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Financial Sector Debt Bias

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Abstract

Most tax systems create a tax bias toward debt finance. Such debt bias increases leverage and may negatively affect financial stability. This paper models and estimates debt bias in the financial sector, and present novel estimates for investment banks and non-bank financial intermediaries such as finance and insurance companies. We find debt bias to be pervasive, explaining as much as 10 percent of total leverage for regular banks and 20 percent for investment banks, with the effects most pronounced before the global financial crisis. Going forward, debt bias is likely to once again gain prominence as a key driver of leverage decisions, underscoring the importance of policy reform at this juncture.

JEL Classification Numbers: G21, G32, H25

Keywords: Tax bias, Debt bias, Leverage, Financial Sector, Banks, Non-Banks, Financial Stability.

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[1] This paper supports the analysis presented in the IMF Policy Paper on Tax Policy, Leverage and Macroeconomic Stability (IMF, 2016b). The authors gratefully acknowledge comments from colleagues and seminar participants. All errors – hopefully few – remain our own.

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I. INTRODUCTION

Tax bias toward debt finance is pervasive in the corporate sector. In most countries, the tax system allows for a deduction of interest paid on debt, while not featuring a similar deduction for equity. This implies that debt is artificially cheap relative to equity, 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 the absence of this incentive. This effect is labeled debt bias.

Debt bias differs from debt shifting. Debt shifting is another tax distortion in corporate financing decisions: Having decided on the total amount of leverage, firms subsequently consider taxation when deciding in which jurisdictions to take on this debt, normally taking on debt in high-tax jurisdictions. This is a form of profit shifting within a multinational firm, and hence a concern related to Base Erosion and Profit Shifting (BEPS). In contrast to debt bias, debt shifting does not influence the total amount of debt and hence is not seen as a first order macroeconomic stability concern.

Debt bias negatively affects financial stability. Debt bias drives up leverage, and the probability of distress or bankruptcy increases with leverage for non-financial and financial firms alike.[2] However, financial firms stand out in two ways. First, the systemic importance of the financial system is much larger than that of firms in other economic sectors. These spillovers imply that the social cost of financial sector distress is much larger than the cost to any individual firm, presenting a negative externality which the firm does not take into account. Second, financial firms on average operate with leverage ratios much higher than non-financial corporates, meaning that they have lower buffers to deal with adverse shocks. These two features imply that debt bias can negatively affect financial stability, and hence have larger economic consequences in the financial sector than elsewhere.

Financial sector regulation has aimed to increase financial firms' buffers, but tax policy works in the opposite direction. The very aim of capital and solvency regulation is to increase equity and reserve buffers and hence limit leverage, so as to strengthen financial firms' resilience and to decrease the negative externalities discussed above. The drive toward capital increase has been especially widespread since the global financial crisis proved financial sector buffers inadequate in many countries. However, tax deductibility of interest on debt encourages leverage and hence decreases buffers, pointing to a basic inconsistency between the tax and regulatory realms of public policy. To the extent that minimum leverage ratios can be seen as a distortion aimed at fixing a tax distortion encouraging leverage, removing debt bias from the tax system might be a more effective policy.

Evidence for debt bias in financial firms is scarce and limited to banks. Even as the financial sector has been in focus since the global financial crisis, most research has focused on financial stability from the regulatory angle. Studies in this literature typically focus on the design of regulation to mitigate the probability of another large crisis, and the level at which bank capital should be set (see, e.g., Diamond and Rajan, 2000, Acharya, Engle, and Richardson, 2012, Admati and Hellwig, 2014, and Dagher et. al, 2016). Tax distortions to financial institutions'

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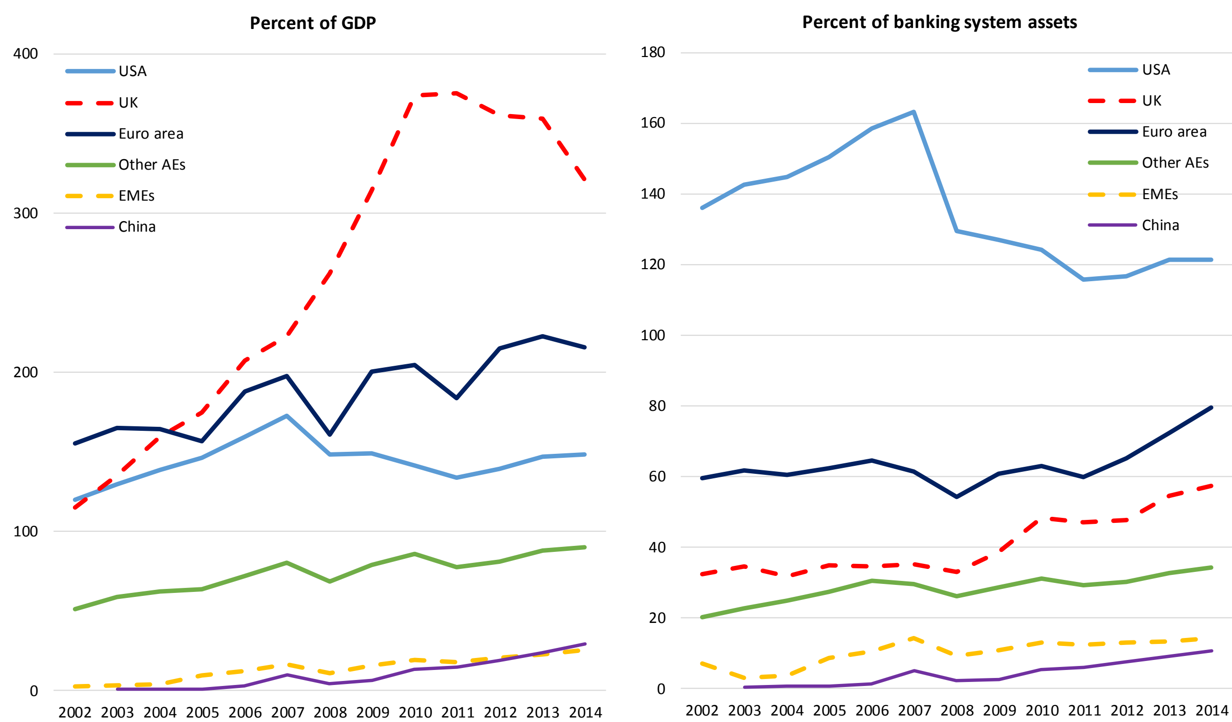
[2] Of course debt bias is far from the only consideration driving firms' capital structure. For instance, another well-know driver of debt finance is the reluctance of existing shareholders to avoid dilution.

capital structure have received less attention. While some observers have raised the issue of debt bias in financial institutions shortly after the crisis (e.g., Slemrod 2009), the first comprehensive empirical studies have been published only recently, on Europe (Langedijk et al 2014) and banks worldwide (De Mooij and Keen 2016). However, even these papers limit their analyses to "regular" banks, and cover data only until 2011 and 2009 respectively.

This paper analyzes bank and non-bank financial firms' leverage decisions in the face of corporate taxation. It adds to the literature by looking at investment banks, non-bank finance companies, and life and non-life insurance companies, besides regular commercial, cooperative and savings banks. Our study thus includes a significant part of the non-bank financial sector, which is large and growing (Figure 1). In several countries this sector represents a multiple of GDP and is comparable in size with the regular banking sector. Firms in this sector often perform bank-like financial intermediation services but do not operate under a banking license, and hence face different, often lighter, regulation (IMF, 2014). We show the different patterns of leverage in these different types of institutions, and estimate to what extent taxation drives leverage choices.

Figure 1. The Non-Bank Financial System



Note: Data excludes insurance and pension funds. Advanced Economies (AEs): Canada, Hong Kong, Japan, Korea, Singapore, Australia, Switzerland, Chile, and Mexico. Emerging Market Economies (EMEs): Argentina, Brazil, China, India, Indonesia, Russia, Saudi Arabia, South Africa, and Turkey.
Source: Financial Stability Board

The paper also gauges how the global financial crisis (GFC) has changed financial firms' sensitivity to corporate taxation. As we have seven years of post-crisis data available, we contrast findings for the pre- and post-crisis periods, as well as the full sample period. We also analyze whether firm size or degree of leverage influences firms' behavior by analyzing whether large (small) or highly (modestly) leveraged firms behave differently when compared to the average firm.

Our main findings are that while financial sector firms have become less sensitive to taxation post-crisis, taxation is still a relevant consideration driving leverage. For regular banks we find that pre-crisis, debt bias may have increased leverage by 9 percentage points[3], a substantial amount when compared to the average leverage of 87 percent among banks in our sample. Post-crisis, this effect decreases to some 5 percentage points, as many financial firms focused on rebuilding and increasing buffers, partly in response to tighter regulation and increased supervisory scrutiny. In this environment, tax considerations were likely of secondary importance when deciding on leverage. In addition, in the post-GFC ultra-low interest rate environment, incentives associated with tax deductibility of interest payments are less strong.

The paper proceeds as follows. The next section lays out a theoretical model of debt bias. Section III describes the estimation procedure and data used to estimate the model. Section IV presents our main empirical findings, while Section V concludes and briefly discusses policy implications.

II. A MODEL OF LEVERAGE

We employ a theoretical model of leverage to show how debt bias affects regulated and unregulated entitites differently. First, we present a model of regulated banks and show that debt bias increases with the tax rate. Second, we show how the tradeoffs involved differ for non-bank financial institutions that are not or more lightly regulated.

A. Bank Leverage

We model banks' leverage choice as a tradeoff between the return on equity and the probability of violating regulatory thresholds. Given a certain return on assets from normal business revenue, a higher leverage ratio implies a higher return on equity (i.e., a higher payoff for shareholders). At the same time, higher leverage implies lower buffers to deal with losses, and hence a higher probability of breaching regulatory minimum thresholds, or even failure.[4] We model banks subject to profit taxation and capital regulation. Our model builds on De Mooij and Keen (2016). It features a different process for choosing leverage, starting from a fixed equity base and deciding on the amount debt and hence total liabilities.

We employ a two period model for a single bank. In period 1, the bank receives a fixed equity investment $E>0$ from a risk-neutral investor. As this investor is the single owner, agency costs are assumed not to be relevant. The bank subsequently chooses the amount of external debt $D>0$ it employs. Total assets are $W=E+D$.[5] The bank holds a fixed proportion $\alpha \in (0,1)$ in risky assets (e.g., loans), with the remainder $1-\alpha$ in risk free assets.

[3] Assuming deductibility at an average CIT rate of 25 percent.

[4] As a bank would breach regulatory minimum thresholds well-before failing, for regular banks we model breaking the regulatory constraint, while ignoring failure. We introduce the probability of failure as a relevant constraint in our model of non-bank financial firms below.

[5] Unlike in De Mooij and Keen (2016), total assets are therefore not fixed, and payment on debt do not accrue to the bank owner.

In period 2, the payoff is as follows. The risky assets yield a return θ*-1*, with the random variable θ distributed with a twice-differentiable distribution function $\Phi(\theta)$ and density $\phi(\theta)$ on support $(0,\infty)$, with mean $\bar{\theta}$. The risk-free assets yield a fixed return $R>0$, which is the same rate at which the bank pays interest on its debt. Thus the bank's assets pay off $\alpha(\theta-1)W + (1-\alpha)RW - RD$, implying that total net worth of the bank in period 2 is $\alpha\theta W + (1-\alpha)(1+R)W - (1+R)D$ before payment of dividend, tax, and any penalties for breaking minimum capital ratios.

The bank is subject to profit tax and regulation. The bank pays a profit tax rate $T \in (0,1)$ on the return on the safe and risky assets, with a deduction for interest paid on debt. The amount of tax paid is thus equal to

$$T\{(1-\alpha)(D+E)R + \alpha(D+E)(\theta-1) - RD\}. \qquad (1)$$

Per bank regulation, the bank's capital ratio K, defined as equity over risky asset, cannot fall short of minimum capital requirement $\bar{K} \in (0,1)$. This constraint can thus be written as

$$K = \frac{\alpha\theta(D+E) + (1-\alpha)(1+R)(D+E) - (1+R)D}{\alpha\theta(D+E)} > \bar{K}. \qquad (2)$$

The minimum return θ^K on risky assets that satisfies this constraint is

$$\theta^K(D) = \frac{(1+R)\{D-(1-\alpha)(D+E)\}}{\alpha(D+E)(1-\bar{K})}. \qquad (3)$$

The bank is penalized whenever this minimum capital ratio is not observed. The penalty is assumed to amount to $C^K>0$ for each unit by which equity falls short of the minimum capital ratio, i.e., the total penalty amounts to $C^K\alpha\theta(D+E)(\bar{K}-K)$, if $\bar{K} > K$, and 0 otherwise. Using (2) the penalty can be expressed as

$$C^K\alpha(D+E)(1-\bar{K})(\theta^K-\theta). \qquad (4)$$

Taking all this together, the bank's wealth at the end of period 2 in state of the world θ thus is

$$\begin{aligned}\Pi(D,\theta) = \alpha\theta(D+E) + (1-\alpha)(1+R)(D+E) - (1+R)D \\ - T\{\alpha(\theta-1)(D+E) + (1-\alpha)R(D+E) - RD\} \\ -C^K\alpha(D+E)(1-\bar{K})max\{\theta^K-\theta, 0\}.\end{aligned} \qquad (5)$$

Taking the expectation of (5) yields

$$\begin{aligned}E_\theta[\Pi(D,\theta)] \equiv \Pi(D) \\ = (1-\alpha)(D+E)\{1+R(1-T)\} + TRD - (1+R)D \\ + \alpha(D+E)\{\bar{\theta} + T(1-\bar{\theta})\}\end{aligned} \qquad (6)$$

$$-S^K(D),$$

with $S^K(D)$ the expected regulatory penalty for violating the minimum capital constraint

$$S^K(D) = C^K \alpha W(1-\bar{K}) \int_0^{\theta^K(D)} (\theta^K - \theta)\phi(\theta)d\theta. \tag{7}$$

The bank will seek to maximize $\boldsymbol{\Pi(D)}$, the first order condition for which is

$$\frac{d\Pi(D)}{dD} = (1-T)\alpha\{(\bar{\theta}-1)-R\} - \frac{\partial S^K}{\partial D} = 0. \tag{8}$$

As, from (3),

$$\frac{d\theta^K(D)}{dD} = \frac{(1+R)E}{\alpha(D+E)^2(1-\bar{K})} > 0, \tag{9}$$

we have

$$\frac{\partial S^K}{\partial D} = C^K(1+R)\frac{E}{D+E}\Phi(\theta^K)\,, \tag{10}$$

The first order condition can be expressed as

$$(1-T)\alpha\{(\bar{\theta}-1)-R\} = C^K(1+R)\frac{E}{D+E}\Phi(\theta^K). \tag{11}$$

The bank thus borrows up to the point where the expected return on an additional dollar of debt equals the expected additional cost of this debt, which consists of the expected costs of violating the regulatory constraint. This optimal level of debt is denoted as D^{ID}, where the index *ID* stands for "interest rate deductibility".

In a world without interest deduction, this condition changes only slightly to

$$(1-T)\alpha\{(\bar{\theta}-1)-R\} - TR = C^K(1+R)\frac{E}{D+E}\Phi(\theta^K). \tag{12}$$

Note that we assume that

$$T < \frac{\alpha\{(\bar{\theta}-1)-R\}}{(1-\alpha)R+\alpha(\bar{\theta}-1)} > 0,$$

so that the left hand side of (12) remains positive. Denote the optimal debt given by this condition by D^{NID}.

The debt bias is defined as the amount of additional debt the bank takes on because of interest rate deductibility, that is,

$$Debt\ Bias \equiv B = D^{ID} - D^{NID}. \tag{13}$$

By differentiating (13), using (9), one can show the following.

Proposition 1. *As long as*

$$\Phi(\theta^K) < \frac{(1+R)E}{\alpha(D+E)(1-\bar{K})}\phi(\theta^K) \tag{14}$$

debt bias increases with the tax rate T. I.e.,

$$\frac{\partial B}{\partial T} = \frac{R}{C^K(1+R)\frac{E}{(D+E)^2}\left[\frac{(1+R)E}{\alpha(D+E)(1-\bar{K})}\phi(\theta^K) - \Phi(\theta^K)\right]} > 0. \tag{15}$$

To see the condition (14) is generally satisfied, consider that

$$\theta^K(D) = \frac{(1+R)\{D-(1-\alpha)(D+E)\}}{\alpha(D+E)(1-\bar{K})} = (1+R) - \frac{1+R}{1-\bar{K}}\Omega, \tag{16}$$

with

$$\Omega \equiv \frac{E}{\alpha(D+E)} - \bar{K} \geq 0 \tag{17}$$

the ex-ante (prior to the realization of θ) equity buffer a bank holds over its minimum regulatory required capital. Thus $\theta^K(D) \leq 1 + R$, i.e. θ^K is relatively small. As condition (14) compares a distribution function to a density function, the condition would generally be satisfied for small θ.

This proposition implies that a higher tax rate leads to higher debt bias. In other words, the higher the corporate income tax rate, the more additional debt banks will take on to profit from the tax relief provided by interest rate deductibility. Consequently, banks' buffers are lower because of debt bias.

B. Leverage in Insurance and Non-Bank Financial Firms

Adapting this model of bank leverage to insurance companies is straightforward. Insurance companies face a similar tradeoff as banks. They collect premia and invest in risky assets in order to generate a return to satisfy future obligations to policy holders. Regulation requires an equity buffer to absorb risks associated with risky assets. This is much like banking regulation, although the minimum size of the equity buffer $\overline{K}$ and the punishment C^K associated with breaking this threshold are both different. In addition, insurance companies face regulation on the calculation of their technical reserves, representing the net present value of the future obligations to policy holders.[6] This influences the composition of liabilities and hence choice on what assets to hold, but in a normal environment does not in itself prescribe additional equity buffers. We hence choose not to model technical reserves.

Other non-bank financial firms are different in the sense that they are more lightly regulated than both regular banks and insurance companies. To the extent they face capital regulation, our model for bank leverage applies. But even for the case without capital regulation, these firms will face a tradeoff between additional leverage generating a higher return on equity and the probability of failure. A firm fails when the return on its risky assets is sufficiently bad to wipe out all equity, i.e., when

$$(1-\alpha)W(1+R)+\alpha\theta W-(1+R)D<0$$

or

$$\theta<(1+R)\frac{D-(1-\alpha)W}{\alpha W}=(1+R)\frac{\alpha W-E}{\alpha W}\equiv\theta^F(D). \tag{18}$$

The probability the firm survives into period 2 to reign in profits is thus[7]

$$1-Pr(\theta<\theta^F)=1-\int_0^{\theta^F(D)}\theta^F\phi(\theta)d\theta=\ 1-\Phi\big(\theta^F(D)\big). \tag{19}$$

Thus a non-bank financial firm's risk neutral chooses debt to optimize the trade-off payoff conditional on not going bankrupt and the probability of bankruptcy. The owner optimizes

$$\begin{aligned}E_\theta[\Pi^{Shadow}(D,\theta)]\equiv\Pi^{Shadow}(D)=\\ \big[1-\Phi\big(\theta^F(D)\big)\big]\,[(1-\alpha)(D+E)\{1+R(1-T)\}+TRD-(1+R)D\\ +\alpha(D+E)\{\bar{\theta}+T(1-\bar{\theta})\}]\end{aligned} \tag{20}$$

The first part of (20) denotes the probability of survival into the payoff period (not going bankrupt). It is decreasing in *D*, that is,

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[6] Thus the liability side of their balance sheets consists of technical reserves, equity and relatively small other liabilities. See below for further discussion.

[7] Note that failure is not part of the original bank leverage model, but substituted by regulation and punishment. While the original model could be expanded to include failure, it would severely complicate the model without generating additional insights.

$$\frac{\partial}{\partial D}\left[1-\Phi\left(\theta^{F}(D)\right)\right] = -\phi\left(\theta^{F}(D)\right)\frac{(1+R)E}{\alpha(D+E)^2} < 0. \tag{21}$$

The second part of (20) represents the payoff conditional on not having gone bankrupt. Through the leverage effect, this increases in *D*,

$$\frac{\partial}{\partial D}[(1-\alpha)(D+E)\{1+R(1-T)\}+TRD-(1+R)D + \alpha(D+E)\{\bar{\theta}+T(1-\bar{\theta})\}] = (1-T)\alpha\{(\bar{\theta}-1)-R\} > 0. \tag{22}$$

Thus (21) and (22) illustrates the basic trade-off between debt increasing payoff in period two but decreasing the probability of surviving into this period (i.e., not going bankrupt) in order to enjoy these payoffs.[8]

III. Regression Analysis

A. Specification

To explore whether debt bias increases with the tax rate as suggested by the model above, we estimate the effect of debt bias using the following reduced-form specification:

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 Tax_{it} + \beta_3 X_{it} + \lambda_{\boldsymbol{t}} + \mu_i + \epsilon_{it}, \tag{23}$$

where Y_{it} is the leverage ratio of financial institution *i* in year *t*, calculated as total liabilities over total assets. Tax_{it} is the top statutory corporate income tax (CIT) rate in the country in which firm *i* resides. X_{it} is a vector of controls.[9] The coefficients β_j , *j = 1,2,3*, are respectively the autoregressive coefficient, the debt bias coefficient (our coefficient of interest), and the vector of coefficients associated with control variables. The controls include indicators of the *size of the banks* (proxied by the book value of a bank's total assets on a logarithmic scale, included as both a linear and a quadratic term), *profitability* (measured as pre-tax profitability, as a share of bank assets), *macroeconomic conditions* (GDP growth and inflation) in the country in which firm *i* is incorporated, as well as *riskiness of bank assets* (measured as the ratio of risk-weighted assets to total assets). The inclusion of the lagged independent variable captures sluggishness in the response of leverage. Specification (23) includes year fixed effects (λ_t) that capture year-specific effects that are common across all financial institutions in the sample (e.g., global economic shocks). It also includes firm fixed effects (μ_i) that control for unobserved firm (and country)-specific time-invariant heterogeneity.

The coefficient of interest $\boldsymbol{\beta_2}$ is expected to be positive, indicating a direct effect of CIT on leverage: the higher the statutory CIT rate, the higher the leverage, as per Proposition 1. As the CIT tax rate is set at the national level, it can reasonably be considered exogenous from the

[8] Working out this first order condition (FOC) in detail does not provide further insights, and is therefore omitted. The derivation of the FOC, as well as all other mathematical derivations, are available from the authors upon request.

[9] For simplicity of notation and in line with the literature, we choose not to introduce a country index, even though the macroeconomic and tax variables vary by country rather than by firm.

perspective of the individual firm. Thus causality – if any – would run from tax rates to leverage. The size of the coefficient estimate β_2 indicates the strength of this debt bias in the short-run. The long-term effect of the CIT on leverage can be computed as $\frac{\beta_2}{1-\beta_1}$.

We analyze investment banks and non-bank financial institutions, in addition to "regular" (i.e., commercial, savings, and cooperative) banks. As regulation varies between these different categories of financial institutions (IMF 2016b, Box 3), they may be expected to react differently to taxation. We allow for such difference by including interaction terms between group-specific dummies (investment banks Inv_i and non-bank financial corporations Fin_i) and the CIT rate, as specified in equation (24). Here, the coefficients β_4 and β_5 on the interaction terms give the differential effects of taxes on leverage depending on the type of bank. The non-tax effects are assumed to be identical across the different types of financial firms. Our data (see Section III.B) provides sufficient degrees of freedom to include these interaction effects.

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 Tax_{it} + \beta_3 X_{it} + \beta_4 (Inv_i \times Tax_{it}) + \beta_5 (Fin_i \times Tax_{it}) + \lambda_{\boldsymbol{t}} + \mu_i + \epsilon_{it} \quad (24)$$

We perform separate regressions for the sample of insurance companies, differentiating life and non-life insurance companies. We choose to treat insurance companies separately, as their business model and hence leverage decisions are generally very different from banks (see discussion in subsection B). We further differentiate between life and non-life insurers, as these entities have different balance sheets and leverage profiles. In these regressions we use as controls *size of the company* (proxied by the book value of total assets on a logarithmic scale, included as both a linear and a quadratic term), *profitability* (proxied by pre-tax profits to firm total assets), and *macroeconomic conditions* (GDP growth and inflation) in the country in which the firm resides. However, we have no control for risk, as for insurers there is no straightforward and widely reported equivalent to banks' risk-weighted assets.

The estimation is done using a system GMM dynamic panel. To correct for estimation biases arising from the use of a lagged dependent variable and panel fixed effects and deal with endogeneity problems with the risk variable (the causality between leverage and risk can run in both directions), we estimate our specifications using the Blundell and Bond (1998) system GMM dynamic panel estimator. This estimator is appropriate because the panel dataset has a short time dimension (T=15) and a large bank/insurance dimension (N>14,000, 7,500 for banks and insurance companies respectively). Statistical inference is based on cluster-robust standard errors at the country level. Estimation errors for firms in the same country might be correlated given that our tax variable is a macroeconomic variable that varies only at the country level.

Our analysis is further extended to gauge whether firm size or the level of leverage of a firm influences its reaction to taxation. To study size effects we interact firm size with the CIT rate in (25).

$$Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 Tax_{it} + \beta_3 X_{it} + \beta_4 (Size_{it} \times Tax_{it}) + \lambda_{\boldsymbol{t}} + \mu_i + \epsilon_{it} \quad (25)$$

To examine whether highly (modestly) leveraged firms behave differently from other firms, we employ quantile regressions. These regressions allow us to estimate the conditional median and, more generally, the conditional quantiles response of financial leverage to taxes. We can thus gauge whether taxation has less impact for institutions that have lower buffers and are thus more constrained by regulatory requirements. As we are mainly interested in how the long-term effect changes with the degree of leverage, we use a simple static model (26). In addition, this approach allows us to directly compare our results with similar estimates in the literature.

$$Y_{it} = \alpha + \beta_1 Tax_{it} + \beta_2 X_{it} + \lambda_{\boldsymbol{t}} + \epsilon_{it}. \quad (26)$$

Throughout, we perform robustness checks. Specifically, we redo our analysis using only the middle 80 percent of our sample distribution by winsorizing the data at the 10^{th} and 90^{th} percentiles.[10] We also employ different control variables.

B. Data

We use financial institution-level data from the companies' balance sheets and profit & loss accounts. We choose to analyze unconsolidated firm accounts only, to align the effect of tax rates and regulations to 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.

The banks and non-bank finance company data comes from the BankScope database by Bureau van Dijk. It contains about 151,000 observations corresponding to almost 14,000 distinct banks and finance companies in 131 countries over the period 2001–15. This sample is large enough to allow us to study bank behavior before and after the 2008 crisis. Almost 93 percent of firms in our sample are "regular" banks, followed by a small number of non-bank finance companies (5 percent of the firms) and investment banks (2 percent of the firms).

The insurance company data is taken from the Orbis Insurance Focus database by Bureau van Dijk. It contains over 68,000 observations corresponding to more than 7,500 firms from 85 countries over the period 2005-2015. Of these firms, 30 percent are life insurers and 70 percent non-life insurers (property and casualty, health, and title insurance services). All macroeconomic data on comes from the IMF's World Economic Outlook database, while data on statutory CIT rates originates from the IMF's Fiscal Affair Department database.

We control for outliers and preserve minimum consistency. Thus, in both the BankScope and Insurance Focus data, all variables have been winsorized at the 1 percent level, except for tax,

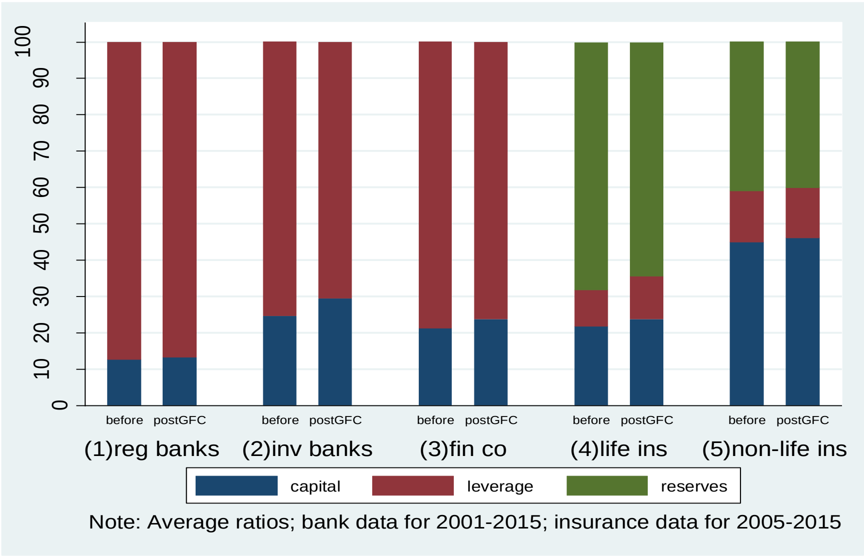
[10] I.e., all data below the 1^{st} / 10^{th} (above the 99^{th} / 90^{th}) percentile is bunched at the 1^{st} / 10^{th} (99^{th} / 90^{th}) percentile value.

inflation, and GDP growth rates.[10] Firms that did not report financial results for a minimum of three consecutive years were dropped from the samples, as were countries with less than 20 observations.[11]

Summary statistics show banks to be highly leveraged. Tables 1 and 2 provide summary statistics of the main variables. The average leverage ratio across the regular banks sample is 87 percent, with lower values for investment banks at 73 percent and finance companies at 77 percent. By comparison, average leverage in the non-financial private sector (excluding extractive industries) in a sample of firm-level data from a number of Euro area countries was found to be 17.6 percent (Bluedorn and Ebeke, 2016).

Insurance companies' leverage – measured net of technical reserves – is much lower. In calculating the leverage ratio for insurance companies, we consider liabilities net of technical reserves. Technical reserves represent the net present value of obligations to policy holders and essentially reflect a firm's business model (Thimann, 2014). Technical reserves are tightly regulated, and hence presumably not influenced by taxation. These reserves average 65 percent of assets across life insurers in the sample and 40 percent on average for non-life insurers (Figure 2).[12] The leverage decisions potentially subject to tax considerations are thus confined to the relatively small stock of liabilities in excess of technical reserves, comprising 11.5 percent for life insurers and 13.9 percent for non-life insurers.

Figure 2. Capital Structure by Type of Financial Institution



Source: BankScope, ORBIS Insurance Focus and IMF Staff Calculations.

[11] In this process, we only lose a marginal fraction of the data. In the banks sample, from the original 153,896 observations we drop 2,087 observations corresponding to firms reporting for less than three consecutive years and 346 observations coresponding to countries with less than 20 observations. Similarly in the insurance sample, from the original 68,233 observations we drop 676, and 189 obsrevations respectively. This leaves us with 151,463 bank observations and 67,368 insurance company observations.

[12] Non-life insurers tend to have smaller technical reserves than life insurers, mainly because the average maturity of their obligations is much shorter.

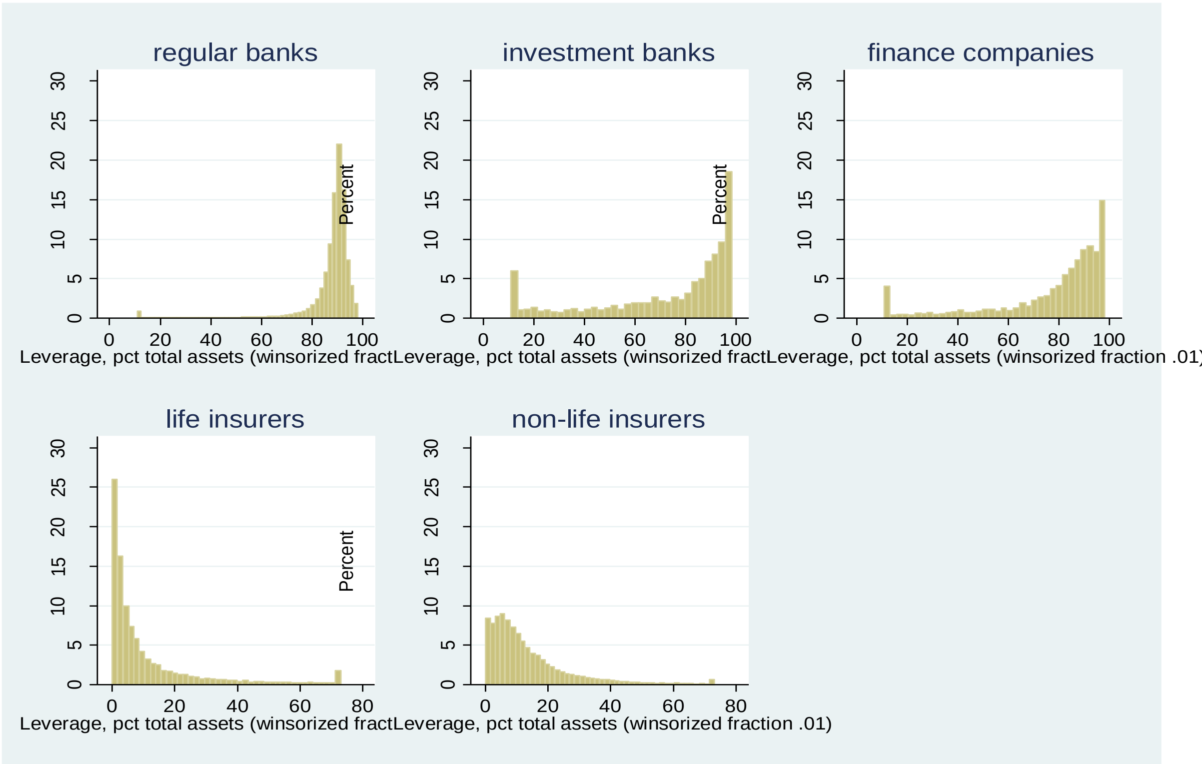
The distribution of leverage and asset size varies across types of institutions. Insurance companies show a concentration of companies with low leverage, whereas banks, investment banks, and finance companies show the opposite (Figure 3). Looking at asset size, investment banks and finance companies show a two-humped distribution, with bunching at moderately low and moderately high leverage. In contrast, banks and insurers show unimodal distributions (Figure 4).

There is some variability in the CIT rates over time and across countries. The mean of the statutory CIT rate in the banking sample is 31.2 percent, with a minimum value of 8.5 percent and a maximum value of 60 percent (due to Libya in the early years of the decade). In the insurance sample, the mean CIT rate is 29.4 percent. Over the analyzed period, there is a decreasing trend in CIT rates in all regions (Figure 5). However, there is little variation in the rate for the United States.

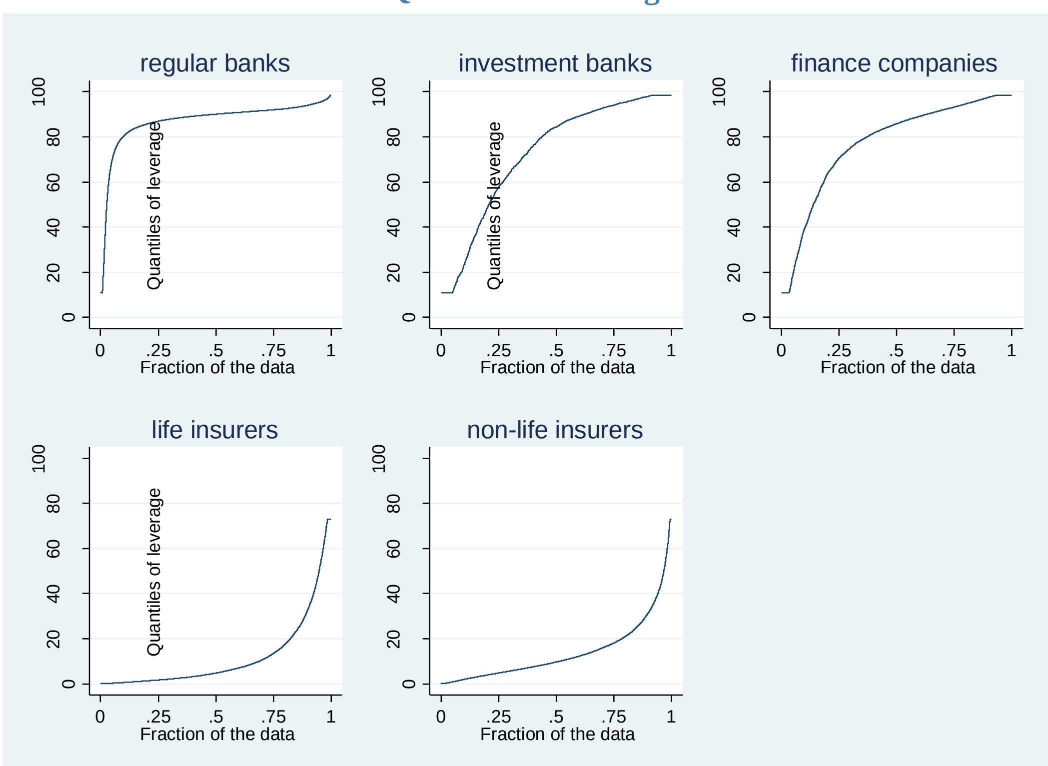
The samples are unbalanced across countries. Both the banking and insurance samples are dominated by observations in the United States (over 60 percent of the banking observations and over 40 percent of the insurance observations) and several other advanced economies. For banking, the next 20 percent of observations are distributed in descending order across Germany, Russia, and Japan. For insurance companies, the next 20 percent of observations are from Germany, UK, Canada, Spain, and France (Table 3). However, the basic pattern is similar to the rest of the data when the US is excluded.

Some basic patterns show in our data. Plotting the leverage ratio against the statutory tax rate in binned scatter plots (Figure 6) we see a positive correlation between these two variables, for both banks and insurance companies. When looking at leverage as a function of firm size as measured by assets (Figure 6), we see a clear positive correlation for banks. For insurance companies, no clear linear relation between size and leverage is discernable.

Figure 3. Distribution of Leverage by Type of Financial Institution

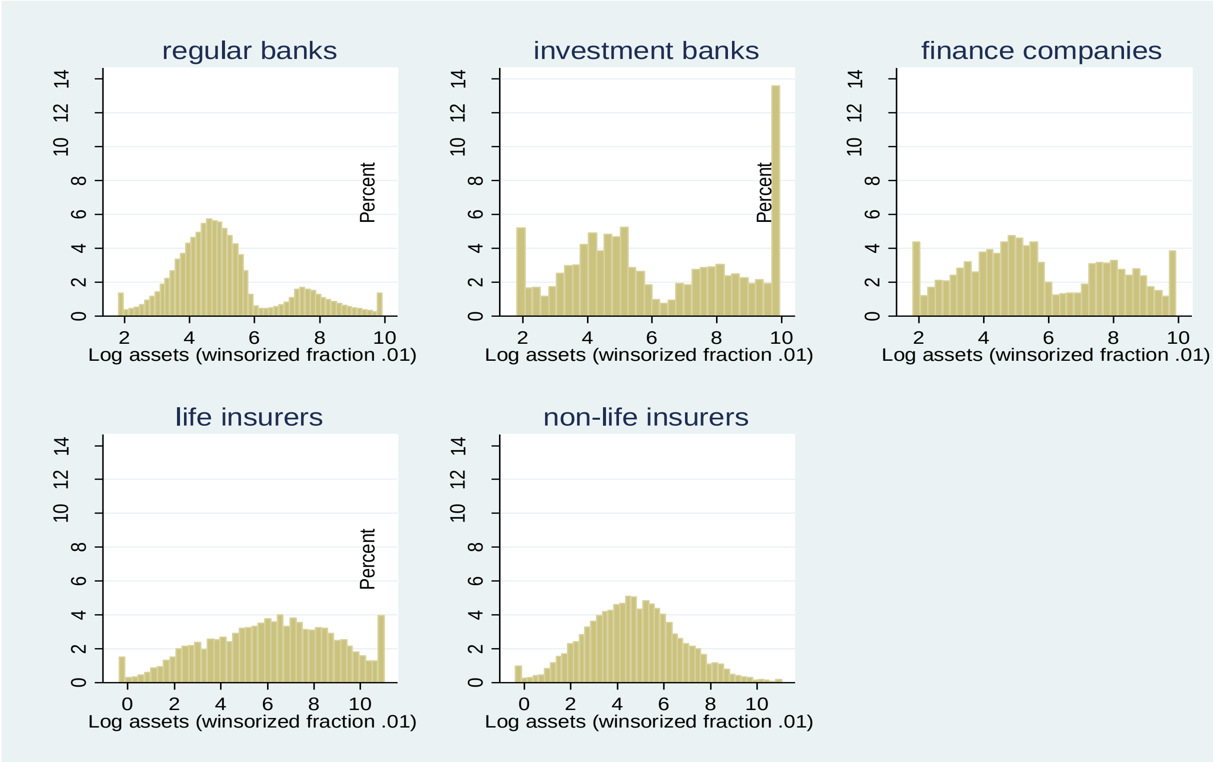


Quantiles of leverage

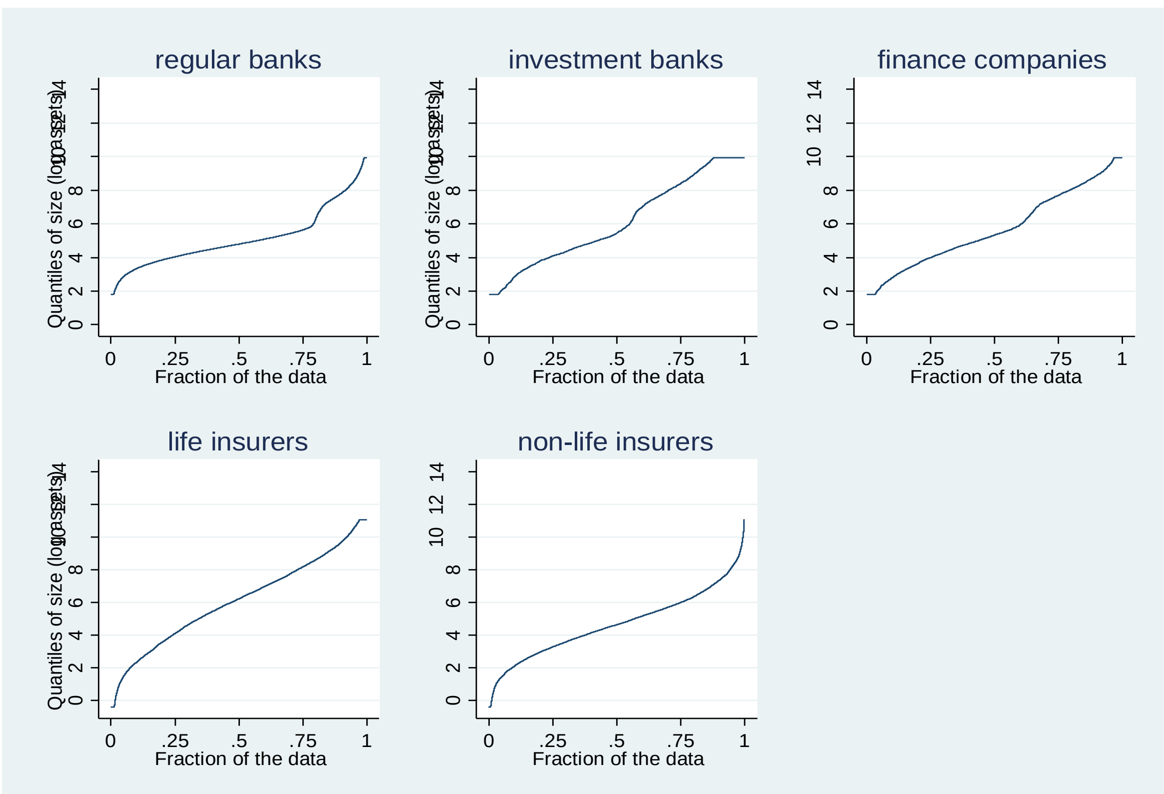


Source: BankScope, ORBIS Insurance Focus and IMF Staff Calculations.

Figure 4. Asset Size Distribution by Type of Financial Institution

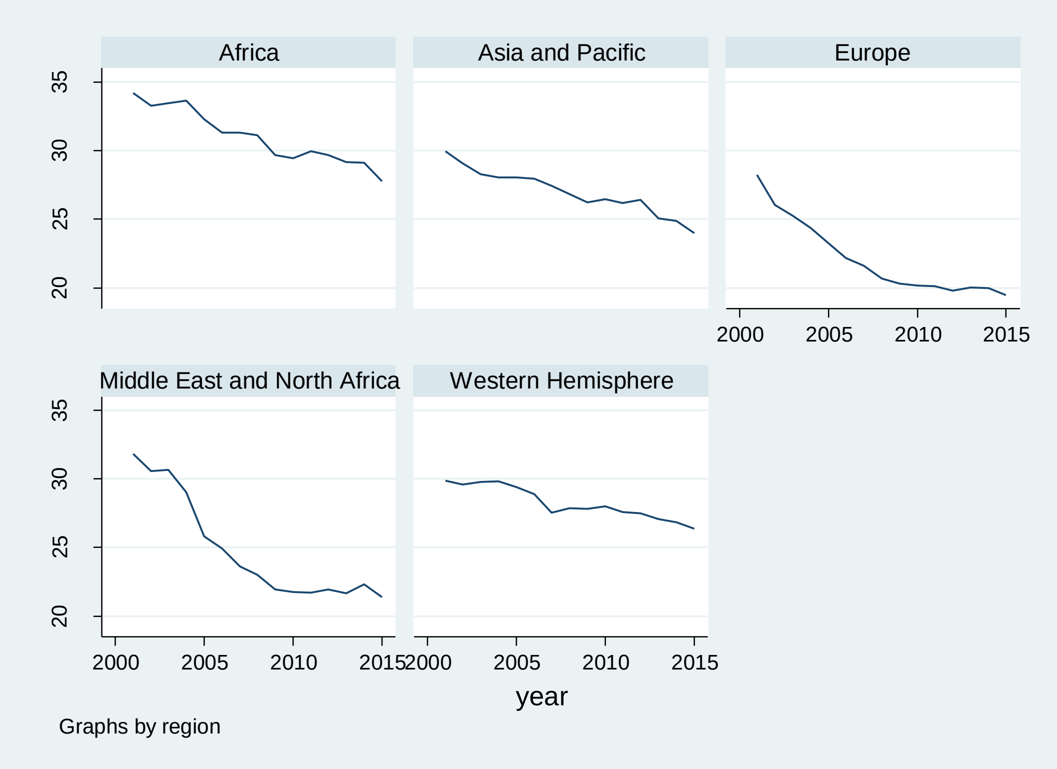


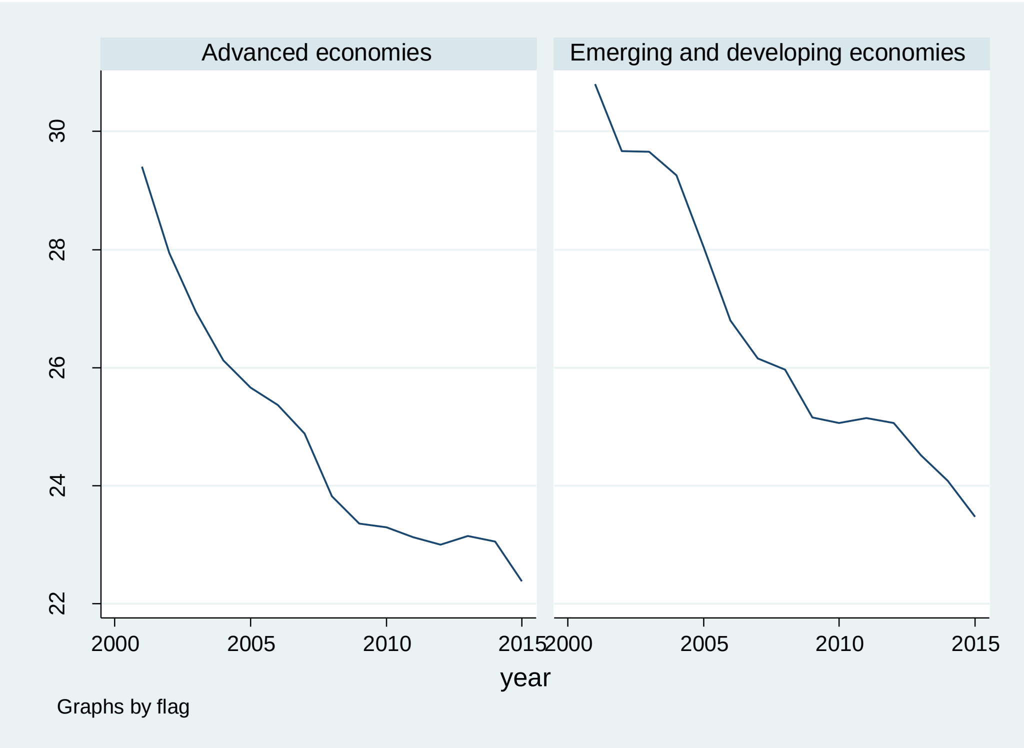
Quantiles of firm size



Source: BankScope, ORBIS Insurance Focus and IMF Staff Calculations.

Figure 5. Variation in the CIT Rate by Year and Region[1/]

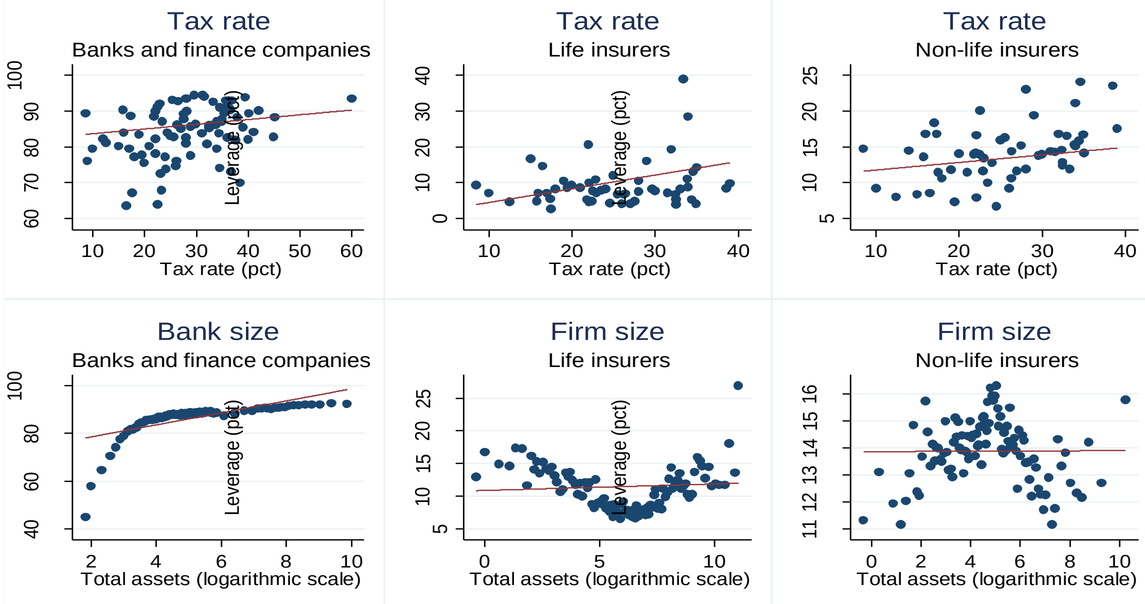




Source: IMF Fiscal Affairs Department Database and IMF Staff Calculations

1/ Average by region/classification, based on the sample of banks containing about 30 advanced and 80 emerging and developing economies.

Figure 6. Binned Scatter Plots of Leverage and Size



Source: BankScope, ORBIS Insurance Focus, and IMF Staff Calculations.

Note: Full sample of regular banks, investment banks and finance companies (2001-15) and separate samples of life and non-life insurance companies (2005-5).

IV. Empirical Results

This section discusses our main results. We present estimations for a sample of regular banks as a baseline. We move to analysis of non-bank financial companies by employing a larger sample including investment banks and finance companies, and separate sample of insurance companies. We then focus on quantile regressions to gauge in what way firms with high and low leverage behave differently from firms with average levels of leverage. Finally, we analyze whether large financial firms – which are the most important from a systemic risk perspective – exhibit different sensitivity to taxation.

We find a significant effect on leverage from taxation for regular bank. Table 4 presents estimation results from specification (23) for a sample of regular banks. This estimation is in line with the analysis of De Mooij and Keen (2016), using more recent data. Robust standard errors are clustered at the country level and reported in parentheses. In columns (1)–(2), the OLS regressions with and without fixed effects suggest that the tax rate has a strongly significant impact on leverage over the period of interest. Next, we explore these effects in system GMM specifications on the full sample and on two separate subsamples, before and after 2008. The basic GMM specifications in columns (3)–(5) confirm a positive and, over the full period and the period up to the crisis, statistically significant effect of taxes on leverage. The short-term coefficient estimate for the tax effect in the period before the crisis in column (4), at 0.24, is double the effect during the full period presented in column (3).

Post-crisis, banks' leverage decision may have been driven more by regulatory constraints than taxation. While the tax effect remains positive, it is smaller and not significantly different from 0 for the post-crisis period.[13] This may reflect the impact of tighter regulation requiring banks to build up additional capital, which, in combination with market pressure for larger bank buffers, for many banks became binding constraints in the immediate aftermath of the crisis period. Thus the buffer of capital in excess of minimum requirements that banks can flexibly adjust – the part of liabilities debt bias can influence – decreased considerably. In addition, low interest rates prevailing in most advanced economies in the post-crisis period also imply that the tax benefits, and hence the incentives to lever up, are lower than before.

The long-term effects of tax on leverage are large. The long-run coefficients are calculated by taking account of the sluggish response, estimated through the coefficient of the lagged dependent variable. For regular banks, this long-run coefficient is of 0.38 for the pre-crisis period and smaller at 0.17 for the entire period and the post-crisis period, reasonably close to the findings in De Mooij and Keen (2016). These coefficients remain stable (at 0.37 and 0.21 respectively) when including investment banks and finance companies in the sample.

Investment banks and finance companies behave differently from regular banks. Table 5 summarizes results from estimating specifications (1) and (2) using an extended sample which includes both regular, as well as investment banks and non-bank finance companies. Including investment banks and finance companies in the sample (columns (1)-(3)) does not change the overall coefficient estimates on the tax rate observed in Table 4 (columns (3)–(5)). In columns (4)-(6), the specification is augmented with interaction terms between the CIT rate and dummies for these two additional groups of financial institutions.

Over the whole sample period, the CIT rate is not a significant driver of leverage for investment banks and finance companies, but these findings mask important differences in behavior for the pre- and post-crisis sub periods. When looking at the entire sample period, the interaction dummy for investment banks is significant, negative, and comparable in size to the CIT coefficient estimate, implying that the CIT rate is not a significant driver of leverage for investment banks.[14] Non-bank finance companies also feature a significant negative interaction dummy (albeit that the coefficient is smaller than for investment banks), and over the entire sample period the CIT rate is not a significant driver of leverage. However, these findings seem to be based on different pre- and post-crisis behavior partially cancelling each other out.

In the period prior to the GFC, investment banks exhibit much higher sensitivity to tax rates than regular banks. The short-term coefficient estimate for investment banks of 0.37 (=

[13] In addition, the standard Hansen and autocorrelation statistical tests fail. These issues do not occur – i.e., the test statistics are normal – in an alternative specification with a more restrictive treatment of outliers, as detailed in Table 6 and discussed below.

[14] A formal F tests confirms this result. The hypothesis of a zero net effect of tax on leverage for investment banks cannot be rejected either on the full or the post-crisis sample. As investment banks in our sample on average are more than 4 times larger than regular banks, this result is consistent with our finding that large banks are less tax-sensitive.

0.23 + 0.14) is some 60 percent higher than the coefficient estimate for regular banks, and the difference is highly significant. It translates into a long-term tax coefficient of 0.59 for investment banks in the pre-crisis period, significantly higher than the effect long-term effect estimated for regular banks. Thus, investment banks seem to have based their leverage decisions on the prevailing tax rate to a greater extent than regular banks.

Since the crisis, however, regulatory constraints have likely been more important for investment banks' leverage decisions and tax considerations have not played a significant role. This may have been due to the urgent need, driven both by market pressures and enhanced regulation, for these institutions to quickly rebuild buffers after severe losses during the crisis. These factors likely have been the dominant drivers of leverage decisions post-crisis. In addition, some statistical tests fail, indicating that in the post-crisis period, the model may exhibit autocorrelation.[15]

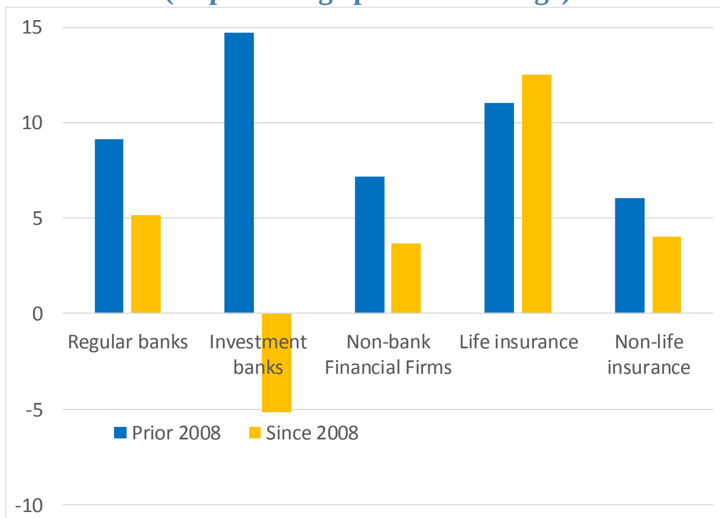
Finance companies, in contrast, exhibit tax sensitivity similar to regular banks in both pre- and post-crisis periods. In both periods, the interaction dummy for finance companies is not significantly different from zero. In the pre-crisis period, the net effect of the CIT coefficient and the interaction dummy for finance companies is significant, suggesting that pre-crisis finance companies increased leverage in response to tax rates. The effect is somewhat less than regular banks, with a long-term coefficient of 0.28. Post-crisis, we find no significant effect.[16] This may once again be due to the need to rebuild buffers, while at the same time the benefits from interest rate deductibility are relatively small due to ultra-low interest rates in most advanced economies.

[15] Specifically, the tests for second order autocorrelation fail for some of the post-crisis regressions.

[16] Formal F tests confirm these results. For the full period and post-crisis periods, the hypothesis of a zero net effect of tax on leverage for finance companies cannot be rejected.

These results imply that debt bias may have increased pre-crisis bank leverage by as much as 9 percentage points, and investment banks leverage by almost 15 percentage points (Figure 7). The long-run coefficient estimates for the pre-crisis period of 0.37 for regular banks and 0.59 for investment banks imply that eliminating the debt bias in a country with a 25 percent corporate income tax rate would reduce bank leverage by 9 percent and investment bank leverage by some 15 percentage points. These are significant reductions of about 10 and 20 percent of ex-ante average leverage of 87 percent for regular banks and 73 percent for investment banks. Our estimates are consistent with estimates from similar analysis in the literature, e.g., a synthetic control experiment for Belgium explored in IMF (2016b).

Figure 7. Contribution of Debt Bias to Leverage[1/ 2/]
(In percentage point of leverage)



Source: IMF Staff estimates presented in Tables 5, 7 and 8
1/ At a 25 percent CIT rate.
2/ Not all coefficient estimates are significantly different from 0.

The results are robust to a different treatment of data outliers. To further investigate how sensitive our results are to outliers, we perform the same analysis on a sample where the highest and lowest 10 percent outliers are winsorized. The results in Table 6 indicate that the tax coefficients remain significant and positive, and now also are significantly different from zero for the post-crisis period. In addition, the standard test statistics for overidentifying restrictions and serial autocorrelation do not indicate any misspecification. Thus, at least for the 80 percent of banks in the middle of the sample distribution, tax bias remains of significant relevance also post crisis, despite the increased focus of regulation on increasing capital. In line with our findings above, leverage decisions at investment banks are found to be sensitive to the CIT rate for the pre-crisis, but not for the post-crisis period, while finance companies behave much like regular banks.

For life insurers, we also find significant large effects of tax rates on leverage. Table 7 summarizes results from estimating specification (23) on a sample of life insurance companies. The long-run coefficient estimate for the full sample period 2005-15 is 0.28 and suggests that debt bias adds some 7 percentage points to leverage. This is more than half of total leverage in excess of technical reserves to leverage. When splitting the sample at the GFC, we see that the debt bias was strongest pre-crisis.[17] Post-crisis, the size of the short-run effect shrinks but remains significant. This may be partially the effect of rebuilding buffers, as many insurers were hit by

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[17] These results, however, do not pass the AR(1) and AR(2) autocorrelation tests, likely as the pre-2008 sample is relatively short. Specifications with different lags did not improve the test statistcs.

negative returns on investment during the crisis, and partially due to the lower benefits of tax deductibility in the post-crisis low interest rate environment.

For non-life insurers, we find a similar pattern with slightly smaller coefficient estimates (Table 8). The coefficient estimates range from 0.05 over the whole sample, to 0.16 for the pre-crisis period and 0.06 post-crisis. Long-run coefficient estimates range between 0.14-0.24, suggesting debt bias may have increased leverage by between 3½ to 6 percentage points for non-life insurers. However, the regression results do not meet the standard robustness tests, and therefore have to be interpreted with caution.[18]

Our results suggest that asset size is of different importance for insurance and bank leverage. For life insurers, the combined coefficient estimate on the log assets variable is of -1.5, indicating a strong inverse effect on leverage: larger firms (in terms of assets) are associated with lower leverage.[19] In contrast, for the sample consisting of regular banks, investment banks and finance companies, the relation between size and leverage is strongly positive, suggesting that the bigger banks have higher leverage and hence lower buffers.[20] Thus we find that the largest banks, which are most important from a financial stability perspective, are precisely the ones that are most leveraged.

Large banks are less responsive to taxation. To gauge whether the largest firms react differently to taxation than the average bank, we interact size with the tax rate. We find that large banks are less responsive to changes in taxation, while large insurance firm are more responsive. The coefficients in Table 9, columns (1), (3), and (6) replicate the tax effect found in the full period sample for banks, life insurers, and non-life insurers respectively. Columns (2), (4), and (6) estimate the additional effect that size has on the tax coefficient. The combined long-term coefficient is then calculated at the different quantiles of bank asset size. For the average bank, the long-term coefficient is of 0.19. The long term effect is three times larger for the smallest banks and gradually decreases along the quantiles of size, implying that the coefficient for the largest banks would even become negative, although not significantly different from zero. A possible explanation for this size effect may lie in the fact that the largest banks generally hold lower buffers in excess of regulatory minima (as discussed above). Hence their capital structure exhibits less room for tax considerations to influence leverage decisions. The results are less clear for insures. For both life and non-life companies we find insignificant size effects, formally confirming the lack of a clear relation between size and leverage in the scatter plots (Figure 6). When we calculate the long-run tax coefficients along the quantiles of size we find the coefficient estimate decreases with size for life insurers, but remains constant for non-life insurers.

The most leveraged banks also respond less to taxation, likely as they face regulatory constraints. We analyze the relation between long-run tax responsiveness and the level of

[18] For specifications (2) and (4) the Hansen test for overidentifying restrictions and the test for AR(2) errors are not satisfied. In specification (3), the serial autocorrelation tests are not computed due to the short sample period.

[19] This impact is calculated by gauging the net effect of the linear and quadratic size terms, evaluated for the largest firm in the sample (-0.8 * 11 + 0.06 * 122 =-1.5).

[20] See footnote 20. The effect is estimated to come out at 21.3 = 6.14 * 9.9 – 0.4 * 98.8, i.e., positive even for the largest bank in the sample.

leverage in a firm through quantile regressions. We choose a static specification looking at the 0.05, 0.10, 0.25, 0.50, 0.75, 0.90 and 0.95 quantiles of the conditional leverage distribution. For banks we find a strictly decreasing relationship between the tax coefficient estimate and leverage, with all coefficient estimates highly significant (Table 10). The least leveraged banks featuring a long-run tax coefficient of 0.63, while the tax coefficient estimate decreases monotonically with leverage to -0.04 for the most leveraged banks. We believe the decreasing trend in the coefficient estimates can be explained by the increased importance of regulatory constraints, as the most leverage institutions find themselves closest to regulatory minima and thus have little room to let tax considerations influence their leverage decisions.

The most leveraged insurers, in contrast, are more sensitive to taxation. Quantile regression for insurers show the coefficient estimates increasing with leverage. These effects are strongest in life companies (Table 11), but also clearly visible in our quantile regression for non-life insurers (Table 12). Thus for insurance companies, leverage decisions are most influenced by tax considerations at the most leveraged firms. This may be as leverage plays a different role in insurance companies. As leverage is a function of the business model of the insurance firm, the most leveraged firms tend to be the ones with the lowest technical reserves (e.g., because of their relatively short maturity of obligations to policyholders). That is, in contrast to the banks, the most leveraged firms are the ones least bound by regulatory constraints. In addition, from Figure 4 we have seen that leverage among insurance companies remains fairly low for most companies, with a small minority of firms exhibiting very high leverage.

V. Conclusion and Policy Implications

We find clear evidence of debt bias for banks, and extend this analysis to investment banks and non-bank financial intermediaries. We document these effects for regular banks in line with the literature, as well as for in investment banks, finance companies and insurance companies, which has not previously been investigated. The bias is found to be most prevalent before the GFC, but in several cases is also clearly demonstrated in the post-crisis period, although the magnitude of the bias is generally lower post-crisis.

Debt bias in financial firms is likely to become more prevalent over the medium-term. Post-crisis, many financial firms needed to focus on rebuilding buffers, rendering tax considerations of secondary importance for decisions on leverage. In addition, ultra-low interest rates in most advanced economies post-crisis have lowered interest payments and hence tax incentives associated with debt finance. Both of these arguments suggest that once a new steady state with adequate buffers and normalized interest rates is reached, debt bias will likely once again gain prominence as a key driver of leverage. Whether debt bias in the new steady state will be stronger than in the pre-crisis period remains an empirical question.

The macroeconomic and financial stability consequences of debt bias should thus be taken into account in tax policy design. Tax policies should aim to put debt and equity finance on an equal footing, thus rendering the tax system neutral with respect to corporate finance decisions. Options for reform of the current system include denying or limiting interest rate deductibility, or introducing an allowance for corporate equity, both discussed extensively in IMF (2016b).

Eliminating or reducing the debt bias would also serve to align the tax system with financial sector regulation. Currently, financial sector regulation focusses on increasing buffers and imposes limits on leverage. In contrast, the tax system incentivizes leverage. While perfectly coordinating tax and regulatory policy may be elusive and perhaps not even be desirable, reducing debt bias would at least ensure aligned tax and prudential policies on financial sector leverage and buffers.

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Table 1. Summary Statistics—Banking

Variable	Obs	Mean	Std. Dev	Min	Max
All banks [13,990 bank IDs; 131 countries]					
Leverage, pct total assets (winsorized fraction .01)	151,463	86.5	13.2	10.9	98.5
CIT rate (pct)	151,174	31.2	6.5	8.5	60.0
Log assets (winsorized fraction .01)	151,463	5.2	1.7	1.8	9.9
Log assets sq (winsorized fraction .01)	151,463	29.6	20.8	3.4	98.8
GDP growth (pct)	151,449	1.9	2.6	-62.1	104.5
CPI inflation (pct)	151,048	2.9	3.9	-37.2	359.9
Pre-tax profit, pct total assets (winsorized fraction .01)	151,120	1.0	1.9	-6.4	10.6
Risk (winsorized fraction .01)	100,663	0.7	0.2	0.2	1.0
Total assets, million USD (winsorized fraction .01)	151,463	1,119	3,194	6	20,753
Total equity, million USD (winsorized fraction .01)	151,463	93	270	1	1,971
Pretax profits, million USD (winsorized fraction .01)	151,120	9	31	-22	210
Regular banks (commercial, cooperative and savings banks) [13,047 bank IDs; 131 countries]					
Leverage, pct total assets (winsorized fraction .01)	144,552	87.0	12.2	10.9	98.5
CIT rate (pct)	144,309	31.4	6.4	8.5	60.0
Log assets (winsorized fraction .01)	144,552	5.1	1.7	1.8	9.9
Log assets sq (winsorized fraction .01)	144,552	29.1	20.2	3.4	98.8
GDP growth (pct)	144,538	1.9	2.6	-62.1	104.5
CPI inflation (pct)	144,165	2.8	3.8	-37.2	359.9
Pre-tax profit, pct total assets (winsorized fraction .01)	144,419	1.0	1.8	-6.4	10.6
Risk (winsorized fraction .01)	99,714	0.7	0.2	0.2	1.0
Total assets, million USD (winsorized fraction .01)	144,552	1,029	2,993	6	20,753
Total equity, million USD (winsorized fraction .01)	144,552	86	256	1	1,971
Pretax profits, million USD (winsorized fraction .01)	144,419	9	30	-22	210
Investment banks [308 bank IDs; 67 countries]					
Leverage, pct total assets (winsorized fraction .01)	2,477	72.6	27.2	10.9	98.5
CIT rate (pct)	2,467	26.5	7.4	8.5	45.2
Log assets (winsorized fraction .01)	2,477	6.1	2.6	1.8	9.9
Log assets sq (winsorized fraction .01)	2,477	43.5	32.2	3.4	98.8
GDP growth (pct)	2,477	2.4	3.4	-12.8	36.9
CPI inflation (pct)	2,474	4.1	7.5	-4.5	152.6
Pre-tax profit, pct total assets (winsorized fraction .01)	2,313	2.0	4.1	-6.4	10.6
Risk (winsorized fraction .01)	289	0.5	0.3	0.2	1.0
Total assets, million USD (winsorized fraction .01)	2,477	4,247	7,093	6	20,753
Total equity, million USD (winsorized fraction .01)	2,477	301	531	1	1,971
Pretax profits, million USD (winsorized fraction .01)	2,313	25	54	-22	210
Finance companies [635 bank IDs; 85 countries]					
Leverage, pct total assets (winsorized fraction .01)	4,434	77.0	23.3	10.9	98.5
CIT rate (pct)	4,398	27.6	6.7	8.5	40.2
Log assets (winsorized fraction .01)	4,434	5.7	2.3	1.8	9.9
Log assets sq (winsorized fraction .01)	4,434	37.5	27.0	3.4	98.8
GDP growth (pct)	4,434	2.4	3.2	-16.5	14.2
CPI inflation (pct)	4,409	3.7	4.0	-37.2	48.7
Pre-tax profit, pct total assets (winsorized fraction .01)	4,388	2.1	3.5	-6.4	10.6
Risk (winsorized fraction .01)	660	0.7	0.3	0.2	1.0
Total assets, million USD (winsorized fraction .01)	4,434	2,287	4,598	6	20,753
Total equity, million USD (winsorized fraction .01)	4,434	187	394	1	1,971
Pretax profits, million USD (winsorized fraction .01)	4,388	22	48	-22	210

Table 2. Summary Statistics—Insurance

Variable	Obs	Mean	Std. Dev	Min	Max
Life insurance companies [2,294 firm IDs; 80 countries]					
Leverage, pct total assets (winsorized fraction .01)	19,469	11.5	16.1	0.0	73.0
CIT rate (pct)	19,419	28.3	7.5	8.5	39.0
Log assets (winsorized fraction .01)	19,469	6.1	2.7	-0.4	11.0
Log assets sq (winsorized fraction .01)	19,469	44.7	32.9	0.2	122.0
GDP growth (pct)	19,469	2.1	3.0	-15.1	15.2
CPI inflation (pct)	17,993	2.7	3.0	-21.0	48.7
Pre-tax profit, pct total assets (winsorized fraction .01)	19,411	2	7	-29	38
Total assets, million USD (winsorized fraction .01)	19,469	5,654	13,240	1	62,574
Total equity, million USD (winsorized fraction .01)	19,469	406	1,080	0	6,633
Pretax profits, million USD (winsorized fraction .01)	19,411	48	148	-94	866
Non-life insurance companies [5,348 firm IDs; 85 countries]					
Leverage, pct total assets (winsorized fraction .01)	47,899	13.9	13.6	0.0	73.0
CIT rate (pct)	47,760	29.9	7.3	8.5	39.0
Log assets (winsorized fraction .01)	47,899	4.7	2.0	-0.4	11.0
Log assets sq (winsorized fraction .01)	47,899	26.1	20.2	0.2	122.0
GDP growth (pct)	47,899	1.8	2.6	-15.1	26.2
CPI inflation (pct)	44,104	2.4	2.7	-21.0	48.7
Pre-tax profit, pct total assets (winsorized fraction .01)	47,811	4	9	-29	38
Total assets, million USD (winsorized fraction .01)	47,899	878	3,765	1	62,574
Total equity, million USD (winsorized fraction .01)	47,899	245	757	0	6,633
Pretax profits, million USD (winsorized fraction .01)	47,811	30	102	-94	866

Table 3. Summary Statistics—Country Distribution

Financial companies (excluding insurance)

	Country	Frequency	Percent	Cumulative
1	United States	95,791	63.24	63.2
2	Germany	13,946	9.21	72.5
3	Russian Federation	7,515	4.96	77.4
4	Japan	4,657	3.07	80.5
5	Italy	3,594	2.37	82.9
6	Switzerland	2,038	1.35	84.2
7	France	1,906	1.26	85.5
8	Austria	1,603	1.06	86.5
9	United Kingdom	1,388	0.92	87.4
10	Spain	963	0.64	88.1
11	Brazil	754	0.5	88.6
12	Sweden	682	0.45	89.0
13	Luxembourg	677	0.45	89.5
14	China,P.R.: Mainland	666	0.44	89.9
15	India	659	0.44	90.4
16	Argentina	657	0.43	90.8
17	Norway	657	0.43	91.2
18	Denmark	622	0.41	91.6
19	Costa Rica	498	0.33	92.0
20	Dominican Republic	481	0.32	92.3
21	Belgium	466	0.31	92.6
22	Mexico	448	0.3	92.9
23	Indonesia	430	0.28	93.2
24	Portugal	385	0.25	93.4
25	Ukraine	360	0.24	93.7
26	Venezuela, Rep. Bol.	355	0.23	93.9
27	Uruguay	295	0.19	94.1
28	Egypt	290	0.19	94.3
29	Croatia	268	0.18	94.5
30	Turkey	253	0.17	94.6
31	Guatemala	240	0.16	94.8
32	Kenya	207	0.14	94.9
33	Panama	199	0.13	95.1
34	Bosnia & Herzegovina	178	0.12	95.2
35	Czech Republic	174	0.11	95.3
36	Algeria	162	0.11	95.4
37	Canada	162	0.11	95.5
38	Serbia, Republic of	160	0.11	95.6
39	Tanzania	160	0.11	95.7
40	Romania	154	0.1	95.8
	Other countries	6363	4.21	100.0

Insurance companies

	Country	Frequency	Percent	Cumulative
1	United States	31,162	46.26	46.3
2	Germany	4,651	6.9	53.2
3	United Kingdom	2,707	4.02	57.2
4	Canada	1,843	2.74	59.9
5	Spain	1,664	2.47	62.4
6	France	1,454	2.16	64.6
7	Brazil	1,380	2.05	66.6
8	Ireland	1,327	1.97	68.6
9	Switzerland	1,214	1.8	70.4
10	Netherlands	1,096	1.63	72.0
11	Indonesia	987	1.47	73.5
12	Argentina	975	1.45	74.9
13	Japan	961	1.43	76.4
14	China,P.R.: Mainland	945	1.4	77.8
15	Sweden	912	1.35	79.1
16	Denmark	877	1.3	80.4
17	Italy	829	1.23	81.6
18	Mexico	783	1.16	82.8
19	Australia	780	1.16	84.0
20	Chile	515	0.76	84.7
21	Thailand	477	0.71	85.4
22	Norway	469	0.7	86.1
23	Colombia	456	0.68	86.8
24	India	426	0.63	87.4
25	Belgium	409	0.61	88.0
26	New Zealand	371	0.55	88.6
27	China,P.R.:Hong Kong	361	0.54	89.1
28	Malaysia	341	0.51	89.6
29	Korea, Republic of	329	0.49	90.1
30	Portugal	327	0.49	90.6
31	Russian Federation	316	0.47	91.1
32	Bulgaria	299	0.44	91.5
33	Finland	288	0.43	92.0
34	Pakistan	280	0.42	92.4
35	Singapore	279	0.41	92.8
36	Turkey	277	0.41	93.2
37	South Africa	267	0.4	93.6
38	Ukraine	241	0.36	94.0
39	Philippines	239	0.35	94.3
40	Luxembourg	219	0.33	94.6
	Other countries	3635	5.36	100.0

Table 4. Tax Rate and Bank Leverage: Regular Banks

	(1)	(2)	(3)	(4)	(5)
	OLS			System GMM	
VARIABLES	noFE	FE	full period	before 2008	2008 on
Leverage, pct total assets (winsorized fraction .01). Lagged value.	0.81***	0.37***	0.34***	0.36***	0.69***
	[0.01]	[0.01]	[0.02]	[0.03]	[0.08]
CIT rate (pct)	0.04***	0.06*	0.11**	0.24***	0.05
	[0.01]	[0.03]	[0.05]	[0.07]	[0.04]
Log assets (winsorized fraction .01)	2.35***	8.83***	6.38***	6.74***	3.13***
	[0.68]	[1.69]	[0.62]	[0.61]	[0.85]
Log assets sq (winsorized fraction .01)	-0.17***	-0.40***	-0.44***	-0.51***	-0.21***
	[0.05]	[0.09]	[0.07]	[0.05]	[0.06]
Pre-tax profit, pct total assets (winsorized fraction .01)	-0.78***	-0.61***	-1.21***	-1.55***	-0.74***
	[0.06]	[0.05]	[0.08]	[0.03]	[0.10]
GDP growth (pct)	0.07**	0.11**	-0.07	0.09	0.03
	[0.03]	[0.06]	[0.07]	[0.15]	[0.04]
CPI inflation, pct	-0.01	0.05	-0.03	0.19	-0.01
	[0.01]	[0.04]	[0.04]	[0.15]	[0.02]
Risk (winsorized fraction .01)			3.42**	8.81***	0.81
			[1.64]	[1.34]	[3.01]
Observations	131,118	131,118	91,950	38,372	47,104
R-squared	0.83	0.40			
Bank FE	NO	YES			
Year FE	NO	YES	YES	YES	YES
Cluster level	country	country	country	country	country
Number of id		13,024	9,970	7,405	8,563
Hansep			0.68	0.78	0.07
AR1			0.00	0.00	0.00
AR2			0.62	0.25	0.06
Long-term effect	0.23***	0.09*	0.17**	0.38***	0.17
	[0.05]	[0.05]	[0.07]	[0.11]	[0.12]

Notes: Data Sample: Regular banks, unconsolidated accounts. 2001–15.

Specifications: Columns (1)-(2) are estimated by OLS, and columns (3)-(5) by two-step system GMM with the lagged dependent variable and risk instrumented. FE = fixed effects. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent level.

Table 5. Tax Rate and Bank Leverage: Regular Banks, Investment Banks and Finance Companies

	(1)	(2)	(3)	(4)	(5)	(6)
	System GMM, Basic			System GMM, with interaction terms		
VARIABLES	full period	before 2008	2008 on	full period	before 2008	2008 on
Leverage, pct total assets (winsorized fraction .01). Lagged value.	0.34***	0.37***	0.65***	0.34***	0.37***	0.66***
	[0.02]	[0.03]	[0.09]	[0.02]	[0.03]	[0.08]
CIT rate (pct)	0.12**	0.23***	0.07	0.12**	0.23***	0.07
	[0.05]	[0.06]	[0.05]	[0.05]	[0.06]	[0.05]
Log assets (winsorized fraction .01)	6.26***	6.57***	3.66***	6.14***	6.53***	3.48***
	[0.61]	[0.68]	[0.88]	[0.65]	[0.73]	[0.84]
Log assets sq (winsorized fraction .01)	-0.42***	-0.49***	-0.24***	-0.40***	-0.49***	-0.23***
	[0.07]	[0.06]	[0.06]	[0.07]	[0.06]	[0.06]
GDP growth (pct)	-0.09	0.11	0.02	-0.08	0.12	0.03
	[0.07]	[0.15]	[0.04]	[0.06]	[0.15]	[0.04]
CPI inflation, pct	-0.04	0.23	-0.01	-0.03	0.22	-0.01
	[0.04]	[0.15]	[0.02]	[0.04]	[0.16]	[0.02]
Pre-tax profit, pct total assets (winsorized fraction .01)	-1.22***	-1.56***	-0.79***	-1.21***	-1.56***	-0.77***
	[0.08]	[0.03]	[0.11]	[0.09]	[0.03]	[0.10]
Risk (winsorized fraction .01)	3.14*	9.20***	-0.26	3.13*	9.40***	-0.14
	[1.66]	[1.27]	[3.22]	[1.72]	[1.41]	[3.14]
Interaction term (CIT* Investment bank)				-0.17**	0.14***	-0.14*
				[0.08]	[0.02]	[0.07]
Interaction term (CIT* Finance companies)				-0.06*	-0.05	-0.02
				[0.04]	[0.05]	[0.03]
Observations	92,818	38,449	47,832	92,818	38,449	47,832
Number of id	10,173	7,446	8,760	10,173	7,446	8,760
Year FE	YES	YES	YES	YES	YES	YES
Cluster level	country	country	country	country	country	country
Hansep	0.75	0.69	0.19	0.71	0.71	0.18
AR1	0.00	0.00	0.00	0.00	0.00	0.00
AR2	0.77	0.23	0.03	0.77	0.24	0.03
Long-term effect	0.19**	0.36***	0.21*	0.19**	0.36***	0.21*
	[0.07]	[0.09]	[0.11]	[0.07]	[0.10]	[0.11]
Long-term effect: Investment bank				-0.06	0.59***	-0.20
				[0.16]	[0.11]	[0.31]
Long-term effect: Finance companies				0.09	0.28**	0.14
				[0.09]	[0.13]	[0.15]

Notes: Data sample: regular banks, investment banks, and non-bank finance companies, unconsolidated accounts. 2001-2015.

Specifications: Coefficients are estimated by two-step system GMM with the lagged dependent variable and risk instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent, 1 percent level.

Table 6. Tax Rate and Bank Leverage: Sample of Regular and Investment Banks and Finance Companies - Alternative Treatment of Outliers

	(1)	(2)	(3)	(4)	(5)	(6)
	System GMM, Basic			System GMM, with interaction terms		
VARIABLES	full period	before 2008	2008 on	full period	before 2008	2008 on
Leverage, pct total assets (winsorized fraction .01). Lagged value.	0.80***	0.70***	0.77***	0.80***	0.70***	0.77***
	[0.02]	[0.02]	[0.05]	[0.02]	[0.02]	[0.05]
CIT rate (pct)	0.03***	0.06***	0.04***	0.03***	0.06***	0.03***
	[0.00]	[0.01]	[0.01]	[0.00]	[0.01]	[0.01]
Log assets (winsorized fraction .01)	1.28***	1.75***	1.39***	1.28***	1.74***	1.38***
	[0.19]	[0.28]	[0.16]	[0.18]	[0.27]	[0.16]
Log assets sq (winsorized fraction .01)	-0.09***	-0.14***	-0.10***	-0.09***	-0.14***	-0.10***
	[0.02]	[0.03]	[0.01]	[0.02]	[0.03]	[0.01]
GDP growth (pct)	0.02	0.09**	0.02	0.02	0.08*	0.02
	[0.01]	[0.04]	[0.02]	[0.01]	[0.04]	[0.02]
CPI inflation, pct	-0.00	0.01	-0.01	-0.00	0.02	-0.01
	[0.01]	[0.06]	[0.00]	[0.01]	[0.06]	[0.00]
Pre-tax profit, pct total assets (winsorized fraction .01)	-0.61***	-0.57***	-0.63***	-0.61***	-0.57***	-0.63***
	[0.02]	[0.01]	[0.06]	[0.02]	[0.01]	[0.06]
Risk (winsorized fraction .01)	-2.12***	0.74***	-4.72***	-2.13***	0.75***	-4.70***
	[0.47]	[0.22]	[0.66]	[0.47]	[0.22]	[0.65]
Interaction term (CIT* Investment bank)				-0.02**	0.01	-0.03***
				[0.01]	[0.01]	[0.01]
Interaction term (CIT* Finance companies)				0.00	0.02*	0.00
				[0.01]	[0.01]	[0.01]
Observations	92,818	38,449	47,832	92,818	38,449	47,832
Number of id	10,173	7,446	8,760	10,173	7,446	8,760
Year FE	YES	YES	YES	YES	YES	YES
Cluster level	country	country	country	country	country	country
Hansep	0.49	0.72	0.38	0.50	0.80	0.38
AR1	0.00	0.00	0.00	0.00	0.00	0.00
AR2	0.84	0.50	0.63	0.84	0.50	0.63
Long-term effect	0.13***	0.19***	0.15***	0.13***	0.21***	0.15***
	[0.03]	[0.05]	[0.02]	[0.03]	[0.05]	[0.02]
Long-term effect: Investment bank				0.04	0.25***	0.03
				[0.05]	[0.08]	[0.04]
Long-term effect: Finance companies				0.13**	0.29***	0.16***
				[0.06]	[0.08]	[0.05]

Notes: Data sample: regular banks, investment banks, and non-bank finance companies, unconsolidated accounts. 2001-2015.

Specifications: Coefficients are estimated by two-step system GMM with the lagged dependent variable and risk instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent, 1 percent level.

Table 7. Tax Rate and Leverage: Life Insurance Companies

VARIABLES	(1) Static OLS	(2) OLS	(3) System GMM full period	(4) System GMM before 2008	(5) System GMM 2008 on
Leverage, pct total assets (winsorized fraction .01). Lagged value.		0.93***	0.71***	0.41***	0.82***
		[0.02]	[0.04]	[0.15]	[0.04]
CIT rate (pct)	0.39***	0.03*	0.08***	0.26***	0.09***
	[0.13]	[0.02]	[0.03]	[0.09]	[0.03]
Log assets (winsorized fraction .01)	-3.14***	-0.32***	-0.80***	-0.79**	-0.68***
	[0.95]	[0.07]	[0.24]	[0.38]	[0.18]
Log assets sq (winsorized fraction .01)	0.30**	0.03***	0.06***	0.11**	0.07***
	[0.13]	[0.01]	[0.02]	[0.05]	[0.02]
Pre-tax profit, pct total assets (winsorized fraction .01)	0.08	-0.03**	-0.04**	0.04	-0.04***
	[0.06]	[0.01]	[0.02]	[0.06]	[0.01]
GDP growth (pct)	0.21	0.05**	0.12***	-0.10	0.10***
	[0.13]	[0.02]	[0.04]	[0.11]	[0.04]
CPI inflation, pct	0.40	-0.04	0.04	0.55**	0.02
	[0.32]	[0.04]	[0.06]	[0.26]	[0.04]
Observations	17,890	17,015	17,015	2,237	13,036
R-squared	0.07	0.88			
Firm FE	NO	NO			
Year FE	NO	NO	YES	YES	YES
Cluster level	country	country	country	country	country
Number of id			2,279	1,639	2,261
Hansep			0.51	0.33	0.94
AR1			0.00	e(ar1p)	0.00
AR2			0.45	e(ar2p)	0.86
Long-term effect		0.4	0.28***	0.43***	0.48***
se		[0.25]	[0.09]	[0.14]	[0.14]

Notes: Data sample: life insurance companies, unconsolidated accounts. 2005-2015.

Specifications: Columns (1)-(2) are estimated by OLS, and columns (3)-(5) by two-step system GMM with the lagged dependent variable instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent level.

Table 8. Tax Rate and Leverage: Non-Life Insurance Companies

VARIABLES	(1) Static OLS	(2) OLS	(3) full period	(4) System GMM before 2008	(5) 2008 on
Leverage, pct total assets (winsorized fraction .01). Lagged value.		0.86***	0.64***	0.34***	0.63***
		[0.01]	[0.03]	[0.12]	[0.03]
CIT rate (pct)	0.11*	0.02	0.05**	0.16**	0.06*
	[0.06]	[0.01]	[0.03]	[0.08]	[0.03]
Log assets (winsorized fraction .01)	0.78	0.17	0.15	0.59*	0.27
	[0.61]	[0.15]	[0.33]	[0.32]	[0.40]
Log assets sq (winsorized fraction .01)	-0.08	-0.02	-0.02	-0.06*	-0.03
	[0.05]	[0.01]	[0.03]	[0.03]	[0.03]
Pre-tax profit, pct total assets (winsorized fraction .01)	-0.03*	-0.02**	-0.03***	-0.08***	-0.02*
	[0.02]	[0.01]	[0.01]	[0.02]	[0.01]
GDP growth (pct)	0.27***	0.07***	0.12**	0.47**	0.12**
	[0.08]	[0.02]	[0.05]	[0.19]	[0.05]
CPI inflation, pct	0.19**	-0.00	0.08	0.39*	0.05
	[0.09]	[0.03]	[0.05]	[0.23]	[0.06]
Observations	43,887	42,243	42,243	5,307	32,502
R-squared	0.01	0.74			
Firm FE	NO	NO			
Year FE	NO	NO	YES	YES	YES
Cluster level	country	country	country	country	country
Number of id			5,320	4,229	5,298
Hansep			0.03	0.67	0.01
AR1			0.00	e(ar1p)	0.00
AR2			0.00	e(ar2p)	0.07
Long-term effect		0.14	0.14**	0.24**	0.15*
		[0.09]	[0.07]	[0.11]	[0.08]

Notes: Data sample: non-life insurance companies, unconsolidated accounts. 2005-2015
Specifications: Columns (1)-(2) are estimated by OLS, and columns (3)-(5) by two-step system GMM with the lagged dependent variable instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent and 1 percent level.

Table 9. Leverage and Size

VARIABLES	(1) Banks basic	(2) Banks interaction	(3) Life insurance basic	(4) Life insurance interaction	(5) Non-Life insurance basic	(6) Non-Life insurance interaction
Leverage, pct total assets (winsorized fraction .01). Lagged value.	0.34***	0.34***	0.71***	0.71***	0.64***	0.64***
	[0.02]	[0.02]	[0.04]	[0.04]	[0.03]	[0.03]
CIT rate (pct)	0.12**	0.67**	0.08***	0.11	0.05**	0.05
	[0.05]	[0.28]	[0.03]	[0.12]	[0.03]	[0.04]
CIT*log assets		-0.09**		-0.00		0.00
		[0.04]		[0.02]		[0.01]
Log assets (winsorized fraction .01)	6.26***	9.91***	-0.80***	-0.64	0.15	0.16
	[0.61]	[1.79]	[0.24]	[0.70]	[0.33]	[0.25]
Log assets sq (winsorized fraction .01)	-0.42***	-0.49***	0.06***	0.06**	-0.02	-0.02
	[0.07]	[0.06]	[0.02]	[0.03]	[0.03]	[0.03]
GDP growth (pct)	-0.09	-0.08	0.12***	0.12***	0.12**	0.12**
	[0.07]	[0.06]	[0.04]	[0.04]	[0.05]	[0.05]
CPI inflation, pct	-0.04	-0.02	0.04	0.05	0.08	0.08
	[0.04]	[0.04]	[0.06]	[0.06]	[0.05]	[0.05]
Pre-tax profit, pct total assets (winsorized fraction .01)	-1.22***	-1.21***	-0.04**	-0.04**	-0.03***	-0.03***
	[0.08]	[0.08]	[0.02]	[0.02]	[0.01]	[0.01]
Risk (winsorized fraction .01)	3.14*	2.83				
	[1.66]	[1.84]				
Observations	92,818	92,818	17,015	17,015	42,243	42,243
Number of id	10,173	10,173	2,279	2,279	5,320	5,320
Year FE	YES	YES	YES	YES	YES	YES
Cluster level	country	country	country	country	country	country
Hansep	0.75	0.67	0.51	0.51	0.03	0.03
AR1	0.00	0.00	0.00	0.00	0.00	0.00
AR2	0.77	0.78	0.45	0.45	0.00	0.00
Long-term effect	0.19**	1.01**	0.28***	0.40	0.14**	0.14
	[0.07]	[0.41]	[0.09]	[0.44]	[0.07]	[0.12]
Quantiles of asset size	Log assets	Est. tax coef	Log assets	Est. tax coef	Log assets	Est. tax coef
Q10	3.32	0.57**	2.35	0.36	2.11	0.14*
Q25	4.04	0.47**	4.10	0.33**	3.28	0.14**
Q50	4.81	0.37**	6.22	0.30***	4.64	0.14**
Q75	5.69	0.25**	8.17	0.27	5.99	0.14*
Q90	7.90	-0.05	9.67	0.24	7.34	0.14
Q95	8.66	-0.15	10.55	0.23	8.17	0.14

Notes: Data sample: regular banks, investment banks, non-bank finance companies (2001-2015), and insurance companies (2005-2015). Unconsolidated accounts.

Specifications: Coefficients are estimated by two-step system GMM with the lagged dependent variable and risk instrumented. Lag limits is (2,1). Standard errors (between brackets) are heteroscedasticity robust and clustered within countries. *, **, and *** denote significance at the 10 percent, 5 percent, 1 percent level.

Table 10. Bank Leverage: Quantile Regressions

VARIABLES	(1) OLS	(2) Q(0.05)	(3) Q(0.10)	(4) Q(0.25)	(5) Q(0.50)	(6) Q(0.75)	(7) Q(0.90)	(8) Q(0.95)
CIT rate (pct)	0.18***	0.63***	0.41***	0.13***	0.02***	-0.02***	-0.03***	-0.04***
	[0.01]	[0.08]	[0.02]	[0.01]	[0.01]	[0.00]	[0.00]	[0.01]
Log assets (winsorized fraction .01)	9.67***	35.08***	17.36***	5.51***	2.26***	0.85***	0.18***	-0.00
	[0.23]	[0.69]	[0.72]	[0.13]	[0.05]	[0.04]	[0.04]	[0.05]
Log assets sq (winsorized fraction .01)	-0.69***	-2.77***	-1.34***	-0.40***	-0.15***	-0.04***	0.02***	0.03***
	[0.02]	[0.06]	[0.06]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
GDP growth (pct)	-0.10**	-0.48***	-0.38***	-0.08**	-0.03	-0.00	-0.01	-0.01
	[0.05]	[0.16]	[0.10]	[0.04]	[0.02]	[0.02]	[0.01]	[0.02]
Inflation (pct)	-0.05*	-0.94***	-0.75***	-0.46***	-0.08**	0.02***	0.02***	0.01
	[0.03]	[0.21]	[0.13]	[0.07]	[0.04]	[0.00]	[0.01]	[0.01]
Profitability (winsorized fraction .01)	-2.21***	-2.01***	-1.68***	-1.07***	-0.84***	-0.75***	-0.77***	-0.79***
	[0.06]	[0.05]	[0.04]	[0.02]	[0.02]	[0.02]	[0.01]	[0.01]
Risk, lagged value (winsorized fraction .01)	7.84***	13.07***	8.57***	4.74***	1.81***	0.05	-0.98***	-1.39***
	[0.36]	[0.57]	[0.35]	[0.14]	[0.10]	[0.11]	[0.09]	[0.08]
Observations	90,871	90,871	90,871	90,871	90,871	90,871	90,871	90,871
R-squared	0.28							

Notes: Data sample: regular banks, investment banks, and non-bank finance companies, unconsolidated accounts. 2001-2015.

Specifications: Column (1) is estimated by simple OLS and columns (2)-(8) are estimated by quantile regressions. Time effects are included. Standard errors (between brackets) are heteroscedasticity robust. *, **, and *** denote significance at the 10 percent, 5 percent, 1 percent level.

Table 11. Life Insurers Leverage: Quantile Regressions

VARIABLES	(1) OLS	(2) Q(0.05)	(3) Q(0.10)	(4) Q(0.25)	(5) Q(0.50)	(6) Q(0.75)	(7) Q(0.90)	(8) Q(0.95)
CIT rate (pct)	0.40***	0.02***	0.02***	0.03***	0.08***	0.39***	0.93***	1.33***
	[0.02]	[0.00]	[0.00]	[0.00]	[0.01]	[0.02]	[0.04]	[0.07]
Log assets (winsorized fraction .01)	-3.00***	0.05***	-0.08**	-0.49***	-1.98***	-6.78***	-9.19***	-4.64***
	[0.18]	[0.02]	[0.03]	[0.05]	[0.19]	[0.42]	[0.76]	[0.60]
Log assets sq (winsorized fraction .01)	0.29***	0.00	0.01***	0.05***	0.16***	0.58***	0.87***	0.53***
	[0.02]	[0.00]	[0.00]	[0.00]	[0.01]	[0.03]	[0.06]	[0.05]
GDP growth (pct)	0.36***	0.07***	0.11***	0.21***	0.47***	0.54***	0.42**	0.57***
	[0.05]	[0.01]	[0.01]	[0.01]	[0.03]	[0.08]	[0.19]	[0.17]
Inflation (pct)	0.48***	0.06***	0.09***	0.18***	0.26***	0.45***	0.98***	0.98***
	[0.04]	[0.01]	[0.01]	[0.02]	[0.04]	[0.08]	[0.17]	[0.11]
Profitability (winsorized fraction .01)	0.07***	0.02***	0.04***	0.08***	0.14***	0.15***	-0.02	-0.24***
	[0.02]	[0.00]	[0.01]	[0.01]	[0.01]	[0.02]	[0.03]	[0.08]
Observations	17,890	17,890	17,890	17,890	17,890	17,890	17,890	17,890
R-squared	0.09							

Notes: Data sample: life insurance companies, unconsolidated accounts. 2005-2015.

Specifications: Column (1) is estimated by simple OLS and columns (2)-(8) are estimated by quantile regressions. Time effects are included. Standard errors (between brackets) are heteroscedasticity robust. *, **, and *** denote significance at the 10 percent, 5 percent, 1 percent level.

Table 12. Non-Life Insurers Leverage: Quantile Regressions

VARIABLES	(1) OLS	(2) Q(0.05)	(3) Q(0.10)	(4) Q(0.25)	(5) Q(0.50)	(6) Q(0.75)	(7) Q(0.90)	(8) Q(0.95)
CIT rate (pct)	0.12***	0.00	0.01***	0.03***	0.01	0.11***	0.37***	0.55***
	[0.01]	[0.00]	[0.00]	[0.00]	[0.01]	[0.02]	[0.02]	[0.04]
Log assets (winsorized fraction .01)	0.77***	0.08***	0.43***	0.81***	0.77***	0.57***	-0.13	-0.11
	[0.10]	[0.02]	[0.03]	[0.05]	[0.09]	[0.21]	[0.26]	[0.52]
Log assets sq (winsorized fraction .01)	-0.07***	0.02***	-0.00	-0.04***	-0.04***	-0.07***	-0.08***	-0.11**
	[0.01]	[0.00]	[0.00]	[0.01]	[0.01]	[0.02]	[0.02]	[0.05]
GDP growth (pct)	0.48***	0.08***	0.14***	0.28***	0.39***	0.65***	0.75***	0.84***
	[0.03]	[0.02]	[0.02]	[0.01]	[0.03]	[0.03]	[0.10]	[0.17]
Inflation (pct)	0.24***	0.11***	0.20***	0.31***	0.40***	0.29***	0.02	-0.00
	[0.03]	[0.02]	[0.02]	[0.01]	[0.04]	[0.05]	[0.07]	[0.07]
Profitability (winsorized fraction .01)	-0.03***	0.02***	0.02***	0.02***	0.01	-0.02	-0.11***	-0.27***
	[0.01]	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]	[0.02]	[0.03]
Observations	43,887	43,887	43,887	43,887	43,887	43,887	43,887	43,887
R-squared	0.01							

Notes: Data sample: non-life insurance companies, unconsolidated accounts. 2005-2015.

Specifications Column (1) is estimated by simple OLS and columns (2)-(8) are estimated by quantile regressions.. Time effects are included. Standard errors (between brackets) are heteroscedasticity robust. *, **, and *** denote significance at the 10 percent, 5 percent, 1 percent level.