the interaction coefficient for cash flow is significant at the 1 percent level. The smallest firms hence seem to rely more on cash flow to take advantage of debt bias than they do on the availability of collateral. Intuitively, lenders will be more willing to provide financing to firms that can show an ability to service debt through cash flows than to firms that can provide collateral.

Fifth, our results are also robust to including more recent observations (Table 10). Here we use a different version of the Orbis database, which covers all years up to 2015 and even include some 2016 data points. A drawback of this version of the database for our purpose is that, while it provides more recent data, its coverage before 2005 is very limited, limiting the gist of the sample to just 11 years and limiting variations in the CIT rate.[16]

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[16] The up-to-date version of Orbis covers data from 1990 to 2016, but the sample is strongly unbalanced. It starts with just several thousand observations per year in the 1990s. The coverage increases to several million observations per year only after 2005.

Sixth, there is no indication that any particular economic sector is driving our results. We run our baseline regression on each economic sector separately to gauge whether any sector particularly stands out.[17] We split our sample into 11 different nonfinancial macroeconomic sectors, as defined by their NACE codes. We find that our results are broad-based across economic sectors. While coefficient estimates are generally less strongly significant in the sectoral regressions, this is likely due to the smaller sample size.

Seventh, when we look at the largest firms in our sample only, we find that the determinants of leverage differ to some extent. We define a firm as large when it is in the largest quartile of our sample by asset size. With this sample, the effect of size is different from what we found before, with a negative (control) coefficient estimate for asset size (Table 12). This is in line with the stylized facts presented in Figure *2*. In addition, among these firms, collateral and revenues (while still significant) explain a smaller part of leverage, while capital intensity explains a larger part of leverage. All this is presumably related to the fact that large firms have better access to financial markets and hence have less of a need to secure credit by posting collateral. Instead, the capital intensity of their production drives much of their demand for credit and, with their better access to credit, ultimately leverage. The estimates of debt bias all maintain the same sign but become insignificant for asset size and tangibility, as these two variables are not discriminant in this particular subsample of large firms.

Eighth, employing a balanced sample does not qualitatively change the results. We investigate the robustness of our findings by limiting the observations to the firms that are present in the data for a minimum of 10 consecutive years, in effect creating an (almost) balanced sample. This comes at the cost of a sharply decreased number of just 1.3 million observations. The coefficient estimates are close to those of our baseline results, and mostly remain significant (Table *12*). Tangibility and revenue no longer seem to significantly influence the degree to which a firm takes advantage of debt bias, while the influence of cash flow is much larger and significant at the 1 percent level in this sample.

Ninth, using binary instead of continuous firm-level variables in the interaction terms does not qualitatively change our conclusions. To get closer to a setup *à la* Rajan and ZIngales (1998), we map firm characteristic into a binary dummy indicating whether the value is above or below the median firm value. Our results hold with this new specification (Table 14).

## V. POLICY IMPLICATIONS

We find that debt bias boosts non-financial firm leverage for SMEs as well as for large firms. Our regressions show that, almost uniformly, firms react to tax incentives favoring debt finance by increasing leverage. Importantly, we show that this behavior is also observed in small, unlisted SMEs, even though large firms on average may increase leverage more in response to debt bias. We also show the importance of collateral in the form of tangible assets for levering up in

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[17] Tables with these regression results are not included, but available upon request.

response to debt bias and find evidence that firms with more volatile revenues are less able to do so. Lastly, we demonstrate that more capital-intensive firms are more sensitive to debt bias, while firms that are able to self-finance through higher revenues respond less to debt bias. The magnitude of debt bias is significant, explaining up to 27 percent of leverage.

Nonfinancial firm leverage can raise macroeconomic stability risks. Excessive corporate leverage may lead to rapid deleveraging in an adverse economic environment, exacerbating economic downturns (IMF, 2016b). As a result, firms may curb investment for prolonged periods of time, thus affecting the economy's overall (potential) growth rate. In addition, excessive leverage may lead to a spike in non-performing bank loans, leading banks to curb credit elsewhere and further hurting economic growth. These risks may be even more prevalent when firms borrow in foreign currency and thus are susceptible to exchange rate shocks, as is the case in a substantial number of emerging economies.

Tax policies can be employed to contain such risks. Our findings support the view that tax policies in many countries currently encourage leverage. Such tax policies seem to be at odds with regulatory and other policies aimed at increasing macroeconomic resilience by encouraging corporate balance sheet repair and deleveraging. To support nonfinancial corporate deleveraging, authorities might thus want to reconsider the tax-deductibility of interest payments.

The most straightforward policy options to address debt bias include limiting interest deductibility or introducing a similar deduction for equity. A recent study (IMF, 2016a) shows that, while a number of countries have introduced thin capitalization rules restricting interest deductibility, these have often only partially addressed debt bias. In contrast, an allowance for corporate equity has proved effective in mitigating debt bias in several countries. A more radical idea is to replace the CIT with a destination-based cash flow tax with border adjustment, as discussed in, e.g., Auerbach et al. (2017) and recently debated in the US. Such a cash-flow tax would restore the neutrality between debt and equity finance, and hence eliminate debt bias. Alternatively, a tax on borrowing could also re-equilibrate the favorable tax treatment and transfer to companies a part of the social cost of excessive leverage (Jeanne and Korinek, 2010).

Such policies would serve to put debt and equity finance on equal footing and increase firms' resilience. Neutrality with respect to the source of finance would increase economic efficiency as distortions from taxation would be reduced. In such an environment, debt finance would be lower, and equity finance higher. Firms' capital—its main shock absorber—would thus be larger, enhancing resilience of firms, as well as the macroeconomy, to shocks and cyclical downturns. In addition, adopting such policies would better align tax policies with other policies aimed at containing corporate leverage.

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**Table 1. Variable Definitions**

| Name | Definition | Unit | Source |
|---|---|---|---|
| **LEVERAGE** | (Loans & Long-term debt)-to-total assets | Percent | Orbis |
| **LEVERAGE2** | Long-term debt-to-total assets | Percent | Orbis |
| **LEVERAGE3** | (Loans & Long-term debt)-to-equity | Percent | Orbis |
| **LEVERAGE4** | (Loans & Long-term debt)-to-earnings | Percent | Orbis |
| **TA** | Total assets [log] | USD | Orbis |
| **TA-SQ** | Total assets [log] squared | | Orbis |
| **TFA-TA** | Tangible fixed assets-to-total assets ratio | Ratio | Orbis |
| **REV-TA** | Revenue-to-total assets ratio | Ratio | Orbis |
| **CASHFLOW-TA** | Cash flow-to-total assets | Ratio | Orbis |
| **REV-VOL** | Revenue-to-assets standard deviation | Ratio | Orbis |
| **CAPITAL-TA** | Capital-to-total assets (inverse of labor-to-total assets) | Ratio | Orbis |
| **CIT** | Top central statutory CIT rate | Ratio | IMF |

*Note:* ratio as unit means for instance that CIT = 0.3 for a country where 30 percent of income is levied.

**Table 2. Summary Statistics (Micro Level)**

| VARIABLES | min | mean | p25 | p50 | p75 | max | sd | # of obs. |
|---|---|---|---|---|---|---|---|---|
| LEVERAGE | ≈0 | 25.74 | 6.839 | 20.25 | 39.78 | 104.1 | 22.31 | 7,367,751 |
| LEVERAGE2 | ≈0 | 21.92 | 5.333 | 15.48 | 32.94 | 93.35 | 20.70 | 5,956,281 |
| LEVERAGE3 | -144.8 | 39.95 | 0.361 | 13.60 | 48.81 | 564.0 | 68.63 | 9,246,447 |
| LEVERAGE4 | -3,695 | 225.4 | 0 | 61.14 | 306.7 | 5,453 | 659.2 | 7,962,715 |
| TA | 0 | 14.73 | 13.78 | 14.85 | 16.00 | 20.57 | 2.253 | 10,973,463 |
| TA-SQ | 0 | 222.1 | 189.8 | 220.4 | 256.1 | 423.2 | 61.47 | 10,973,463 |
| TFA-TA | 0 | 0.251 | 0.06 | 0.183 | 0.390 | 0.926 | 0.229 | 10,951,096 |
| REV-TA | 0 | 1.886 | 1.003 | 1.587 | 2.411 | 8.656 | 1.313 | 10,973,463 |
| CASHFLOW-TA | 0 | 0.092 | 0.034 | 0.07 | 0.127 | 0.465 | 0.079 | 8,038,252 |
| REV-VOL | 0 | 0.642 | 0.232 | 0.454 | 0.839 | 4.257 | 0.612 | 11,097,374 |
| CAPITAL-TA | -3.571 | -0.488 | -0.619 | -0.316 | -0.153 | 0 | 0.524 | 9,002,220 |

**Table 3. Main Results**

| | Dependent Variable: LEVERAGE | | | | | | |
|---|---|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| LEVERAGE (L) | **0.842*** ** | **0.842*** ** | **0.842*** ** | **0.842*** ** | **0.842*** ** | **0.842*** ** | **0.842*** ** |
| | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** |
| TA (L) | **-0.283*** ** | **0.117** ** | **0.110** ** | **0.118** ** | **0.109** ** | **0.110** ** | **-0.269*** ** |
| | **[0.078]** | **[0.050]** | **[0.050]** | **[0.050]** | **[0.050]** | **[0.050]** | **[0.077]** |
| TA-SQ (L) | -0.002 | **-0.005*** ** | **-0.005*** ** | **-0.005*** ** | **-0.005*** ** | **-0.005*** ** | -0.002 |
| | [0.002] | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | [0.002] |
| TFA-TA (L) | **1.880*** ** | **0.945** ** | **1.885*** ** | **1.859*** ** | **1.870*** ** | **1.877*** ** | **1.334*** ** |
| | **[0.153]** | **[0.474]** | **[0.154]** | **[0.152]** | **[0.153]** | **[0.153]** | **[0.462]** |
| REV-TA (L) | **0.146*** ** | **0.150*** ** | **0.433*** ** | **0.151*** ** | **0.151*** ** | **0.150*** ** | **0.364*** ** |
| | **[0.017]** | **[0.017]** | **[0.072]** | **[0.017]** | **[0.017]** | **[0.017]** | **[0.086]** |
| CASHFLOW-TA (L) | **-6.750*** ** | **-6.749*** ** | **-6.744*** ** | **-8.311*** ** | **-6.720*** ** | **-6.735*** ** | **-9.554*** ** |
| | **[0.232]** | **[0.228]** | **[0.230]** | **[1.068]** | **[0.231]** | **[0.231]** | **[1.014]** |
| REV-VOL | **-0.379*** ** | **-0.391*** ** | **-0.391*** ** | **-0.391*** ** | -0.145 | **-0.391*** ** | **-0.575*** ** |
| | **[0.028]** | **[0.029]** | **[0.029]** | **[0.029]** | [0.116] | **[0.029]** | **[0.132]** |
| CAPITAL-TA (L) | **0.353*** ** | **0.348*** ** | **0.344*** ** | **0.347*** ** | **0.349*** ** | **-0.385** ** | 0.314 |
| | **[0.043]** | **[0.043]** | **[0.042]** | **[0.043]** | **[0.043]** | **[0.176]** | [0.213] |
| TA x CIT | **0.907*** ** | | | | | | **0.882*** ** |
| | **[0.134]** | | | | | | **[0.136]** |
| TFA-TA x CIT | | **3.047*** | | | | | 1.811 |
| | | **[1.761]** | | | | | [1.726] |
| REV-TA x CIT | | | **-0.908*** ** | | | | **-0.702*** ** |
| | | | **[0.214]** | | | | **[0.258]** |
| CASHFLOW-TA x CIT | | | | 5.203 | | | **8.994*** ** |
| | | | | [3.532] | | | **[3.329]** |
| REV-VOL x CIT | | | | | **-0.786** ** | | 0.627 |
| | | | | | **[0.380]** | | [0.422] |
| CAPITAL-TA x CIT | | | | | | **2.320*** ** | 0.114 |
| | | | | | | **[0.556]** | [0.649] |
| Observations | 3,494,804 | 3,494,804 | 3,494,804 | 3,494,804 | 3,494,804 | 3,494,804 | 3,494,804 |
| Adj. R-squared | 0.762 | 0.762 | 0.762 | 0.762 | 0.762 | 0.762 | 0.762 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table. (L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate

## Table 4. Quantile Regressions

### (a) Total Assets

| | Dependent variable: LEVERAGE | | | | |
|---|---|---|---|---|---|
| VARIABLES | 0.1 | 0.25 | 0.5 | 0.75 | 0.9 |
| LEVERAGE (L) | **0.673*** ** | **0.835*** ** | **0.946*** ** | **0.976*** ** | **0.934*** ** |
| | **[0.001]** | **[0.000]** | **[0.000]** | **[0.001]** | **[0.001]** |
| TA (L) | **0.065*** ** | **-0.067*** ** | **-0.105*** ** | **-0.188*** ** | **-0.227*** ** |
| | **[0.015]** | **[0.013]** | **[0.011]** | **[0.029]** | **[0.060]** |
| TA-SQ (L) | **0.001*** ** | **0.005*** ** | **0.005*** ** | 0.000 | **-0.007*** ** |
| | **[0.001]** | **[0.000]** | **[0.000]** | [0.001] | **[0.002]** |
| TFA-TA (L) | **1.175*** ** | **0.353*** ** | -0.003 | **0.107** ** | **0.828*** ** |
| | **[0.020]** | **[0.016]** | [0.016] | **[0.047]** | **[0.096]** |
| REV-TA (L) | **-0.192*** ** | **-0.141*** ** | 0.005 | **0.369*** ** | **0.700*** ** |
| | **[0.005]** | **[0.006]** | [0.005] | **[0.014]** | **[0.026]** |
| CASHFLOW-TA (L) | **-5.735*** ** | **-4.708*** ** | **-2.522*** ** | **-4.131*** ** | **-2.618*** ** |
| | **[0.049]** | **[0.059]** | **[0.049]** | **[0.146]** | **[0.312]** |
| REV-VOL (L) | **-0.219*** ** | **-0.093*** ** | -0.009 | **0.081*** ** | 0.021 |
| | **[0.007]** | **[0.009]** | [0.009] | **[0.021]** | [0.041] |
| CAPITAL-TA (L) | **0.601*** ** | **0.463*** ** | **0.203*** ** | **0.366*** ** | **0.219*** ** |
| | **[0.013]** | **[0.016]** | **[0.013]** | **[0.034]** | **[0.069]** |
| TA x CIT | **-0.204*** ** | **-0.074*** ** | 0.007 | **0.310*** ** | **0.622*** ** |
| | **[0.018]** | **[0.013]** | [0.010] | **[0.025]** | **[0.048]** |
| Observations | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 |

### (b) Tangible Fixed Assets

| | Dependent variable: LEVERAGE | | | | |
|---|---|---|---|---|---|
| VARIABLES | 0.1 | 0.25 | 0.5 | 0.75 | 0.9 |
| LEVERAGE (L) | **0.674*** ** | **0.835*** ** | **0.946*** ** | **0.976*** ** | **0.934*** ** |
| | **[0.001]** | **[0.000]** | **[0.000]** | **[0.001]** | **[0.001]** |
| TA (L) | **-0.032*** ** | **-0.100*** ** | **-0.104*** ** | **-0.064** ** | 0.050 |
| | **[0.012]** | **[0.012]** | **[0.011]** | **[0.027]** | [0.057] |
| TA-SQ (L) | **0.002*** ** | **0.006*** ** | **0.005*** ** | -0.000 | **-0.009*** ** |
| | **[0.000]** | **[0.000]** | **[0.000]** | [0.001] | **[0.002]** |
| TFA-TA (L) | **4.665*** ** | **2.967*** ** | **0.620*** ** | **-2.677*** ** | **-7.940*** ** |
| | **[0.118]** | **[0.081]** | **[0.060]** | **[0.183]** | **[0.424]** |
| REV-TA (L) | **-0.191*** ** | **-0.140*** ** | 0.006 | **0.368*** ** | **0.704*** ** |
| | **[0.004]** | **[0.006]** | [0.005] | **[0.014]** | **[0.026]** |
| CASHFLOW-TA (L) | **-5.573*** ** | **-4.561*** ** | **-2.491*** ** | **-4.293*** ** | **-3.062*** ** |
| | **[0.053]** | **[0.061]** | **[0.051]** | **[0.143]** | **[0.310]** |
| REV-VOL (L) | **-0.217*** ** | **-0.091*** ** | -0.009 | **0.073*** ** | -0.005 |
| | **[0.010]** | **[0.009]** | [0.009] | **[0.021]** | [0.041] |
| CAPITAL-TA (L) | **0.592*** ** | **0.462*** ** | **0.203*** ** | **0.368*** ** | **0.245*** ** |
| | **[0.013]** | **[0.015]** | **[0.013]** | **[0.035]** | **[0.071]** |
| TFA-TA x CIT | **-11.170*** ** | **-8.438*** ** | **-1.994*** ** | **8.949*** ** | **28.339*** ** |
| | **[0.357]** | **[0.257]** | **[0.199]** | **[0.576]** | **[1.356]** |
| Observations | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 |

### (c) Revenue

| VARIABLES | Dependent variable: LEVERAGE | | | | |
|---|---|---|---|---|---|
| | 0.1 | 0.25 | 0.5 | 0.75 | 0.9 |
| LEVERAGE (L) | **0.673*** ** | **0.835*** ** | **0.946*** ** | **0.976*** ** | **0.934*** ** |
| | **[0.001]** | **[0.000]** | **[0.000]** | **[0.001]** | **[0.001]** |
| TA (L) | **-0.024* ** | **-0.094*** ** | **-0.102*** ** | **-0.075*** ** | 0.011 |
| | **[0.013]** | **[0.012]** | **[0.011]** | **[0.027]** | [0.059] |
| TA-SQ (L) | **0.002*** ** | **0.006*** ** | **0.005*** ** | -0.000 | **-0.008*** ** |
| | **[0.000]** | **[0.000]** | **[0.000]** | [0.001] | **[0.002]** |
| TFA-TA (L) | **1.186*** ** | **0.346*** ** | -0.006 | **0.131*** ** | **0.883*** ** |
| | **[0.021]** | **[0.016]** | [0.017] | **[0.048]** | **[0.098]** |
| REV-TA (L) | **-0.165*** ** | **-0.216*** ** | -0.022 | **0.674*** ** | **1.383*** ** |
| | **[0.025]** | **[0.022]** | [0.018] | **[0.050]** | **[0.092]** |
| CASHFLOW-TA (L) | **-5.751*** ** | **-4.704*** ** | **-2.522*** ** | **-4.156*** ** | **-2.719*** ** |
| | **[0.059]** | **[0.061]** | **[0.049]** | **[0.144]** | **[0.314]** |
| REV-VOL (L) | **-0.220*** ** | **-0.094*** ** | -0.008 | **0.075*** ** | 0.000 |
| | **[0.010]** | **[0.009]** | [0.009] | **[0.021]** | [0.042] |
| CAPITAL-TA (L) | **0.591*** ** | **0.461*** ** | **0.202*** ** | **0.373*** ** | **0.242*** ** |
| | **[0.013]** | **[0.015]** | **[0.013]** | **[0.035]** | **[0.074]** |
| REV-TA x CIT | -0.078 | **0.234*** ** | 0.083 | **-0.944*** ** | **-2.081*** ** |
| | [0.073] | **[0.067]** | [0.052] | **[0.144]** | **[0.269]** |
| Observations | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 |

### (d) Cash Flow

| VARIABLES | Dependent variable: LEVERAGE | | | | |
|---|---|---|---|---|---|
| | 0.1 | 0.25 | 0.5 | 0.75 | 0.9 |
| LEVERAGE (L) | **0.673*** ** | **0.835*** ** | **0.946*** ** | **0.976*** ** | **0.934*** ** |
| | **[0.001]** | **[0.000]** | **[0.000]** | **[0.001]** | **[0.001]** |
| TA (L) | **-0.022* ** | **-0.096*** ** | **-0.105*** ** | **-0.065** ** | 0.029 |
| | **[0.012]** | **[0.012]** | **[0.011]** | **[0.028]** | [0.059] |
| TA-SQ (L) | **0.002*** ** | **0.006*** ** | **0.005*** ** | -0.000 | **-0.009*** ** |
| | **[0.000]** | **[0.000]** | **[0.000]** | [0.001] | **[0.002]** |
| TFA-TA (L) | **1.183*** ** | **0.341*** ** | -0.020 | **0.093* ** | **0.833*** ** |
| | **[0.022]** | **[0.016]** | [0.018] | **[0.048]** | **[0.098]** |
| REV-TA (L) | **-0.190*** ** | **-0.141*** ** | 0.005 | **0.365*** ** | **0.703*** ** |
| | **[0.004]** | **[0.006]** | [0.005] | **[0.014]** | **[0.026]** |
| CASHFLOW-TA (L) | **-9.006*** ** | **-8.320*** ** | **-5.699*** ** | **-7.928*** ** | -1.957 |
| | **[0.372]** | **[0.347]** | **[0.241]** | **[0.674]** | [1.522] |
| REV-VOL (L) | **-0.220*** ** | **-0.094*** ** | -0.009 | **0.081*** ** | 0.023 |
| | **[0.010]** | **[0.009]** | [0.009] | **[0.021]** | [0.041] |
| CAPITAL-TA (L) | **0.593*** ** | **0.462*** ** | **0.201*** ** | **0.365*** ** | **0.226*** ** |
| | **[0.012]** | **[0.015]** | **[0.013]** | **[0.035]** | **[0.070]** |
| CASH-TA x CIT | **10.123*** ** | **11.318*** ** | **9.851*** ** | **11.885*** ** | -2.035 |
| | **[1.134]** | **[1.070]** | **[0.736]** | **[2.054]** | [4.614] |
| Observations | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 |

### (e) Revenue Volatility

| VARIABLES | Dependent variable: LEVERAGE | | | | |
|---|---|---|---|---|---|
| | 0.1 | 0.25 | 0.5 | 0.75 | 0.9 |
| LEVERAGE (L) | **0.673*** ** | **0.835*** ** | **0.946*** ** | **0.976*** ** | **0.934*** ** |
| | **[0.001]** | **[0.000]** | **[0.000]** | **[0.001]** | **[0.001]** |
| TA (L) | **-0.031** ** | **-0.089*** ** | **-0.099*** ** | **-0.082*** ** | -0.031 |
| | **[0.013]** | **[0.012]** | **[0.010]** | **[0.028]** | [0.058] |
| TA-SQ (L) | **0.002*** ** | **0.005*** ** | **0.004*** ** | -0.000 | **-0.007*** ** |
| | **[0.000]** | **[0.000]** | **[0.000]** | [0.001] | **[0.002]** |
| TFA-TA (L) | **1.185*** ** | **0.347*** ** | -0.007 | **0.114** ** | **0.881*** ** |
| | **[0.020]** | **[0.016]** | [0.017] | **[0.048]** | **[0.097]** |
| REV-TA (L) | **-0.190*** ** | **-0.140*** ** | 0.005 | **0.368*** ** | **0.706*** ** |
| | **[0.004]** | **[0.005]** | [0.005] | **[0.014]** | **[0.026]** |
| CASHFLOW-TA (L) | **-5.748*** ** | **-4.702*** ** | **-2.521*** ** | **-4.127*** ** | **-2.735*** ** |
| | **[0.055]** | **[0.060]** | **[0.050]** | **[0.144]** | **[0.312]** |
| REV-VOL (L) | **-0.083* ** | **-0.262*** ** | **-0.105*** ** | **0.470*** ** | **1.341*** ** |
| | **[0.050]** | **[0.031]** | **[0.036]** | **[0.079]** | **[0.139]** |
| CAPITAL-TA (L) | **0.591*** ** | **0.459*** ** | **0.202*** ** | **0.376*** ** | **0.254*** ** |
| | **[0.012]** | **[0.015]** | **[0.013]** | **[0.034]** | **[0.070]** |
| REV-VOL x CIT | **-0.441*** ** | **0.521*** ** | **0.299*** ** | **-1.228*** ** | **-4.175*** ** |
| | **[0.160]** | **[0.104]** | **[0.108]** | **[0.230]** | **[0.403]** |
| Observations | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 |

### (f) Capital Intensity

| VARIABLES | Dependent variable: LEVERAGE | | | | |
|---|---|---|---|---|---|
| | 0.1 | 0.25 | 0.5 | 0.75 | 0.9 |
| LEVERAGE (L) | **0.673*** ** | **0.835*** ** | **0.946*** ** | **0.976*** ** | **0.934*** ** |
| | **[0.001]** | **[0.000]** | **[0.000]** | **[0.001]** | **[0.001]** |
| TA (L) | **-0.024* ** | **-0.094*** ** | **-0.103*** ** | **-0.078*** ** | 0.000 |
| | **[0.013]** | **[0.011]** | **[0.010]** | **[0.028]** | [0.057] |
| TA-SQ (L) | **0.002*** ** | **0.006*** ** | **0.005*** ** | -0.000 | **-0.008*** ** |
| | **[0.000]** | **[0.000]** | **[0.000]** | [0.001] | **[0.002]** |
| TFA-TA (L) | **1.190*** ** | **0.352*** ** | -0.002 | **0.134*** ** | **0.919*** ** |
| | **[0.020]** | **[0.015]** | [0.016] | **[0.048]** | **[0.097]** |
| REV-TA (L) | **-0.192*** ** | **-0.141*** ** | 0.005 | **0.364*** ** | **0.696*** ** |
| | **[0.004]** | **[0.006]** | [0.005] | **[0.014]** | **[0.027]** |
| CASHFLOW-TA (L) | **-5.746*** ** | **-4.706*** ** | **-2.527*** ** | **-4.169*** ** | **-2.796*** ** |
| | **[0.053]** | **[0.058]** | **[0.048]** | **[0.144]** | **[0.316]** |
| REV-VOL (L) | **-0.220*** ** | **-0.095*** ** | -0.009 | **0.079*** ** | 0.017 |
| | **[0.010]** | **[0.009]** | [0.009] | **[0.021]** | [0.041] |
| CAPITAL-TA (L) | 0.001 | **0.272*** ** | **0.109* ** | **-1.434*** ** | **-4.468*** ** |
| | [0.086] | **[0.075]** | **[0.058]** | **[0.177]** | **[0.307]** |
| CAPITAL-TA x CIT | **1.796*** ** | **0.587** ** | **0.288* ** | **5.450*** ** | **14.289*** ** |
| | **[0.251]** | **[0.228]** | **[0.171]** | **[0.508]** | **[0.856]** |
| Observations | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 |

## Table 5. Long-Term Debt Instead of Total Liabilities

| VARIABLES | Dependent Variable: LEVERAGE2 | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| LEVERAGE2 (L) | **0.818*** ** | **0.819*** ** | **0.819*** ** | **0.819*** ** | **0.819*** ** | **0.819*** ** | **0.818*** ** |
| | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** |
| TA (L) | **-0.603*** ** | 0.043 | 0.035 | 0.040 | 0.030 | 0.037 | **-0.624*** ** |
| | **[0.099]** | [0.047] | [0.046] | [0.046] | [0.047] | [0.047] | **[0.107]** |
| TA-SQ (L) | 0.001 | **-0.005*** ** | **-0.005** ** | **-0.005*** ** | **-0.005** ** | **-0.005** ** | 0.001 |
| | [0.002] | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | [0.002] |
| TFA-TA (L) | **2.402*** ** | **1.231*** ** | **2.389*** ** | **2.379*** ** | **2.377*** ** | **2.378*** ** | **1.518*** ** |
| | **[0.121]** | **[0.393]** | **[0.121]** | **[0.122]** | **[0.121]** | **[0.122]** | **[0.419]** |
| REV-TA (L) | **-0.127*** ** | **-0.122*** ** | **0.239*** ** | **-0.121*** ** | **-0.122*** ** | **-0.122*** ** | 0.116 |
| | **[0.019]** | **[0.019]** | **[0.075]** | **[0.019]** | **[0.019]** | **[0.019]** | [0.091] |
| CASHFLOW-TA (L) | **-5.382*** ** | **-5.353*** ** | **-5.353*** ** | **-2.796*** ** | **-5.330*** ** | **-5.326*** ** | **-4.228*** ** |
| | **[0.226]** | **[0.227]** | **[0.227]** | **[0.964]** | **[0.230]** | **[0.229]** | **[0.860]** |
| REV-VOL | **-0.513*** ** | **-0.524*** ** | **-0.522*** ** | **-0.525*** ** | -0.083 | **-0.524*** ** | **-0.525*** ** |
| | **[0.032]** | **[0.032]** | **[0.031]** | **[0.032]** | [0.117] | **[0.032]** | **[0.158]** |
| CAPITAL-TA (L) | **0.122*** ** | **0.122*** ** | **0.112** ** | **0.119** ** | **0.119** ** | **-0.384** ** | **0.952*** ** |
| | **[0.046]** | **[0.047]** | **[0.046]** | **[0.047]** | **[0.047]** | **[0.194]** | **[0.282]** |
| TA x CIT | **1.528*** ** | | | | | | **1.586*** ** |
| | **[0.225]** | | | | | | **[0.254]** |
| TFA-TA x CIT | | **3.862*** ** | | | | | **3.010** ** |
| | | **[1.281]** | | | | | **[1.388]** |
| REV-TA x CIT | | | **-1.209*** ** | | | | **-0.815*** ** |
| | | | **[0.239]** | | | | **[0.292]** |
| CASHFLOW-TA x CIT | | | | **-8.494*** ** | | | -4.024 |
| | | | | **[3.141]** | | | [2.848] |
| REV-VOL x CIT | | | | | **-1.459*** ** | | 0.041 |
| | | | | | **[0.414]** | | [0.549] |
| CAPITAL-TA x CIT | | | | | | **1.651*** ** | **-2.730*** ** |
| | | | | | | **[0.611]** | **[0.859]** |
| Observations | 2,420,610 | 2,420,610 | 2,420,610 | 2,420,610 | 2,420,610 | 2,420,610 | 2,420,610 |
| Adj. R-squared | 0.738 | 0.738 | 0.738 | 0.738 | 0.738 | 0.738 | 0.738 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate.

## Table 6. Total Liabilities-to-Equity Instead of Total Liabilities-to-Assets

| VARIABLES | Dependent Variable: LEVERAGE3 (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| LEVERAGE3 (L) | **0.791*** ** | **0.792*** ** | **0.792*** ** | **0.792*** ** | **0.792*** ** | **0.792*** ** | **0.791*** ** |
| | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** |
| TA (L) | **-1.368*** ** | -0.091 | -0.106 | -0.092 | -0.086 | -0.108 | **-1.338*** ** |
| | **[0.248]** | [0.164] | [0.164] | [0.164] | [0.165] | [0.164] | **[0.249]** |
| TA-SQ (L) | **0.013* ** | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | **0.013* ** |
| | **[0.007]** | [0.007] | [0.007] | [0.007] | [0.007] | [0.007] | **[0.007]** |
| TFA-TA (L) | **7.758*** ** | **10.430*** ** | **7.763*** ** | **7.734*** ** | **7.719*** ** | **7.750*** ** | **11.363*** ** |
| | **[0.325]** | **[1.198]** | **[0.326]** | **[0.323]** | **[0.324]** | **[0.324]** | **[1.180]** |
| REV-TA (L) | **0.264*** ** | **0.283*** ** | **0.962*** ** | **0.281*** ** | **0.281*** ** | **0.277*** ** | **1.092*** ** |
| | **[0.041]** | **[0.042]** | **[0.170]** | **[0.042]** | **[0.042]** | **[0.042]** | **[0.212]** |
| CASHFLOW-TA (L) | **-19.467*** ** | **-19.278*** ** | **-19.429*** ** | **-16.647*** ** | **-19.369*** ** | **-19.420*** ** | **-21.570*** ** |
| | **[0.610]** | **[0.607]** | **[0.608]** | **[2.557]** | **[0.608]** | **[0.608]** | **[2.478]** |
| REV-VOL | **-0.832*** ** | **-0.870*** ** | **-0.867*** ** | **-0.869*** ** | **-0.980*** ** | **-0.868*** ** | **-2.143*** ** |
| | **[0.074]** | **[0.076]** | **[0.075]** | **[0.076]** | **[0.273]** | **[0.076]** | **[0.333]** |
| CAPITAL-TA (L) | **1.025*** ** | **0.989*** ** | **0.982*** ** | **0.989*** ** | **0.989*** ** | **-0.895** ** | **1.057** ** |
| | **[0.106]** | **[0.104]** | **[0.104]** | **[0.104]** | **[0.104]** | **[0.394]** | **[0.534]** |
| TA x CIT | **2.810*** ** | | | | | | **2.806*** ** |
| | **[0.408]** | | | | | | **[0.431]** |
| TFA-TA x CIT | | **-8.975** ** | | | | | **-11.889*** ** |
| | | **[3.935]** | | | | | **[3.875]** |
| REV-TA x CIT | | | **-2.223*** ** | | | | **-2.675*** ** |
| | | | **[0.495]** | | | | **[0.622]** |
| CASHFLOW-TA x CIT | | | | -8.966 | | | 7.206 |
| | | | | [8.499] | | | [8.175] |
| REV-VOL x CIT | | | | | 0.355 | | **4.194*** ** |
| | | | | | [0.853] | | **[1.007]** |
| CAPITAL-TA x CIT | | | | | | **6.046*** ** | -0.155 |
| | | | | | | **[1.248]** | [1.630] |
| Observations | 4,513,192 | 4,513,192 | 4,513,192 | 4,513,192 | 4,513,192 | 4,513,192 | 4,513,192 |
| Adj. R-squared | 0.679 | 0.679 | 0.679 | 0.679 | 0.679 | 0.679 | 0.679 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate.

## Table 7. European Countries

| VARIABLES | Dependent Variable: LEVERAGE (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| LEVERAGE (L) | **0.833*** ** | **0.833*** ** | **0.833*** ** | **0.833*** ** | **0.833*** ** | **0.833*** ** | **0.833*** ** |
| | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** |
| TA (L) | **-0.344*** ** | -0.015 | -0.018 | -0.014 | -0.023 | -0.022 | **-0.328*** ** |
| | **[0.075]** | [0.048] | [0.048] | [0.048] | [0.048] | [0.048] | **[0.074]** |
| TA-SQ (L) | **0.003*** | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | **0.003*** |
| | **[0.002]** | [0.002] | [0.002] | [0.002] | [0.002] | [0.002] | **[0.002]** |
| TFA-TA (L) | **2.125*** ** | **1.747*** ** | **2.121*** ** | **2.106*** ** | **2.119*** ** | **2.125*** ** | **2.018*** ** |
| | **[0.168]** | **[0.489]** | **[0.169]** | **[0.168]** | **[0.168]** | **[0.168]** | **[0.480]** |
| REV-TA (L) | **0.089*** ** | **0.093*** ** | **0.198*** ** | **0.093*** ** | **0.093*** ** | **0.092*** ** | 0.030 |
| | **[0.016]** | **[0.016]** | **[0.066]** | **[0.016]** | **[0.016]** | **[0.016]** | [0.072] |
| CASHFLOW-TA (L) | **-6.938*** ** | **-6.924*** ** | **-6.921*** ** | **-9.384*** ** | **-6.918*** ** | **-6.933*** ** | **-10.388*** ** |
| | **[0.244]** | **[0.241]** | **[0.243]** | **[1.179]** | **[0.244]** | **[0.244]** | **[1.095]** |
| REV-VOL | **-0.333*** ** | **-0.344*** ** | **-0.343*** ** | **-0.344*** ** | -0.077 | **-0.343*** ** | **-0.243*** |
| | **[0.029]** | **[0.029]** | **[0.029]** | **[0.029]** | [0.126] | **[0.029]** | **[0.125]** |
| CAPITAL-TA (L) | **0.268*** ** | **0.261*** ** | **0.261*** ** | **0.259*** ** | **0.262*** ** | **-0.467** ** | -0.212 |
| | **[0.041]** | **[0.041]** | **[0.041]** | **[0.041]** | **[0.041]** | **[0.182]** | [0.191] |
| TA x CIT | **0.762*** ** | | | | | | **0.717*** ** |
| | **[0.123]** | | | | | | **[0.121]** |
| TFA-TA x CIT | | 1.195 | | | | | 0.328 |
| | | [1.786] | | | | | [1.762] |
| REV-TA x CIT | | | **-0.333*** | | | | 0.184 |
| | | | **[0.200]** | | | | [0.218] |
| CASHFLOW-TA x CIT | | | | **7.946** ** | | | **11.049*** ** |
| | | | | **[3.848]** | | | **[3.548]** |
| REV-VOL x CIT | | | | | **-0.838** ** | | -0.284 |
| | | | | | **[0.406]** | | [0.401] |
| CAPITAL-TA x CIT | | | | | | **2.292*** ** | **1.511** ** |
| | | | | | | **[0.574]** | **[0.592]** |
| Observations | 3,162,831 | 3,162,831 | 3,162,831 | 3,162,831 | 3,162,831 | 3,162,831 | 3,162,831 |
| Adj. R-squared | 0.741 | 0.741 | 0.741 | 0.741 | 0.741 | 0.741 | 0.741 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate

## Table 8. Trimming Top Two Percent Instead of Top One Percent

| | Dependent Variable: LEVERAGE | | | | | | |
|---|---|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| LEVERAGE (L) | **0.836*** ** | **0.836*** ** | **0.836*** ** | **0.836*** ** | **0.836*** ** | **0.836*** ** | **0.836*** ** |
| | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** |
| TA (L) | **-0.182** ** | **0.251*** ** | **0.241*** ** | **0.252*** ** | **0.244*** ** | **0.243*** ** | **-0.153** ** |
| | **[0.080]** | **[0.053]** | **[0.052]** | **[0.052]** | **[0.052]** | **[0.053]** | **[0.077]** |
| TA-SQ (L) | **-0.006*** ** | **-0.010*** ** | **-0.010*** ** | **-0.010*** ** | **-0.010*** ** | **-0.010*** ** | **-0.006*** ** |
| | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** |
| TFA-TA (L) | **1.970*** ** | **0.975** ** | **1.979*** ** | **1.949*** ** | **1.975*** ** | **1.968*** ** | **1.536*** ** |
| | **[0.155]** | **[0.486]** | **[0.156]** | **[0.154]** | **[0.155]** | **[0.155]** | **[0.472]** |
| REV-TA (L) | **-0.067*** ** | **-0.064*** ** | **0.334*** ** | **-0.064*** ** | **-0.060*** ** | **-0.066*** ** | 0.131 |
| | **[0.019]** | **[0.019]** | **[0.072]** | **[0.019]** | **[0.020]** | **[0.019]** | [0.083] |
| CASHFLOW-TA (L) | **-7.131*** ** | **-7.135*** ** | **-7.142*** ** | **-9.124*** ** | **-7.115*** ** | **-7.117*** ** | **-10.447*** ** |
| | **[0.250]** | **[0.247]** | **[0.249]** | **[1.195]** | **[0.249]** | **[0.249]** | **[1.130]** |
| REV-VOL | **0.868*** ** | **0.864*** ** | **0.870*** ** | **0.868*** ** | **1.925*** ** | **0.870*** ** | **1.422*** ** |
| | **[0.051]** | **[0.050]** | **[0.051]** | **[0.051]** | **[0.206]** | **[0.051]** | **[0.230]** |
| CAPITAL-TA (L) | **0.418*** ** | **0.414*** ** | **0.406*** ** | **0.413*** ** | **0.409*** ** | **-0.494** ** | 0.353 |
| | **[0.047]** | **[0.047]** | **[0.046]** | **[0.047]** | **[0.046]** | **[0.208]** | [0.237] |
| TA x CIT | **0.971*** ** | | | | | | **0.893*** ** |
| | **[0.138]** | | | | | | **[0.135]** |
| TFA-TA x CIT | | **3.236*** | | | | | 1.470 |
| | | **[1.785]** | | | | | [1.740] |
| REV-TA x CIT | | | **-1.285*** ** | | | | **-0.630** ** |
| | | | **[0.226]** | | | | **[0.258]** |
| CASHFLOW-TA x CIT | | | | **6.574*** | | | **10.576*** ** |
| | | | | **[3.953]** | | | **[3.715]** |
| REV-VOL x CIT | | | | | **-3.464*** ** | | **-1.823** ** |
| | | | | | **[0.661]** | | **[0.762]** |
| CAPITAL-TA x CIT | | | | | | **2.858*** ** | 0.193 |
| | | | | | | **[0.656]** | [0.725] |
| Observations | 3,337,008 | 3,337,008 | 3,337,008 | 3,337,008 | 3,337,008 | 3,337,008 | 3,337,008 |
| Adj. R-squared | 0.758 | 0.758 | 0.758 | 0.758 | 0.758 | 0.758 | 0.758 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate.

## Table 9. A Two-Employee Threshold Instead of a Ten-Employee Threshold

| | Dependent Variable: LEVERAGE | | | | | | |
|---|---|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| LEVERAGE (L) | **0.828*** ** | **0.829*** ** | **0.829*** ** | **0.829*** ** | **0.829*** ** | **0.829*** ** | **0.828*** ** |
| | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** |
| TA (L) | **-0.495*** ** | 0.064 | 0.060 | 0.068 | 0.052 | 0.062 | **-0.544*** ** |
| | **[0.075]** | [0.051] | [0.051] | [0.051] | [0.051] | [0.051] | **[0.076]** |
| TA-SQ (L) | -0.001 | **-0.005** ** | **-0.005** ** | **-0.005** ** | **-0.005** ** | **-0.005** ** | -0.000 |
| | [0.002] | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | [0.002] |
| TFA-TA (L) | **1.897*** ** | **1.187** ** | **1.883*** ** | **1.851*** ** | **1.880*** ** | **1.873*** ** | **1.869*** ** |
| | **[0.175]** | **[0.486]** | **[0.175]** | **[0.174]** | **[0.174]** | **[0.174]** | **[0.497]** |
| REV-TA (L) | **0.083*** ** | **0.090*** ** | **0.336*** ** | **0.092*** ** | **0.091*** ** | **0.090*** ** | **0.252*** ** |
| | **[0.017]** | **[0.017]** | **[0.075]** | **[0.017]** | **[0.017]** | **[0.017]** | **[0.080]** |
| CASHFLOW-TA (L) | **-5.544*** ** | **-5.508*** ** | **-5.513*** ** | **-10.623*** ** | **-5.510*** ** | **-5.495*** ** | **-12.610*** ** |
| | **[0.194]** | **[0.192]** | **[0.192]** | **[0.945]** | **[0.192]** | **[0.192]** | **[0.895]** |
| REV-VOL | **-0.288*** ** | **-0.297*** ** | **-0.298*** ** | **-0.297*** ** | **0.340*** ** | **-0.298*** ** | 0.028 |
| | **[0.033]** | **[0.033]** | **[0.033]** | **[0.033]** | **[0.121]** | **[0.034]** | [0.134] |
| CAPITAL-TA (L) | **0.352*** ** | **0.357*** ** | **0.352*** ** | **0.359*** ** | **0.359*** ** | **-0.034** | **0.792*** ** |
| | **[0.046]** | **[0.046]** | **[0.046]** | **[0.047]** | **[0.046]** | **[0.216]** | **[0.228]** |
| TA x CIT | **1.388*** ** | | | | | | **1.505*** ** |
| | **[0.150]** | | | | | | **[0.159]** |
| TFA-TA x CIT | | 2.235 | | | | | 0.063 |
| | | [1.787] | | | | | [1.834] |
| REV-TA x CIT | | | **-0.785*** ** | | | | **-0.537** ** |
| | | | **[0.230]** | | | | **[0.239]** |
| CASHFLOW-TA x CIT | | | | **16.534*** ** | | | **22.670*** ** |
| | | | | **[3.001]** | | | **[2.834]** |
| REV-VOL x CIT | | | | | **-2.044*** ** | | **-1.010** ** |
| | | | | | **[0.412]** | | **[0.451]** |
| CAPITAL-TA x CIT | | | | | | **1.227* ** | **-1.377* ** |
| | | | | | | **[0.709]** | **[0.730]** |
| Observations | 8,143,290 | 8,143,290 | 8,143,290 | 8,143,290 | 8,143,290 | 8,143,290 | 8,143,290 |
| Adj. R-squared | 0.726 | 0.726 | 0.726 | 0.726 | 0.726 | 0.726 | 0.726 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate.

## Table 10. More Recent Orbis Vintage (2005-2015)

| | Dependent Variable: LEVERAGE | | | | | | |
|---|---|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| LEVERAGE (L) | **0.813*** ** | **0.813*** ** | **0.813*** ** | **0.813*** ** | **0.813*** ** | **0.813*** ** | **0.813*** ** |
| | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** |
| TA (L) | **-1.163*** ** | **-0.528*** ** | **-0.559*** ** | **-0.524*** ** | **-0.532*** ** | **-0.537*** ** | **-1.191*** ** |
| | **[0.143]** | **[0.125]** | **[0.124]** | **[0.124]** | **[0.125]** | **[0.125]** | **[0.145]** |
| TA-SQ (L) | **0.022*** ** | **0.015*** ** | **0.016*** ** | **0.015*** ** | **0.015*** ** | **0.016*** ** | **0.022*** ** |
| | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** | **[0.004]** |
| TFA-TA (L) | **2.482*** ** | 0.449 | **2.482*** ** | **2.453*** ** | **2.456*** ** | **2.459*** ** | **0.809* ** |
| | **[0.161]** | [0.481] | **[0.163]** | **[0.162]** | **[0.162]** | **[0.162]** | **[0.484]** |
| REV-TA (L) | **0.055*** ** | **0.056*** ** | **0.412*** ** | **0.059*** ** | **0.059*** ** | **0.058*** ** | **0.561*** ** |
| | **[0.018]** | **[0.018]** | **[0.080]** | **[0.018]** | **[0.018]** | **[0.018]** | **[0.101]** |
| CASHFLOW-TA (L) | **-4.762*** ** | **-4.767*** ** | **-4.758*** ** | **-5.918*** ** | **-4.719*** ** | **-4.723*** ** | **-7.828*** ** |
| | **[0.219]** | **[0.219]** | **[0.219]** | **[1.108]** | **[0.219]** | **[0.219]** | **[1.049]** |
| REV-VOL | **-0.153*** ** | **-0.157*** ** | **-0.158*** ** | **-0.155*** ** | **-0.214* ** | **-0.155*** ** | **-0.858*** ** |
| | **[0.029]** | **[0.030]** | **[0.030]** | **[0.030]** | **[0.113]** | **[0.030]** | **[0.141]** |
| CAPITAL-TA (L) | **0.577*** ** | **0.578*** ** | **0.570*** ** | **0.578*** ** | **0.579*** ** | **0.473*** ** | **1.644*** ** |
| | **[0.038]** | **[0.039]** | **[0.037]** | **[0.039]** | **[0.039]** | **[0.173]** | **[0.226]** |
| TA x CIT | **1.370*** ** | | | | | | **1.515*** ** |
| | **[0.224]** | | | | | | **[0.229]** |
| TFA-TA x CIT | | **6.582*** ** | | | | | **5.477*** ** |
| | | **[1.719]** | | | | | **[1.740]** |
| REV-TA x CIT | | | **-1.134*** ** | | | | **-1.618*** ** |
| | | | **[0.234]** | | | | **[0.300]** |
| CASHFLOW-TA x CIT | | | | 3.825 | | | **9.637*** ** |
| | | | | [3.544] | | | **[3.375]** |
| REV-VOL x CIT | | | | | 0.189 | | **2.241*** ** |
| | | | | | [0.364] | | **[0.437]** |
| CAPITAL-TA x CIT | | | | | | 0.333 | **-3.392*** ** |
| | | | | | | [0.558] | **[0.694]** |
| Observations | 5,954,763 | 5,954,763 | 5,954,763 | 5,954,763 | 5,954,763 | 5,954,763 | 5,954,763 |
| Adj. R-squared | 0.718 | 0.718 | 0.718 | 0.718 | 0.718 | 0.718 | 0.718 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate.

## Table 11. Large Firms Only

| VARIABLES | Dependent Variable: LEVERAGE | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| LEVERAGE (L) | **0.879*** ** | **0.879*** ** | **0.879*** ** | **0.879*** ** | **0.879*** ** | **0.879*** ** | **0.879*** ** |
| | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** |
| TA (L) | **-1.456*** ** | **-1.366*** ** | **-1.382*** ** | **-1.366*** ** | **-1.382*** ** | **-1.376*** ** | **-1.419*** ** |
| | **[0.406]** | **[0.376]** | **[0.376]** | **[0.376]** | **[0.376]** | **[0.376]** | **[0.408]** |
| TA-SQ (L) | **0.035*** ** | **0.034*** ** | **0.034*** ** | **0.034*** ** | **0.034*** ** | **0.034*** ** | **0.035*** ** |
| | **[0.011]** | **[0.011]** | **[0.011]** | **[0.011]** | **[0.011]** | **[0.011]** | **[0.011]** |
| TFA-TA (L) | **1.429*** ** | **1.334*** ** | **1.433*** ** | **1.429*** ** | **1.433*** ** | **1.432*** ** | **1.583*** ** |
| | **[0.114]** | **[0.427]** | **[0.114]** | **[0.114]** | **[0.114]** | **[0.114]** | **[0.421]** |
| REV-TA (L) | **0.080*** ** | **0.080*** ** | **0.236** ** | **0.080*** ** | **0.079*** ** | **0.079*** ** | 0.149 |
| | **[0.025]** | **[0.025]** | **[0.098]** | **[0.025]** | **[0.025]** | **[0.025]** | [0.138] |
| CASHFLOW-TA (L) | **-6.955*** ** | **-6.955*** ** | **-6.963*** ** | **-7.581*** ** | **-6.963*** ** | **-6.965*** ** | **-8.088*** ** |
| | **[0.324]** | **[0.325]** | **[0.324]** | **[1.498]** | **[0.324]** | **[0.324]** | **[1.502]** |
| REV-VOL | **-0.296*** ** | **-0.296*** ** | **-0.296*** ** | **-0.296*** ** | 0.003 | **-0.295*** ** | -0.109 |
| | **[0.040]** | **[0.040]** | **[0.040]** | **[0.040]** | [0.153] | **[0.040]** | [0.206] |
| CAPITAL-TA (L) | **0.735*** ** | **0.734*** ** | **0.734*** ** | **0.733*** ** | **0.732*** ** | 0.072 | 0.212 |
| | **[0.077]** | **[0.077]** | **[0.077]** | **[0.077]** | **[0.077]** | [0.337] | [0.396] |
| TA x CIT | 0.217 | | | | | | 0.073 |
| | [0.272] | | | | | | [0.295] |
| TFA-TA x CIT | | 0.331 | | | | | -0.522 |
| | | [1.479] | | | | | [1.466] |
| REV-TA x CIT | | | **-0.532*** | | | | -0.241 |
| | | | **[0.303]** | | | | [0.440] |
| CASHFLOW-TA x CIT | | | | 2.135 | | | 3.795 |
| | | | | [5.074] | | | [5.097] |
| REV-VOL x CIT | | | | | **-1.006** ** | | -0.624 |
| | | | | | **[0.499]** | | [0.674] |
| CAPITAL-TA x CIT | | | | | | **2.230** ** | 1.751 |
| | | | | | | **[1.082]** | [1.268] |
| Observations | 994,978 | 994,978 | 994,978 | 994,978 | 994,978 | 994,978 | 994,978 |
| Adj. R-squared | 0.809 | 0.809 | 0.809 | 0.809 | 0.809 | 0.809 | 0.809 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate.

## Table 12. Balanced Sample

| | Dependent Variable: LEVERAGE | | | | | | |
|---|---|---|---|---|---|---|---|
| VARIABLES | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| LEVERAGE (L) | **0.856*** ** | **0.856*** ** | **0.856*** ** | **0.856*** ** | **0.856*** ** | **0.856*** ** | **0.856*** ** |
| | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** |
| TA (L) | **-0.357*** ** | **-0.117** ** | **-0.118** ** | **-0.117** ** | **-0.130*** ** | **-0.127*** ** | **-0.313*** ** |
| | **[0.083]** | **[0.047]** | **[0.047]** | **[0.047]** | **[0.048]** | **[0.047]** | **[0.085]** |
| TA-SQ (L) | **0.006*** ** | **0.004** ** | **0.004** ** | **0.004** ** | **0.004** ** | **0.004** ** | **0.006*** ** |
| | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** |
| TFA-TA (L) | **1.542*** ** | **1.076** ** | **1.541*** ** | **1.520*** ** | **1.546*** ** | **1.549*** ** | **1.440*** ** |
| | **[0.146]** | **[0.497]** | **[0.145]** | **[0.145]** | **[0.146]** | **[0.146]** | **[0.482]** |
| REV-TA (L) | **0.111*** ** | **0.111*** ** | **0.162* ** | **0.110*** ** | **0.112*** ** | **0.111*** ** | -0.100 |
| | **[0.019]** | **[0.019]** | **[0.087]** | **[0.019]** | **[0.019]** | **[0.019]** | [0.103] |
| CASHFLOW-TA (L) | **-6.653*** ** | **-6.670*** ** | **-6.654*** ** | **-12.374*** ** | **-6.664*** ** | **-6.666*** ** | **-13.008*** ** |
| | **[0.313]** | **[0.313]** | **[0.313]** | **[1.344]** | **[0.314]** | **[0.313]** | **[1.365]** |
| REV-VOL | **-0.235*** ** | **-0.236*** ** | **-0.236*** ** | **-0.233*** ** | 0.149 | **-0.238*** ** | 0.134 |
| | **[0.031]** | **[0.031]** | **[0.031]** | **[0.031]** | [0.140] | **[0.031]** | [0.154] |
| CAPITAL-TA (L) | **0.338*** ** | **0.334*** ** | **0.334*** ** | **0.333*** ** | **0.336*** ** | **-0.727*** ** | **-0.834*** ** |
| | **[0.058]** | **[0.058]** | **[0.058]** | **[0.058]** | **[0.058]** | **[0.253]** | **[0.315]** |
| TA x CIT | **0.547*** ** | | | | | | **0.407** ** |
| | **[0.155]** | | | | | | **[0.166]** |
| TFA-TA x CIT | | 1.474 | | | | | 0.280 |
| | | [1.656] | | | | | [1.617] |
| REV-TA x CIT | | | -0.155 | | | | **0.647** ** |
| | | | [0.255] | | | | **[0.301]** |
| CASHFLOW-TA x CIT | | | | **17.949*** ** | | | **19.863*** ** |
| | | | | **[4.215]** | | | **[4.269]** |
| REV-VOL x CIT | | | | | **-1.206*** ** | | **-1.152** ** |
| | | | | | **[0.426]** | | **[0.461]** |
| CAPITAL-TA x CIT | | | | | | **3.260*** ** | **3.604*** ** |
| | | | | | | **[0.753]** | **[0.931]** |
| Observations | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 | 1,362,563 |
| Adj. R-squared | 0.771 | 0.771 | 0.771 | 0.771 | 0.771 | 0.771 | 0.771 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate.

## Table 13. Binary Variable Instead of Continuous Micro Variable

| VARIABLES | Dependent Variable: LEVERAGE (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| LEVERAGE (L) | **0.842***** | **0.843***** | **0.841***** | **0.830***** | **0.842***** | **0.841***** | **0.829***** |
| | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** | **[0.003]** |
| TA (L) | **0.187***** | **0.121**** | **0.206***** | **0.091*** | **0.119**** | **0.231***** | **0.301***** |
| | **[0.046]** | **[0.050]** | **[0.050]** | **[0.050]** | **[0.050]** | **[0.048]** | **[0.045]** |
| TA-SQ (L) | **-0.012***** | **-0.006***** | **-0.009***** | **-0.004**** | **-0.005***** | **-0.011***** | **-0.016***** |
| | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** | **[0.002]** |
| TFA-TA (L) | **1.879***** | **-0.467***** | **1.518***** | **2.973***** | **1.853***** | **1.899***** | **0.426***** |
| | **[0.153]** | **[0.144]** | **[0.150]** | **[0.158]** | **[0.153]** | **[0.154]** | **[0.149]** |
| REV-TA (L) | **0.162***** | **0.136***** | **0.655***** | **0.175***** | **0.155***** | **0.162***** | **0.582***** |
| | **[0.017]** | **[0.017]** | **[0.031]** | **[0.017]** | **[0.017]** | **[0.017]** | **[0.030]** |
| CASHFLOW-TA (L) | **-6.645***** | **-7.100***** | **-6.874***** | **4.778***** | **-6.695***** | **-6.516***** | **3.919***** |
| | **[0.230]** | **[0.223]** | **[0.231]** | **[0.226]** | **[0.231]** | **[0.231]** | **[0.220]** |
| REV-VOL | **-0.444***** | **-0.396***** | **-0.224***** | **-0.392***** | **-0.327***** | **-0.388***** | **-0.366***** |
| | **[0.030]** | **[0.029]** | **[0.027]** | **[0.027]** | **[0.027]** | **[0.028]** | **[0.026]** |
| CAPITAL-TA (L) | **0.236***** | **0.339***** | **0.114**** | **0.566***** | **0.344***** | **-0.166***** | **-0.144***** |
| | **[0.039]** | **[0.043]** | **[0.044]** | **[0.043]** | **[0.043]** | **[0.044]** | **[0.045]** |
| TA dummy x CIT | **0.698***** | | | | | | **0.580***** |
| | **[0.072]** | | | | | | **[0.065]** |
| TFA-TA dummy x CIT | | **1.466***** | | | | | **1.443***** |
| | | **[0.064]** | | | | | **[0.069]** |
| REV-TA dummy x CIT | | | **-2.205***** | | | | **-1.792***** |
| | | | **[0.060]** | | | | **[0.047]** |
| CASHFLOW-TA dummy x CIT | | | | **-2.950***** | | | **-2.801***** |
| | | | | **[0.055]** | | | **[0.050]** |
| REV-VOL dummy x CIT | | | | | **-0.118***** | | **0.120***** |
| | | | | | **[0.025]** | | **[0.023]** |
| CAPITAL-TA dummy x CIT | | | | | | **0.967***** | **0.683***** |
| | | | | | | **[0.043]** | **[0.031]** |
| Observations | 3,491,369 | 3,483,502 | 3,491,247 | 3,148,929 | 3,494,804 | 3,477,053 | 3,123,957 |
| Adj. R-squared | 0.763 | 0.763 | 0.764 | 0.775 | 0.762 | 0.762 | 0.777 |

*Notes:* Standard errors in brackets are clustered by sector, country and year. Significance at the 1%, 5%, and 10% level are denoted respectively by ***, ** and *. Fixed effects used in all regressions are S*T+S*C+C*T. Constant is included in all regressions but not shown in the results table.
(L) stands for lag. Lagged micro-level variable interacted with contemporaneous CIT rate

## Table 14. Coverage by Country and Sector

### (a) By Country

| *Country* | *# firms* | *# obs.* | *CIT* |
|---|---|---|---|
| Austria | 32,759 | 122,882 | 25 |
| Belgium | 34,056 | 243,481 | 33.99 |
| Canada | 194,198 | 584,242 | 15 |
| Czech Republic | 83,462 | 433,037 | 19 |
| Denmark | 9,385 | 46,415 | 25 |
| Finland | 30,694 | 171,402 | 24.5 |
| France | 349,669 | 1,726,710 | 34.43 |
| Germany | 330,649 | 1,698,813 | 15.825 |
| Greece | 20,696 | 184,311 | 26 |
| Italy | 293,585 | 1,511,880 | 27.5 |
| Japan | 358,416 | 1,628,051 | 28.05 |
| Korea | 130,938 | 535,560 | 22 |
| Latvia | 22,712 | 113,280 | 15 |
| Lithuania | 27,727 | 129,022 | 15 |
| Netherlands | 18,813 | 77,341 | 25 |
| Norway | 48,518 | 202,160 | 28 |
| Portugal | 67,342 | 309,995 | 30 |
| Slovakia | 29,801 | 121,035 | 23 |
| Slovenia | 10,186 | 53,053 | 17 |
| Spain | 291,155 | 1,786,159 | 30 |
| Sweden | 55,709 | 376,880 | 22 |
| Switzerland | 75,880 | 210,678 | 8.5 |
| United Kingdom | 125,797 | 741,121 | 23 |
| United States | 1,245,865 | 1,400,543 | 35 |
| ***Total*** | ***3,888,012*** | ***14,408,051*** | |

### (b) By Sector

| *Sector* | *NACE* | *# firms* | *# obs.* |
|---|---|---|---|
| Agriculture | 01-03 | 51,363 | 188,758 |
| Mining | 05-09 | 18,460 | 74,379 |
| Manufacturing | 10-33 | 752,824 | 3,676,360 |
| Utilities | 35-39 | 40,224 | 176,012 |
| Construction | 41-43 | 583,255 | 2,197,592 |
| IT | 58-63 | 160,783 | 568,634 |
| Other Services | 84-99 | 444,049 | 1,107,367 |
| Trade, accommodation | 49-56 | 1,056,270 | 3,776,257 |
| Transport, storage | 49-53 | 179,776 | 730,646 |
| Real estate | 68 | 102,267 | 325,350 |
| Professional & administrative activities | 69-82 | 498,741 | 1,586,696 |
| ***Total*** | | ***3,888,012*** | ***14,408,051*** |

*Notes*: CIT is the top statutory CIT rate in 2013 expressed in percent. Financial sector is dropped. NACE 2nd revision is used to classify industries.

## APPENDIX. A MODEL OF TAXATION AND CORPORATE LEVERAGE

Consider a one-period model of a stylized nonfinancial firm, whose liabilities are the sum of equity shares $E_t$ and debt $D_t$. Debt can be a mix of bonds and credits, but we assume its cost is homogenous and captured by the interest rate $r_t$. We also assume that debt is rolled over at the end of each period. Shareholders are paid dividends after a fraction $\beta$ (the plowback ratio) of after-tax earnings is retained for investment. The firm uses its debt and capital to acquire a working asset $A_t = E_t + D_t$.

The business model of the firm is summarized by a rate of return on assets $\theta$. Earnings before tax and interest are thus simply $EBIT_t = \theta A_t$. Earnings are subject to a profit tax $\tau$, and interest payments are deductible. Therefore, dividends are:

$$\delta_t = (1-\beta)(1-\tau)[\theta A_{t-1} - r_t D_{t-1}] \tag{2}$$

Investors face an uncertain return on assets. Return is a random variable $\Theta$, about which investors can only conjecture a probability distribution function $F(\theta) : \mathbb{R} \to [0;1]$.[18] Assuming away any principal-agent issues,[19] investors choose leverage to maximize the utility they expect to derive from dividends:

$$\max_{D_{t-1}\geq 0} \mathbb{E}_{t-1} u(\delta_t) = \int_{\mathbb{R}} u\big[(1-\beta)(1-\tau)\big((\theta - r_t)D_{t-1} + \theta E_{t-1}\big)\big] dF(\theta) \tag{3}$$

Investors are risk-averse and lenders are risk-neutral. We make the standard assumption that the Von Neumann–Morgenstern utility function $u$ is non-decreasing and concave, so that investors are risk-averse. For simplicity, we assume lenders are risk-neutral.[20] By concavity of the utility function, we know this maximization problem admits a single solution.[21]

Let $D^* = D^*(\beta, \tau, r_t, E, F)$ denote the solution of the first-order condition:[22]

$$\int_{\mathbb{R}} u'\big[(1-\beta)(1-\tau)\big((\theta - r_t)D^* + \theta E_{t-1}\big)\big](\theta - r_t) dF(\theta) = 0 \tag{4}$$

***Proposition 1.*** *The firm hold more debt the higher the tax rate, the shallower equity capital, and the lower the volatility of the return on assets.*

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[18] The support of the density function is kept as general as possible; in particular, it includes the possibility for negative profitability.

[19] This is equivalent to assuming there is no issue of asymmetric information between investors and managers, or that their utility functions are perfectly aligned.

[20] Assuming risk-averse lenders would yield a similar result but complicate the model.

[21] Indeed, the second-order condition $\int u''\big[(1-\beta)(1-\tau)\big((\theta - r_t)D + \theta E_{t-1}\big)\big](\theta - r_t)^2(1-\beta)^2(1-\tau)^2 dF(\theta) < 0$ is true $\forall D$.

[22] With a constant absolute risk aversion utility function, $u(\delta) = 1 - e^{-\alpha\delta}$, we get an explicit equation in terms of the moments of $\Theta - r_t$:

$$\sum_{n=0}^{\infty} \frac{(-\alpha)^n}{n!}(1-\beta)^n(1-\tau)^n(D^* + E)^n \mathbb{E}[(\Theta - r)^{n+1}] = 0$$

These results are intuitive. Deducting interest payments against a higher tax rate increases the tax advantage of holding debt and will thus lead firms to hold more debt. Lower equity capital implies that the firm is financing more assets with debt. Finally, a lower volatility of return on assets provides more certainty about future income, allowing the firm to support a higher debt burden.

◆ **Proof of Proposition 1**

We are going to take the derivatives of the optimal level of debt with respect to the various parameters of the model. To simplify subsequent formulas, we omit time subscripts and let $\rho = (1-\beta)(1-\tau)$ and $g_i = \mathbb{E}\left(u''[\rho(\Theta - r)D^* + \rho\Theta E](\Theta - r)^i\, \Theta^{2-i}\right)$ for $i \in \{1;2\}$. These are proportional to the first and second moments of the second derivative of utility; they will intervene in the derivatives of $D^*$. We start by proving two lemmas:

*Lemma 1. The firm's optimal decision is to leverage only when the expected return on assets exceeds the cost of capital.*

Given that the function $v: \theta \mapsto u'(\rho(\theta - r)D + \rho\theta E)$ is non-increasing, we know that $\mathrm{cov}(v(\Theta), \Theta) \leq 0$ for all $D$. In other words, choosing $D = D^*$ and assuming $D^* > 0$, we can reinject the first order condition (4):

$$r\mathbb{E}u'(\rho(\Theta - r)D^* + \rho\Theta E) = \mathbb{E}\left(\Theta u'(\rho(\Theta - r)D^* + \rho\Theta E)\right) \leq \mathbb{E}\Theta . \mathbb{E}u'(\rho(\Theta - r)D^* + \rho\Theta E) \quad (5)$$

Which gives the lemma's result, $r \leq \mathbb{E}(\Theta)$, because $u'$ is positive.

*Lemma 2.* $\forall\, i = 1{,}2, g_i < 0.$

Since $u$ is a concave function, $g_2$ is trivially negative. The intuition regarding $g_1$ is that the integrand is negative except on $J = [0, r]$. We therefore split the integral like this:

$$g_1 = \int_{\bar{J}} w(\theta)\theta(\theta - r)dF(\theta) + \int_J w(\theta)\theta(\theta - r)dF(\theta) \quad (6)$$

We assume that $w(\theta) \equiv u''(\rho(\theta - r)D^* + \rho\theta E)$ is strictly non-positive on the support of the density function $f = F'$, which we further assume bounded, so that there exist $m, M$ such that $\forall \theta, f(\theta) > 0 \Rightarrow m \leq w(\theta) \leq M$. Therefore:

$$\begin{aligned} g_1 &\leq M \int_{\mathbb{R}} \theta(\theta - r)dF(\theta) + (m - M)\int_J \theta(\theta - r)dF(\theta) \\ &\leq M(\mathbb{E}(\Theta^2) - r\mathbb{E}\Theta) + (m - M)\frac{r^2}{4}\mathbb{P}(\Theta \in J) \end{aligned} \quad (7)$$

Lemma 1 proves that $\mathbb{E}(\Theta^2) - r\mathbb{E}\Theta \geq 0$, hence $g_1 \leq 0$. Now, it is easy to write interesting derivatives in terms of the $(g_i)$:

$$\frac{\partial D^*}{\partial \tau} = \frac{D^* g_2 + E g_1}{(1 - \tau)g_2} > 0 \quad (8)$$

$$\frac{\partial D^*}{\partial \beta} = \frac{D^* g_2 + E g_1}{(1 - \beta)g_2} > 0 \quad (9)$$

$$\frac{\partial D^*}{\partial r} = \frac{\rho D^* g_1 + r\mathbb{E}u'(\rho(\Theta - r)D^* + \rho\Theta E)}{r\rho g_2} - \frac{D^*}{r} \lesseqgtr 0 \quad (10)$$

$$\frac{\partial D^*}{\partial E} = \frac{-g_1}{g_2} < 0 \tag{11}$$

Equation (8) proves the debt bias itself: the higher the tax rate on profits, the higher deductibility of the interest bill, and the higher leverage. Equation ((10) demonstrates that a high interest rate environment has an ambiguous effect on leverage. This seems intuitive: on the one hand, it means higher financing costs, so a lower marginal utility (the second and third terms); but on the other it means larger interest deductions (the first term). Equation (11) shows that firms with less capital (i.e., lower $E$) tend to leverage more. In equation ((9), we also find that when the dividend policy is generous, that is when the plow-back ratio is small, then investors seek less immediate profits, and take on less debt. That is typically the case when needs for reinvesting earnings are smaller—when the firm is less capital-intensive.

An elegant way to examine the dependence on the shape of the distribution of profitability ($f$) is to compute the derivative of the functional underlying the first order condition:

$$H(f, D) \ = \int u'\big[\rho\big((\theta - r)D + \theta E\big)\big](\theta - r)f(\theta)d\theta \tag{12}$$

From the Euler-Lagrange equation, we get that the functional derivative is:

$$\frac{\delta H}{\delta f}(\theta) = u'\big[\rho\big((\theta - r)D + \theta E\big)\big](\theta - r) \tag{13}$$

By deriving the first order condition itself, we find that:

$$\frac{\delta D^*}{\delta f} = \frac{-\frac{\delta H}{\delta f}}{\left.\frac{\partial H}{\partial D}\right|_{D^*}} = \frac{-u'\big[\rho\big((\theta - r)D^* + \theta E\big)\big](\theta - r)}{\int u''\big[\rho\big((t - r)D + tE\big)\big](t - r)^2 \rho f(t)dt} \tag{14}$$

So, between two close-enough distributions, $f$ and $f + \delta f$, the change in optimal debt is, at the first order:

$$\delta D^* \approx \int \frac{\delta D^*}{\delta f}(\theta)\delta f(\theta)d\theta \tag{15}$$

We choose the marginal transformation in the density function to increase its variance without altering its mean. Algebraically, we thereby have: $\int \delta f(\theta) = \int \theta\delta f(\theta) = 0$ and $\int \theta^2\delta f(\theta) > 0$. We can further assume that the support of $\delta f$ is limited to a small segment $[x - dx, x + dx]$.[23] Abstracting from a positive constant and using a Taylor development of $u'$, we can then write:

$$\delta D^* \approx u''\big[\rho\big((x - r)D^* + xE\big)\big](D^* + E)\rho \int (\theta - r)(\theta - x)\delta f(\theta)d\theta < 0 \tag{16}$$

In other words, in response to a marginal change in the standard deviation of returns, *ceteris paribus*, the risk-averse shareholders decrease their exposure and deleverage.[24]

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[23] In the general case, any $\delta f$ can be decomposed as a series of such functions with limited support.

[24] This is the intuition behind the Markovitz' mean-variance analysis.