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# Corporate Post-Retirement Benefit Plans and Leverage

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## Abstract

This paper shows that defined benefit pension and health care plans are important for firm leverage around the world. While consolidating off-balance sheet post-retirement plans typically increases effective leverage by 32%, firms reduce their level of regular debt by only 22 cents for every dollar of projected benefit obligation, yielding overall 23% higher total leverage of plan sponsors compared to similar firms without post-retirement plans. The most important driver of substitution rates between regular debt and post-retirement obligations is rule of law, followed by labor market freedom and taxes, where countries with a better rule of law, less labor market freedom and higher marginal corporate tax rates show higher substitution rates. In contrast, pension guarantee funds and priority of unfunded pension obligations are less important for substitution rates.

**Keywords:** Capital Structure, post-retirement benefits, pension, health care

**JEL Classification:** G3, F4, F3

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### Abstract

This paper shows that defined benefit pension and health care plans are important for firm leverage around the world. While consolidating off-balance sheet post-retirement plans typically increases effective leverage by 32%, firms reduce their level of regular debt by only 22 cents for every dollar of projected benefit obligation, yielding overall 23% higher total leverage of plan sponsors compared to similar firms without post-retirement plans. The most important driver of substitution rates between regular debt and post-retirement obligations is rule of law, followed by labor market freedom and taxes, where countries with a better rule of law, less labor market freedom and higher marginal corporate tax rates show higher substitution rates. In contrast, pension guarantee funds and priority of unfunded pension obligations are less important for substitution rates.

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# 1 Introduction

In many countries around the world, recent years have witnessed increasing attention to and debate of the pension arrangements of private and public sector employees. In the wake of the financial and economic crisis as well as longer-term trends such as significant demographic transformations, retirement systems have been overhauled to some extent in all OECD countries. There is a notable shift away from Pay-As-You-Go pensions towards funded arrangements, frequently in the form of defined contribution plans. Defined benefit pension plans are often being restructured, contribution levels increased, and final salary schemes modified into arrangements where benefits are a function of average wages. With pension fund assets amounting to 84% of GDP on average across OECD countries in 2013, pension plans are economically very significant in many countries.

This paper considers defined benefit post-retirement plans for pensions and health care from a corporate perspective. In particular, it investigates the role of these plans for corporate capital structure, based on a sample of more than 32,000 publicly traded non-financial firms from 50 countries during the period 2002-2009. For firms outside the United States, little is known about the popularity and size of corporate post-retirement plans, and their capital structure implications are entirely unexplored. However, studying the effect of post-retirement plans on capital structure in an international context is interesting and important for a number of reasons. First, defined benefit post-retirement plans are often more frequent and economically more important outside the United States. Thus, documenting the features and regularities of these plans around the world helps understand the global landscape of post-retirement provision and puts the U.S. evidence into perspective.

Second, while institutional differences are important for understanding capital structure (Rajan and Zingales, 1995), dimensions of the institutional environment that are relevant for post-retirement plans, such as the legal framework, priority in bankruptcy, guarantee mechanisms, external supply of capital, labor market and tax regime, are difficult to analyze within the same legal/economic framework. In contrast, cross-country variation of the environments in which firms operate allows studying the determinants of substitution rates between post-retirement obligations and debt financing. Third, an international study provides an out-of-sample test for earlier U.S. evidence using an alternative data source, which is important for verifying the robustness of these findings (Rajan and Zingales, 1995). Finally, a larger international sample provides more cross-sectional variation in policies and more powerful tests which helps to better understand capital structure. As global markets become more

integrated, it is increasingly important to understand what drives differences in important observed variables such as leverage in order to avoid model/policy mistakes that could affect how firms operate.

The paper shows that the pension assets and liabilities of nonfinancial corporations are substantial in many countries, and that consolidating off-balance sheet plans for pension, health care and other post-retirement benefits typically increases effective leverage.<sup>1</sup> While companies with large post-retirement plans tend to have less regular leverage, the substitution effect is only partial, so that plan sponsors have higher effective leverage after accounting for post-retirement plans. In countries where occupational defined benefit plans are frequent and large, consolidation has a large effect on leverage, while substitution rates are often low, resulting in much higher consolidated leverage of firms with post-retirement plans compared to otherwise similar firms without such plans. The degree of substitution between regular debt and post-retirement obligations varies across countries from 0%-100% as a function of the legal environment, labor market freedom, and corporate tax rates, as well as the size of plan assets, private bond market capitalization and private credit. In contrast, pension guarantee funds and priority of unfunded pension obligations are less important for substitution rates. At the same time, despite this international heterogeneity in the determinants of leverage ratios, firm fixed effects account for at least 84% of the variation of leverage across countries, suggesting that most of the variation in capital structure arises from unobserved time-invariant determinants.

The fact that contributions to occupational pension plans are tax-deductible and that the inability to make them can result in bankruptcy might suggest that post-retirement obligations effectively reflect borrowing from employees that is substituting for other forms of debt and being considered when determining optimal levels of leverage. Thus, in order to obtain more realistic levels of leverage, assets and liabilities of post-retirement benefit plans need to be recognized on the balance sheet and consolidated similar to fully owned subsidiaries, even if they exist in separate legal entities (trusts).<sup>2</sup> In my international sample, firms with defined benefit plans have 20%-70% higher leverage for different measures of gearing once the off-balance sheet assets and liabilities of their post-retirement plans are

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<sup>1</sup> See Dhaliwal (1986) regarding the measurement of financial leverage in the presence of unfunded pension obligations. Graham and Leary (2010) identify variable mis-measurement as one of the key challenges in capital structure research.

<sup>2</sup> See also Shivdasani and Stefanescu (2010), Jin et al. (2006), Bulow et al. (2004), Barth et al. (1992), and Feldstein and Seligman (1981).

consolidated, which might help explain the observed conservative levels of leverage noted in the literature. Plan contributions provide companies with significant tax benefits internationally: Contributions to defined benefit plans are economically significant for plan sponsors, often around 30% of the interest expense on debt, with concomitant benefits in terms of the present values of tax shields.

In some countries, such as the UK, Switzerland and the Netherlands, many firms have a defined benefit post-retirement plan, and the average projected benefit obligations are large. As a result, consolidating defined benefit plans leads to a statistically and economically significant increase in the leverage of plan sponsors, e.g. by three to four times (depending on the measure of leverage) for UK firms. In contrast, the effect is not significant in about half of the countries, where defined benefit plans are less frequent and smaller. Consequently, there is no need to make the effort of collecting information from the footnotes of the annual reports of firms in these countries to assess their leverage.

The effect of consolidating the assets and liabilities of post-retirement plans on leverage is counterbalanced by the fact that firms with large post-retirement obligations have less regular debt. Nevertheless, the substitution effect is partial, i.e. firms reduce their level of regular debt by only 22 cents for every dollar of post-retirement obligation. As a result, the net effect of considering defined benefit plans is 23% higher leverage of plan sponsors compared to non-sponsors holding other firm characteristics constant. The extent to which projected benefit obligations substitute for regular debt also varies across countries. In several countries, such as Austria, plan sponsors reduce their regular leverage to such a degree that their effective leverage is not significantly different from that of non-sponsors. Nevertheless, firms in countries with large plans often only have low substitution rates, leading to much higher consolidated leverage of firms with defined benefit plans compared to otherwise similar firms without such plans, by as much as 57% in the UK, for example.

According to the trade-off theory of capital structure, firms balance the tax benefits of leverage with the expected costs of financial distress. Therefore, plan sponsors might substitute post-retirement obligations for regular debt if the tax benefits are larger and/or the distress costs lower. Across countries, substitution rates between regular debt and post-retirement obligations are higher in countries with a stronger rule of law, where lenders may be less willing to provide funds to companies with significant post-retirement liabilities since post-retirement claims can be enforced more easily. Substitution rates between regular debt and post-retirement obligations are also higher in countries with lower labor market freedom, stronger employment protection, stricter employment laws, and higher

union density, as employees' benefits are better protected and thus larger. Taxes also matter, as larger marginal corporate income tax rates increase the tax incentives of post-retirement plans relative to regular debt and are thus associated with higher substitution rates.

Moreover, if external capital is more easily available due to larger markets for private credit and private bond markets, firms rely more on regular debt and substitution rates are lower. Finally, substitution rates are higher in countries where pension fund assets are small, while pension guarantee schemes and the priority of unfunded pension liabilities in bankruptcy are less important. In terms of economic magnitudes, the legal environment is most important across different determinants of substitution rates, followed by labor market freedom and taxes.

These differences demonstrate the important role that post-retirement benefit plans play for capital structure internationally. Results from variance decompositions of leverage suggest that post-retirement obligations are an element of the time-invariant determinant of capital structure that accounts for the majority of the variation in capital structure across countries, even though the importance of individual firm characteristics varies significantly across countries. The paper complements recent work by Shivdasani and Stefanescu (2010), who examine the capital structure implications of defined benefit corporate pension plans in the United States and show that the existence of a pension plan lowers the extent to which firms can take on additional debt for tax purposes.

The paper is organized as follows. Section 2 presents the main features of benefit plans for pensions and other post-retirement employee benefits. Section 3 discusses the hypotheses, while the sample and data are covered in Section 4. Section 5 presents the results of the empirical analysis, and Section 6 concludes.

## **2 Post-Retirement Benefit Plans**

### **2.1 Pension Plans**

Defined Benefit (DB) pension plans and Defined Contribution (DC) pension plans are the main types of institutional pension arrangements, also referred to as the second pillar of retirement savings, that are complemented by government-provided or state-run pensions (first pillar) and private savings (third pillar). For defined contribution pension plans, the employer only has a legal obligation to make specific contemporaneous payments into the pension account of the employee. Consequently, the beneficiaries, i.e. the employees, bear the investment risk. In contrast, a defined benefit plan specifies the benefits the employees receive at retirement, and the employer bears the investment risk. The

employer is legally required to make contributions to the pension plan so that the assets are sufficient to meet the pension obligations. The analysis in this paper focuses on DB plans, since the obligation of the employer is limited to periodic pension contributions in the case of DC plans.

Annual reports contain information on post-retirement plans both on- and off-balance sheet. Pension plan assets and liabilities are typically treated as off-balance sheet items. The pension liability is measured as the Projected Benefit Obligation (PBO), which reflects the present value of the future benefits to employees, based on current service and future expected salaries. It is a measure of a pension plan's liability at the calculation date assuming that the plan is ongoing and will not terminate in the foreseeable future.<sup>3</sup> In contrast, the pension assets are valued at fair market value. Pension plan assets and liabilities are reported in the footnotes of the annual report, while the balance sheet shows the net amount, i.e. the extent to which pension contributions are above or below pension cost. For severely underfunded pension plans, FASB required U.S. firms until 2006 to recognize an additional minimum liability on the balance sheet that had to be offset by an intangible asset and, for amounts in excess of unrecognized prior service costs, by a charge to book equity.

Pension contributions are the actual payments used to fund the pension assets. They are typically not reported, but can be inferred as the pension expense, which is shown in the income statement as a cost, plus the change in net prepaid pension costs (Revsine et al., 2005). It is generally the pension contribution, not the pension expense that is tax deductible (Rauh, 2006). Pension costs differ from contributions since companies try to smooth pension expenses in order to avoid fluctuations in plan assets and liabilities causing significant variation in corporate accounts, particularly income. The difference between the actual experience and that expected based upon the actuarial assumptions that have not yet been recognized as a component of net periodic benefit cost yields an unrecognized actuarial gain/loss off-balance sheet. The extent to which employers have to make contributions each year depends on the funding status of the pension plan. While companies are required to increase their contributions over a period of time if the plan is severely underfunded (mandatory contributions), they have discretion over whether to make voluntary contributions or not.<sup>4</sup>

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<sup>3</sup> IAS19 refers to this item as the Defined Benefit Obligation (DBO).

<sup>4</sup> Yermo and Severinson (2010) summarize funding requirements across countries.

## **2.2 Other Post-retirement Employee Benefits**

In addition to pension plans, companies may offer Other Post-retirement Employee Benefits (OPEB), which principally refer to medical plans, but also include benefits such as insurance coverage, and other welfare benefits such as tuition assistance, day care, legal services, and housing subsidies provided after retirement. Provisions for these are in many ways similar to those for pensions. To illustrate, similar principles are applied to estimate the expected obligations of medical plans and to value the plan assets; plan assets and obligations are disclosed in the footnotes, and only a measure of the net liability is recognized on the balance sheet. Given these similarities, it is sensible to consider plans for pensions and other post-retirement benefits together, and in fact annual reports (and thus WorldScope) typically only show the combined pre-paid/accrued costs of these plans on the balance sheet, even though they provide separate information on their assets and obligations. Similarly, Standard and Poor's combine the assets and liabilities of all benefits plans. At the same time, there are also a number of differences, such as various additional assumptions that are required about health care cost trend rates, funding levels, guarantees from industry/government agencies, and tax incentives for contributions. Overall, though, the main features of these plans and their accounting treatment are similar for the purpose of this paper.

## **2.3 Accounting Standards**

In the United States, FAS 87 and 88 mandated the disclosure of key pension plan information, such as the fair value of the pension assets and the projected benefit obligations, since 1985. FAS 106, issued in 1990, required similar disclosure for post-retirement benefits other than pensions. FAS 132 (passed in 1998, revised in 2003) was issued as an amendment to both earlier statements, standardizing the disclosure requirements for pensions and other post-retirement benefits to the extent practicable, requiring additional information on changes in the benefit obligations and fair values of plan assets, and eliminating certain disclosures that were no longer deemed useful. Since 2006, FAS 158 requires an employer to recognize the funded status of a defined benefit post-retirement plan in its statement of the financial position and to recognize changes in the year of their occurrence. U.S. and international accounting standards are largely similar with regards to the recognition and disclosure of post-retirement benefit plans. IAS 19 was originally issued in 1983 and subsequently revised in 1993, 1998 and 2000. The provisions of IAS 19, which underwent a limited amendment in 2002, are very similar to FAS 87. Following the European Union's IFRS regulation of 19 July 2002, all publicly traded companies in the European Union are required, in most cases since 2005, to prepare their consolidated

financial statements in accordance with IFRS. Similarly, this standard has been required since 2005 for firms in Australia and South Africa, it is used among many international firms, and in fact many firms adopted IAS already in the 1990s. In the United Kingdom, FRS 17 sets out the accounting treatment for retirement benefits such as pensions and medical care during retirement, replacing SSAP 24 and UIFT Abstract 6. It was issued in 2000 (and revised in 2006), but was fully effective only in 2005 after a long transition period, with early adoption encouraged. Supplemental Appendix A provides an overview of the various accounting standards.

While these accountings standards are not identical, they apply similar principles in terms of the valuation of the assets and liabilities of post-retirement plans, the disclosure of their full values in footnotes, but only limited recognition in terms of accrued costs/funding deficits on the balance sheet. Similarly, while the recognition of the funded status required by FAS 158 is an important change compared to (net) accrued costs, the actual size of plan assets and liabilities remains off-balance sheet, which means that consolidation continues to have a significant effect. Nevertheless, in order to control for potential differences across accounting standards and time, the analysis in this paper uses various fixed effects e.g. for countries, accounting standards, and years, and the results are robust to estimation by country or by year, for the subperiods before and after 2006, or for U.S. GAAP and IAS-compliant firms.

### **3 Post-Retirement Plans and Leverage**

#### **3.1 Consolidation**

Given that pension, health care and other post-retirement benefits constitute legal obligations on the part of a company, they should be recognized in corporate capital structure calculations even when they are reported off-balance sheet. Post-retirement benefit obligations can be viewed as borrowing from employees, and the fact that contributions are tax-deductible and the inability to make them can result in bankruptcy provides clear analogies with other forms of corporate debt. Moreover, companies may be able to trade off other forms of compensation against post-retirement benefits. Rating agencies also treat deferred employee compensation, including health care promises, as debt. To illustrate, Standard & Poor's Ratings Services "*...views unfunded liabilities relating to defined benefit pension plans and retiree medical plans as debt-like in nature. This also is the case with deferred lump-sum payment schemes, such as termination programs for employees in Italy. By accepting a portion of their compensation on a deferred basis, the employees essentially become creditors of the company. As with conventional debt, these liabilities pose risks to their corporate*

*sponsors from the call on future cash flow they represent.*” (Standard and Poor’s, 2006, p. 96).<sup>5</sup> Consequently, I consolidate the assets and liabilities of pension and health care plans in order to assess corporate capital structure, following Shivdasani and Stefanescu (2010), Jin et al. (2006), and Credit Suisse First Boston (2005).<sup>6</sup>

The effect of post-retirement benefit plans on corporate leverage is likely positive in many cases, i.e. incorporating off-balance sheet liabilities of pension and medical plans into capital structure calculations will often lead to higher effective leverage ratios. To illustrate, assume leverage is calculated as Total Debt (TD) to Total Assets (TA) (with  $TD < TA$ ). Even if post-retirement benefit plans are fully funded, so that Post-Retirement Assets (PA) correspond to Post-Retirement Obligations (PO) (i.e.  $PA=PO$ ), leverage will increase since  $TD/TA < (TD + PO)/(TA + PA)$ . Thus, off-balance sheet post-retirement obligations tend to increase leverage ratios, though the effect is not mechanical and depends, e.g., on the funding level of the pension plan. To the extent that post-retirement obligations are similar to other legal commitments, companies with large post-retirement obligations should take out less regular debt. That is, there will be a substitution effect yielding consolidated leverage ratios for firms with DB plans comparable to those of otherwise similar firms without DB plans. In the same vein, contributions to post-retirement benefit plans lower the marginal tax rate and thus the tax benefits associated with debt financing. These two effects of off-balance sheet obligations provide potential explanations for the low levels of observed leverage (Graham, 2000).

While there are a number of similarities between post-retirement obligations and regular financial debt, there are also a number of important differences. To illustrate, governments or industry associations may provide additional insurance schemes for corporate pension plans that do not normally exist for other corporate liabilities (except possibly implicitly for politically or systemically important companies or sectors). In the United States and the United Kingdom, for example, pensions are guaranteed by the Pension Benefit Guaranty Corporation (PBGC) and the Pension Protection Fund, respectively, and thus companies do not bear the full costs of imposing a high level of high risk on pension beneficiaries.

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<sup>5</sup> See also Kraft (2010) for adjustments of leverage ratios for all the types of off-balance sheet finance that credit rating agencies find important (including pension obligations, operating leases).

<sup>6</sup> There is also a body of accounting literature that suggests that investors will consider the assets and liabilities of post-retirement benefits (see e.g. Franzoni and Marín, 2006; Coronado and Sharpe, 2003; Barth et al., 1992; Dhaliwal, 1986) as they do for other off-balance sheet items such as operating leases (Ely, 1995; Imhoff et al., 1993).

External providers of funds also exert more effective monitoring of management than employees, especially if the claims of the latter are insured. Moreover, pension assets cannot easily be liquidated to cover other corporate liabilities. While failure to meet minimum post-retirement benefit plan contributions can trigger bankruptcy, the level and timing of contributions is more flexible than payments to service regular debt. Companies can take advantage of this feature in order to maximize the associated tax shields by making larger contributions when marginal tax rates are high. Higher contributions will also reduce required minimum contributions in future years, build financial slack and increase flexibility (Ballester et al., 2002; Friedman, 1983). As a result, firms may sometimes reduce or even forgo the funding of a period's pension expense ("contribution holiday"), when possible, to meet competing investment or financing cash needs such as plan expansions, corporate acquisitions, debt retirement or dividend increases. In the United States, a pension plan sponsor is obliged to fund at least the annual service cost computed under the plan, unless the plan is overfunded at the beginning of the year. Because plan contributions are tax deductible (up to a limit for already overfunded plans) while plan earnings are non-taxable for the plan sponsor, there is a tax incentive to overfund pension plans. While there is a general lack of a tax-effective method for prefunding the promises to provide other post-retirement benefits in the United States, there are some tax-effective means of prefunding retiree medical plans, such as Voluntary Employees' Beneficiary Association (VEBA) trusts. As with pensions, contributions to a VEBA trust are tax-deductible up to a certain limit.

Moreover, the estimates of pension and health care liabilities rely on a number of assumptions, such as discount rates, the expected long-term rate of return on plan assets, employee turnover, early retirement, salary scale (typically a function of productivity improvements, inflation, merit or promotional increases, seniority raises), disability, family composition, mortality, retirement age, health care cost trend rate, per capita claims cost by age group, medical coverage to be paid by governmental authorities and other providers of health care benefits, etc. Given the large size and long duration of pension obligations, small changes in the assumptions can have large effects on their valuations.<sup>7</sup> While all areas of financial reporting require management to make estimates and judgments, this is

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<sup>7</sup> To illustrate, a 1% decrease in the discount rate will typically boost the estimated pension obligation by 10% to 15% (Revsine et al., 2005, p. 777).

particularly true of accounting for defined benefit plans, which relies on numerous subjective assumptions given the prospective and variable nature of post-retirement promises (Standard and Poor's, 2006).

Companies can vary the size of their post-retirement obligations depending on changes in the fair value of plan assets, which tend to be driven by market movements and to a much lesser extent by changes in interest rates, since fixed income investments generally represent only a fraction of the pension asset portfolio and the maturities of those investments are typically much shorter (Revsine et al., 2005). To illustrate, it has been noted that discount rate assumptions diverge significantly more widely among companies than underlying differences in interest rates and workforce demographics would justify. The resulting degrees of flexibility with regards to the valuation of post-retirement benefits allow companies to use post-retirement benefit plan assumptions to manage their earnings, for example by changing the discount rate applied to value future pension commitments of defined benefit plans (Bergstresser et al., 2006; Feldstein and Mørck, 1983). Companies may even use changes to post-retirement plan assumptions to avoid violations on their other liabilities. These differences suggest that projected benefit obligations may not be perfect substitutes for other liabilities. As a result, the consolidated leverage ratios of firms with DB plans could be higher than those of similar firms that do not sponsor DB plans.

### **3.2 Substitution Rates**

According to the trade-off theory of capital structure, firms will choose a target capital structure by balancing the benefits and costs of their liabilities. Since various institutional features will affect this decision, Rajan and Zingales (1995) conclude in their paper on international capital structure that a deeper understanding of the effects of institutional differences is necessary. While a growing literature considers how country characteristics affect capital structure, the effect of the institutional environment on post-retirement benefit plans and its role for corporate leverage has so far not been investigated.<sup>8</sup> Nevertheless, substitution rates between post-retirement benefit obligations and regular debt should be affected by institutional features (such as regulation) that determine the tax incentives and

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<sup>8</sup> Studies that examine capital structure choices across countries, for instance with regards to the legal system, tax code, public governance, bankruptcy code or external capital supply, include Booth et al. (2001), Claessens et al. (2001), Demirgüç-Kunt and Maksimovic (1996, 1998, 1999), Fan et al. (2012), Giannetti (2003), and De Jong et al. (2008).

bankruptcy risk of the two types of obligations. Since these institutional features tend to vary across but not (or less) within countries, they are best studied in an international setting.

With regards to taxes, reductions in taxable income are more valuable if the statutory marginal tax rate is high. Post-retirement benefit plans are attractive from a tax perspective since it is the contributions made to fund the post-retirement obligations that reduce taxable income, while only interest on debt (but not capital repayment) is tax deductible for financial debt. Thus, financing implications aside, for the same amount of future commitment, the tax benefits of PBOs are much larger than those of regular debt. Moreover, interest on debt is typically determined by a fixed payment schedule, while post-retirement plan contributions are more flexible. At the same time, in contrast to interest payments, there are limits in many countries on the contributions that can be deducted (IOPS). Post-retirement obligations are more attractive in more generous tax environments considering the taxation applied to the contributions, investment income and capital gains of the fund, and to benefit payments. Therefore, substitution rates are likely to be higher in countries with higher marginal corporate tax rates and more generous tax treatment of post-retirement benefit provision, *ceteris paribus*.

With regards to expected bankruptcy costs, the relative ease or difficulty of enforcing unfunded post-retirement obligations and outstanding contributions compared to other liabilities matters. Employees are considered the most vulnerable of company creditors in the insolvency process. Typically, they have not intentionally assumed the credit risk of their employer or negotiated a risk premium, have no recourse, and lack the information and ability to assess credit risk (Johnson, 2007). Unlike other creditors, employees lose their jobs in the insolvency of their employer, in addition to salaries and benefits owed, and they can neither protect their position as easily as sophisticated creditors, nor diversify the credit risk through multiple investments (Sarraf, 2008).

In default, employees might have a number of different claims against their employer, arising from occupational deferred compensation arrangements (outstanding pension contributions, unfunded pension liability), unpaid wages, salaries, and commissions, in-kind payments for accrued vacation and holiday pay, sick leave pay, severance pay, termination pay, travel expenses, and other contracted-for benefits (including health insurance, life insurance, long-term disability insurance, and retiree medical benefits). Given the significance of such claims for individuals, they enjoy some form of protection in many countries, either from a higher priority of claims in bankruptcy and/or a guarantee scheme. Advantages of guarantee funds are that they usually offer immediate financial relief to employees suffering from a job loss due to insolvency or bankruptcy, and that there is no interference

with the hierarchy of claims in insolvency, so that other creditors do not have to be concerned about potentially being subordinated to an unknown amount of liability from the employer's failure to make wage and related compensation payments in the period leading up to insolvency proceedings (Sarra, 2008). On the other hand, a guarantee scheme creates incentives for distressed companies to pay other creditors, but not wages and pension contributions, in the period prior to insolvency, given the protection offered to the latter claims by the fund in case of default. It might further lead to the plan sponsor raising benefits to unsupportable levels, or pursuing a risky investment strategy.

A guarantee mechanism/fund offers protection of post-retirement benefits to plan participants, which makes the benefit promise safer and more valuable to employees, and thus employers might be able to substitute more cash compensation for deferred compensation. However, for such schemes to work effectively, they must have suitable independence and powers to set and collect appropriately risk-adjusted premia, effective funding rules that require extra premia or collateral to be paid should the scheme become underfunded or the plan sponsor insolvent, and to prohibit the voluntary closure of underfunded plans. A guarantee scheme may also encourage the trustees of the post-retirement fund to be tougher. It often takes over the assets and claims of failed plans and can play an important role in the insolvency process, if it becomes subrogated to the rights (and priority) of the employees in the insolvency proceeding. Since the managers of the scheme have more institutional knowledge of the insolvency procedure and represent a larger overall claim, they will have more bargaining power.

In most OECD countries, outstanding occupational pension contribution and wage claims receive some preferential treatment. However, there are variations across countries, for example with regards to the strength of creditor priority (e.g. super-priority, preferred) or the nature of caps on claims (often by amount and for a specified period of time before the filing of the bankruptcy petition). In contrast, underfunded occupational pension liabilities are mostly treated as unsecured claims (Secunda, 2014; Sarra, 2008; Stewart, 1997b). As with pension benefits, many OECD countries have guarantee schemes (such as wage guarantee funds) that will help pay for some employee wage-based benefits upon insolvency.

If unfunded PBOs have high seniority in bankruptcy or are protected by a guarantee scheme, other creditors are less likely to lend to firms with large post-retirement obligations, and thus substitution rates should be higher. At the same time, the seniority effect might not be very strong, since the costs, complexity and required knowledge of bankruptcy proceedings are likely to deter individual

employees from taking advantage of the priority of their claims. Moreover, frequent deviation from absolute priority has been documented (Djankov et al., 2003), and even creditors that are first in line may find it hard to have their claims satisfied if the insolvent plan sponsor has few assets left.<sup>9</sup> Lenders should also be less willing to extend credit to firms with large PBOs in countries where their rights are less protected (weaker creditor rights) and/or these are harder to enforce (weaker rule of law, and law and order). Alternatively, it could be that post-retirement claims benefit more from a good legal environment, since they are harder to enforce in the first place. Further, if there is a greater external supply of capital, it should be easier for firms to raise additional debt. Therefore, substitution rates are likely smaller in countries with larger markets for bonds or private credit. Post-retirement obligations will also be less of a concern for creditors of firms in countries where plans are well funded, since they are less likely to have to fight with plan beneficiaries over corporate assets in default.

Characteristics of the labor market can also be related to the substitution rate between regular debt and post-retirement obligations. In particular, various dimensions that strengthen the rights of individual employees have a potential bearing on the size of the post-retirement obligation. Strong employment protection is likely to entail larger benefit obligations since employees are harder to dismiss (and possibly on better terms) and continue to accumulate benefits. Strong labor unions and collective relations laws that govern the bargaining, adoption, and enforcement of collective agreements, the organization of trade unions, and the industrial action by workers and employers also entail larger (post-retirement) benefits. This includes the renegotiations of the terms of DB schemes that have occurred in recent years. Unions might also seek to bring claims in insolvency for active members under collective bargaining agreements. Overall, better protection of the rights of employees and less labor market freedom mean that post-retirement benefits are likely larger, suggesting higher substitution rates.

These predictions are supported by theoretical arguments and empirical evidence of a negative relation between employment protection and leverage (Simintzi et al., 2014). In particular, greater bargaining power of employees increases labor costs, which lowers access to external finance and generates a crowding-out effect. Labor compensation, which is increasing in employment protection, can consist of salaries, but also post-retirement benefits. In the case of DB plans, the benefits and thus

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<sup>9</sup> A further complication consists of the fact that the bankruptcy law in some countries does not recognize the priority that pensions have under pension law (Steward, 2007b).

the plan obligations are a direct function of salaries and years of service, which increase in employment protection and the bargaining power of employees.

## 4 Sample and Data

The initial sample consists of all firms with data available on WorldScope and DataStream. I exclude utility firms (SIC code 49) and financial firms, i.e. banks, insurance companies, etc. (SIC codes 60-64), due to the effect of regulation on their leverage ratios. I impose a number of filters, because firms can have multiple share classes or listing locations. For example, I screen on the security type, use only primary listings, exclude ADRs, and require that the currency of the stock price be a legal tender in the country of incorporation of the firm. Further, I exclude U.S. OTC Bulletin Board and 'Pink Sheet' stocks, and firms with missing country or firm identifiers. The number of observations in Bahrain, Bermuda, Jordan, Kenya, Lithuania, Oman, Slovenia, Tunisia, the United Arab Emirates, and Zimbabwe is small, and thus firms in these countries are excluded from the analysis. The final sample consists of an unbalanced panel of 33,260 companies from 50 countries during the period 2002-2009.<sup>10</sup>

I classify firms as having defined benefit pension and health care plans depending on whether their annual reports show projected benefit obligations for these plans. Firms with either type of plan are classified as having a DB post-retirement plan. Separately for pension and medical plans, WorldScope has information on the projected benefit obligations, the fair value of plan assets, which are reported off-balance sheet, and the net periodic cost. I manually verify the data on post-retirement plans in the WorldScope database via a comparison with their recognition and disclosure in actual annual reports based on a sub-sample of firms across different countries and years. The items prepaid costs and accrued costs reflect the net recognition of these plans on the balance sheet. They combine information on different types of post-retirement benefit plans (e.g. domestic and foreign, pensions and health care, etc.), and thus for consistency I also combine the off-balance sheet information into corresponding variables for all post-retirement plans (as do S&P). Proxies for contributions to defined benefit plans are calculated as the periodic expense (income) plus the change in net prepaid (accrued)

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<sup>10</sup> While the documentation of the WorldScope database indicates that items on pensions and other post-retirement benefits have been collected in a systematic way since 2005, several items have been populated for prior years as well and, thus, have a longer history. The most important items for the analysis in this paper have decent coverage starting in 2002.

costs. As a measure of the size of post-retirement benefit plans, the projected benefit obligation is normalized by consolidated total assets.

Several different leverage ratios are calculated, based on different measures of debt (alternatively total debt, long-term debt plus preferred stock, or long-term debt), market or book values of total assets, including or excluding payables and other liabilities, and with or without netting cash and short-term investments. In addition to regular leverage ratios, consolidated leverage ratios are calculated based on consolidated balance sheets where the accounts are adjusted for off-balance sheet information on post-retirement benefit plans. In particular, all recognized pension and other post-retirement items are removed from the balance sheet, and the true values of the assets and liabilities of post-retirement benefit plans are incorporated. Specifically, consolidated leverage is calculated by redefining assets as total assets minus prepaid costs (including intangible pension assets where applicable) plus fair value of plan assets. Similarly, debt is increased by the present value of the post-retirement plan liabilities minus already recognized post-retirement items (including additional minimum liability where applicable). The consolidated interest expense is calculated as the sum of the regular interest expense and post-retirement contributions.

Weekly stock return data in U.S. Dollars are obtained from DataStream. For firms with returns data available for at least 25 weeks in the observation year I calculate total risk as the annualized standard deviation of returns. Idiosyncratic risk is calculated as the annualized standard deviation of the residuals from a regression of stock returns on the local market index (with one lead and one lag), the world market index, as well as regional and global HML and SMB, following Bekaert et al. (2010). Market risk is the annualized square root of the difference between total risk squared and idiosyncratic risk squared. Supplemental Appendix B provides definitions of the main variables used in this paper, and Supplemental Appendix C shows their summary statistics.

## **5 Results**

I first assess how important post-retirement assets and liabilities are for non-financial firms across different countries and industries and look at the development of the importance of DB plans over time. Next, I investigate the effect of incorporating off-balance sheet information about post-retirement benefit plans on leverage ratios by comparing regular and consolidated leverage ratios, and assess the tax benefits of these DB plans. Subsequently, I investigate how post-retirement benefit plans relate

to leverage in regression analyses, how important different firm characteristics (including post-retirement benefits) are in explaining variation in leverage ratios, and which country characteristics affect the substitution rate between post-retirement benefit obligations and regular debt.

## 5.1 Importance of Post-Retirement Benefit Plans

Defined benefit plans for pensions and health care exist in many countries. Panel A of Table 1 shows averages of the relative importance of these plans by country based on the firms in the sample, where countries are sorted by the percentage of firms with a DB post-retirement plan.<sup>11</sup> Switzerland is at the top of the list, with 61.9% of all firms having some type of DB plan over the sample period. The other countries in which DB plans are particularly common are Austria (57.6%), Ireland (54.4%), Mexico (48.1%), the Philippines (45.0%), the Netherlands (42.7%), Taiwan (38.5%), Pakistan (38.2%), Luxembourg (38.0%), Japan (37.6%), and Norway (36.5%). Overall, pension plans are much more common than medical plans. 13.7% of U.S. firms have a health care plan, which is the highest frequency across all countries, followed by Pakistan (10.8%), South Africa (9.4%), the Netherlands (7.3%) and Canada (7.3%).

The ratio of projected benefit obligations to consolidated total assets is a measure of the size of post-retirement benefit plans. By this measure, there is also large variation in the economic importance of post-retirement plans across countries, with Venezuela, the United Kingdom, the Netherlands, Switzerland, and Ireland representing the top five. The size of these plans can be economically quite significant: To illustrate, post-retirement benefit obligations are, on average, 27.3% of total assets in the United Kingdom.<sup>12</sup> They tend to be larger in countries where many firms sponsor a defined benefit plan. The second to last column in Panel A shows the degree of underfunding of post-retirement benefit plans, calculated as the difference between the fair value of plan assets and projected benefit obligations scaled by total assets. Strikingly, the typical plan is underfunded in 48 out of 50 countries. While the average degree of underfunding is 2.6% of total assets, underfunding is much more significant in a number of countries, such as Venezuela (23.9%), the United Kingdom (7.9%), the United States (7.6%), Germany (7.2%), and the Netherlands (5.3%). There is a high correlation

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<sup>11</sup> Note that the consolidated accounts combine information on domestic and foreign plans.

<sup>12</sup> The size and deficits of the pension plans of several large UK companies, such as British Airways, British Telecom and BskyB, have been widely publicized. The joke about BA being a large pension fund with a relatively modest airline operation is part of UK pension industry folklore. BA's defined benefit pension schemes are at least four times the size of the company's market capitalization.

between plan size and degree of underfunding, i.e. the plan deficits are large in countries where the plan obligations are large. Finally, the last column of the table shows the net amounts of post-retirement plans recognized on the balance sheet, calculated as prepaid post-retirement costs (and intangible pension assets where applicable) minus accrued post-retirement costs (including additional minimum liabilities where applicable), scaled by total assets. These amounts tend to be smaller than the true economic levels of underfunding, particularly in the countries with the most underfunded plans.

Table 1 also shows summary statistics on other characteristics of defined benefit post-retirement plans, such as the rates being used to discount future pension liabilities back to the present, as well as the annual rate of return that is expected on the plan assets. There is significant variation in these measures both across firms and across countries within the range of 1%-12% (see Supplemental Appendix C). Firms in developing countries tend to use high discount rates, for example Qatar (11.4%), Sri Lanka (11.0%), Indonesia (10.4%), the Philippines (10.1%), and also high expected returns on the assets of defined benefit pension plans. In contrast, firms in Japan, for example, use a discount rate of 2.3% and a return on plan assets of 2.5%, on average.

Data on the asset allocation of defined benefit funds is much sparser since firms are not required to disclose this information in their annual reports, so the numbers have to be interpreted with some care. There is significant variation across countries in the relative fraction of assets invested in different asset classes, with percentages ranging from 8%-74% for equities, 18%-62% for bonds, 0%-17% for property and 0% to 46% for other assets. Overall, developed and developing markets differ mostly with regards to holdings of equities and other assets, while showing similar proportions of bonds and property.

Statistics are broken down by industry in Panel B of Table 1. There is significant variation in the popularity of defined benefit plans across this dimension as well: In the Aircraft (45.2%), Tobacco Products (44.3%), Shipping Containers (32.6%), Candy & Soda (32.2%), and Automobiles (30.5%) industries these types of post-retirement benefit plans are most common. Again the frequencies are largely a function of defined benefit pension plans, while health care plans are only more popular with firms in the Tobacco Products (22.5%), Aircraft (19.3%), Shipping Containers (13.2%), Defense (11.1%) and Books (10.1%) industries. The largest defined benefit plans exist, on average, in the Defense, Aircraft, Coal, Trading, Tobacco Products, Shipping Containers, and Consumer Goods industries. Differences with regards to the asset allocation of defined benefit pension funds are less pronounced across industries than across countries.

Panel C of Table 1 shows the development of post-retirement plans over the sample period of 2002-2009. The relative frequency of firms in the sample with DB post-retirement plans increases from 12.5% in 2002 to 25.0% in 2009 for the United States, and from 5.2% to 25.3% in other countries, mostly accounted for by the increase in DB pension plans.<sup>13</sup> DB health care plans are insignificant outside the United States (2.6% of firms had such a plan in 2009), but 8.4% and 15.9% of U.S. firms had such a plan in 2002 and 2009, respectively. Note that firms are classified as having a defined benefit plan as long as they report liabilities associated with these plans. Consequently, measures such as the number of active participants or the size of defined benefit obligations might be better proxies to characterize the popularity of DB plans over time. In line with recent trends away from defined benefit plans, the size of their obligations shows a decreasing trend over time, from 0.10 to 0.05 and from 0.17 to 0.15 for non-U.S. and U.S. firms, respectively. The typical size of post-retirement liabilities for non-U.S. firms is, on average, about half of that for the typical U.S. firm each year, as is the degree of underfunding and recognition on the balance sheet, but there is huge variation across countries (see Panel A). Figure 1 shows the funding level and recognition on the balance sheet over time. It illustrates that both in the United States and in other countries the recognition of post-retirement deficits on the balance sheet is less than the actual degree of underfunding, though this gap has narrowed over time. For the United States, the gap closes in 2006, reflecting the introduction of FAS 158 which required the recognition of the funded status in financial statements.

## 5.2 Regular and Consolidated Leverage

Traditionally, leverage is measured by forming ratios of different on-balance sheet items, either using book values or market values. These are referred to as regular leverage ratios in this paper. For companies with post-retirement plans, consolidated leverage ratios can be calculated that incorporate off-balance sheet information, in this case with regards to post-retirement benefit plans. While the fair value of plan assets and projected benefit obligations of defined benefit plans are reported off-balance

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<sup>13</sup> In the face of publicized trends away from defined benefit plans, the increase in the relative number of firms with such plans appears *prima vista* surprising. For the United States, the absolute number of sample firms with defined benefit post-retirement plans actually decreases, but the number of firms without such plans declines even more. Thus, the increasing percentages of firms with a defined benefit plan are driven by higher attrition rates of firms without defined benefit post-retirement plans in the 2000s (newer, smaller, technology and dot-com companies) for reasons unrelated to post-retirement plans. Data from Compustat shows similar trends. The absolute number of non-U.S. firms with defined benefit post-retirement plans actually increases slightly over time, which might reflect the significant shift from Pay-As-You-Go plans to funded arrangements (including defined benefit plans) in many countries, while the decrease in the number of firms without such plans is less pronounced.

sheet, there are still selected items that are recognized on the balance sheet, such as net prepaid or accrued post-retirement costs. In order to calculate consolidated leverage ratios, all items on the balance sheet are removed and the actual values of the assets and liabilities of the post-retirement benefit plans are included instead. Shivdasani and Stefanescu (2010) suggest that DB pension plans are akin to wholly owned financial subsidiaries and should be consolidated since the ownership of the plan assets and the responsibility for the plan liabilities lie fully with the firm, which is consistent with evidence in Landsman (1986). Other papers also suggest that the fair market values of plan assets and the plans' projected benefit obligations, as opposed to the net amounts (i.e. the funding levels), are relevant for investors' understanding the economic implications of corporate post-retirement benefit plans (e.g. Franzoni and Marín, 2006; Coronado and Sharpe, 2003; Barth et al., 1992; Barth, 1991). Without considering the off-balance sheet values of pension assets and liabilities, leverage ratios will be biased, and true economic gearing will often be understated.

To this end, Table 2 shows the results of tests on the differences between regular and consolidated leverage ratios. First, Panel A presents results for the full sample of firms with post-retirement benefit plans, considering a range of different ways of calculating leverage, including measures used in Rajan and Zingales (1995) for comparing capital structure in an international context. While the top part of the panel shows gross leverage measures, the bottom part shows leverage measures where cash and short-term investments (with missing values set to zero) are subtracted from both the numerator and denominator of gross leverage ratios. Leverage is calculated with alternative measures of debt and either in book values or market values. The results show that, regardless of the definition of leverage, the mean and median consolidated leverage ratios are higher than regular leverage ratios. Importantly, the differences are not only statistically significant, but also economically. To illustrate, a common measure of gearing based on book values is the ratio of total debt to total assets. For gross leverage, the average regular ratio is 25.7%, but consolidating off-balance sheet post-retirement plans increases effective leverage to a consolidated ratio of 31.7%, which represents a 23% increase. Across different measures of gross leverage, the increase in leverage is 32%. Results are even more dramatic for leverage ratios that net cash and short-term investments, where the average regular and consolidated ratios of total debt to total assets are 12.6% and 21.0%, respectively, representing an increase of 67%. Similarly, the ratio of total debt to the sum of market capitalization, preferred stock and total debt is a commonly used measure of market leverage. Regular and consolidated leverage are 30.2% and 36.7% for gross leverage, and 14.5% and 25.1% for net leverage, on average, representing increases of 22% and 73%.

While off-balance sheet post-retirement benefit plans tend to increase effective (i.e. consolidated) leverage, there is significant variation across countries, as shown in Panel B of Table 2 for selected measures of gearing. There is no difference between consolidated and regular leverage for firms in about half of the 36 countries at conventional significance levels, while there is no country where consolidated leverage is significantly less than regular leverage. While this evidence provides further support for the general direction of the impact of post-retirement plans on leverage, it also documents that the strength and importance of this effect varies significantly across countries. The differences are typically largest in countries where defined benefit plans are popular and large, such as the United Kingdom, Switzerland, the Netherlands, and Ireland. In the United States, consolidated leverage ratios are about twice the size of regular leverage ratios (multiples of 1.7-2.2 depending on the measure of leverage). However, in the United Kingdom, the factor is between three and four, while there are other countries where it is close to one.

Figure 2 shows the average difference between consolidated and regular leverage over time. It suggests that both in the United States and in other countries, the difference has somewhat decreased in recent years, both for book value and market value measures of leverage. Still, even in 2009, significant gaps remain between leverage with and without considering post-retirement benefit plans. For the entire sample, consolidated leverage is statistically significantly higher than regular leverage in every year for all leverage ratios. While the differences tend to decrease over time, they remain statistically and economically significant (on average 8% of total assets in 2009).

### **5.3 Tax Benefits of Post-Retirement Benefit Plans**

Given the complexities of national tax systems, it is challenging to derive good measures of firm-level marginal tax rates for the sample of international companies. Nevertheless, a rough idea of the tax benefits that plan sponsors derive from post-retirement benefit plans can be obtained using average tax rates (Panel A of Table 3), which are available on WorldScope for many firms. Alternatively, results in Panel B of the table are based on the effective marginal corporate tax rates from Bilicka et al. (2011).<sup>14</sup> Table 3 shows results by year as well as for the entire sample period for the interest expense ratio as well as for estimates of the present value of the total tax benefits from contributions to post-

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<sup>14</sup> Note that the data combine domestic as well as foreign plans to which in principle different, national marginal tax rates apply. Tax credits are available in most countries, with the exception of tax regimes where the tax benefit is realized in advance of funding or payment (Standard and Poor's, 2011; Whitehouse, 2005; IOPS).

retirement plans and interest expenses on debt. The interest expense ratio is the ratio of consolidated interest rate payments (defined as the sum of contributions to DB plans plus interest expense on debt) to interest expense on debt. Since some firms have DB plan contributions but only small interest rate payments, the interest expense ratio is highly skewed and thus the table focuses on median values for this variable. Present value calculations of tax benefits assume perpetual tax shields discounted alternatively at 5% or at the estimated average interest rate on debt (from WorldScope), scaled either by total assets or alternatively market capitalization.

The median interest expense ratio is 1.27 for all post-retirement benefit plans, and the by-year results show that it is typically between 1.11 and 1.49. Thus, contributions are economically significant compared to other, standard sources of financial leverage. In terms of present values, the average total, combined tax benefit is 11% (18%) relative to total assets, and 27% (46%) relative to market capitalization, using 5% (the estimated average interest rate on debt) as the discount rate. The present values together with the interest expense ratio give an idea of the relative importance of contributions to post-retirement plans for the overall tax benefit: With a median interest expense ratio of 1.27 and an average present value of 18% of total assets, 14.2% would be attributable to interest expense on debt, and 3.8% to plan contributions. The last two rows in the table show that the median interest expense ratio is 1.13 for the United States but 1.33 for other countries. The present values of the tax benefits are typically slightly larger for non-U.S. firms as well.

The last two panels of Panel A show that both pension and health care plans provide companies with tax benefits. For pension benefits, non-U.S. firms have larger interest expense ratios (1.32) compared to U.S. firms (1.10), but the associated present values tend to be comparable. In contrast, very few firms have defined benefit health care plans (see Table 1), and while medical plans are much more common in the United States, the associated interest expense ratios are actually similar to those in other countries, and lower than those of pensions for firms outside the United States. Consequently, the tax benefits of health care plans are generally modest, and there are only a few companies that obtain these benefits.<sup>15</sup> The results based on effective marginal tax rates in Panel B tend to be slightly smaller on average, but the relative magnitudes are broadly similar to those in Panel A.

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<sup>15</sup>Note that these calculations are very approximate since they rely on a number of simplifying assumptions about marginal tax rates, the timing and size of plan contributions, the appropriate discount rate, etc. Moreover, the tax benefits of health care plans are likely overstated since the tax benefits often arise when the benefits are paid as opposed to when

## 5.4 Post-Retirement Plans and Leverage

### 5.4.1 Multivariate Regression Results

While there is evidence of the predicted relations in univariate results based on portfolio sorts, plan sponsors differ in a number of firm characteristics from firms that do not sponsor a plan, calling for a multivariate analysis. In particular, I study the relation between regular leverage and post-retirement obligations using the following specification:

$$\begin{aligned} \text{Leverage} = & a_0 + a_1 \text{PBO} + a_2 \text{MarketToBook} + a_3 \text{ROAVolatility} + a_4 \text{LogTotalRisk} + a_5 \text{TaxRate} \\ & + a_6 \text{LogTotalAssetsUSD} + a_7 \text{Dividend} + a_8 \text{TangibleAssets} + a_9 \text{NetFXExposure} \\ & + a_{10} \text{DebtMaturity} + a_{11} \text{GrossProfitMargin} + a_{12} \text{PreferredStock} + a_{13} \text{NegativeBookEquity} \\ & + a_{14} \text{IndustryMedianLeverage} + \nu \end{aligned} \quad (1)$$

where *Leverage* is the ratio of total debt to consolidated total assets. *PBO* is the ratio of projected benefit obligations to consolidated total assets (with missing values set to zero), which is a measure of the size of the post-retirement plan. *MarketToBook* is the ratio of market value of equity to book value, *ROA* is the average return on assets over three years, *ROAVolatility* is the standard deviation of the return on assets over the previous five years, *LogTotalRisk* is the natural logarithm of the annualized standard deviation of stock returns in U.S. Dollars, *TaxRate* is the average corporate tax rate (or, alternatively, the effective marginal tax rates from Bilicka et al., 2011), and *LogTotalAssetsUSD* is the natural logarithm of total assets in U.S. Dollars.

*Dividend* is a dummy variable with value one if the company paid a dividend (and zero otherwise), *TangibleAssets* is the difference between total assets and intangible assets scaled by total assets, *NetFXExposure* is the difference between the percentage of foreign sales and the percentage of foreign assets, *DebtMaturity* is the ratio of long-term debt (due in more than one year) to total debt, and *GrossProfitMargin* is the average gross profit margin over three years. *PreferredStock* is the ratio of preferred stock to the market value of the firm (market capitalization plus preferred stock plus total debt), *NegativeBookEquity* is a dummy variable with value one if the book value of common equity is negative (and zero otherwise), and *IndustryMedianLeverage* is the industry median book leverage at the four-digit SIC level. The set of exogenous variables is motivated by theoretical and empirical research in the

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contributions are made, which reduces their present value (though there are some tax-effective means of prefunding retirees' medical plans). Consequently, these results are to be taken with a grain of salt.

literature as well economic intuition. The literature suggests, for instance, that riskier firms choose lower leverage ratios (Berk et al., 2009). Other variables, such as firm size, the average tax rate, and the extent of tangible assets are included as controls. Table A3 in the Appendix shows correlations between all variables.

Table 4 shows results for alternative techniques of estimating the leverage equation and for different samples. In particular, the results in columns (1) to (4) are based on regressions using country, industry and year fixed effects, which control for possible differences across countries, industries and time with regards to regulation, disclosure and recognition, priority in bankruptcy, guarantees of post-retirement plans, etc., where industries are defined at the 4-digit SIC code level. The standard errors are clustered by country to account for possible dependence of observations within countries (Petersen, 2009). The results in Panel A show that the size of post-retirement obligations is negatively related to regular leverage, indicating that firms with larger pension and health care plans take out less regular debt (controlling for other determinants of leverage).

The coefficient of -0.218 indicates that the two sources of leverage are far from being perfect substitutes (which would imply a coefficient of -1): For every dollar in post-retirement obligations, firms have on average only 22 cents less in regular debt (or 11% for the average size of post-retirement obligation). In order to ensure that the results for the full sample are not driven by a few countries with many observations, columns (2)-(4) estimate the same specification as in column (1) excluding the United States, Japan and the United Kingdom. Results without these countries are similar if not stronger compared to the full sample.

Lemmon et al. (2008) show that most of the variation in leverage ratios is time invariant and largely unexplained by previously identified determinants. To this end, specification (5) estimates a regression with firm and year fixed effects to control for this unobserved heterogeneity in leverage. Similar to results in Lemmon et al. (2008), the fixed effects tend to reduce the magnitude of most determinants of leverage, even though most regression coefficients remain highly significant. However, the coefficient on post-retirement obligations drops only slightly to -0.155 (and remains highly significant), which is in contrast to Lemmon et al. (2008) who find that the coefficients of traditional determinants of leverage decline on average by approximately 60-80%.

In order to address potential concerns about selection bias, a treatment effects model is estimated using the following selection equation (probit):

$$\begin{aligned}
Post\ RetirementBenefitPlan = & b_0 + b_1LogEmployees + b_2MarketToBook + b_3Tangible.Assets + b_4ROA \\
& + b_5ROAVolatility + b_6Unionization + b_7EmployeeTenure + \varepsilon
\end{aligned} \tag{2}$$

where *PostRetirementBenefitPlan* is a dummy variable with value 1 if the firm has a defined benefit plan, and zero otherwise, and *LogEmployees* is the natural logarithm of the number of employees. *Unionization* is the ratio of wage and salary earners that are trade union members divided by the total number of wage and salary earners, and *EmployeeTenure* is the average employee tenure for dependent employment. The adoption of a defined benefit plan is likely positively related to the number of employees (due to economies of scale) and firm profitability, but negatively related to growth opportunities and the volatility of profits. Unionization and employee tenure are also likely to have positive coefficients due to the negotiating power of an organized labor force regarding the adoption of a pension plan and employee retention (Shivdasani and Stefanescu, 2010). As is evident from column (6) in Panel A of Table 4, controlling for self-selection via the inverse Mills ratio yields a coefficient on post-retirement obligations of -0.211 that is slightly smaller compared to results without this correction, but overall of similar economic and statistical significance.<sup>16</sup>

The results so far show that consolidating the assets and liabilities of post-retirement plans increases the leverage of plan sponsors, while at the same time firms with a post-retirement benefit plan have less regular leverage. Thus, in order to assess the net effect of considering post-retirement plans for leverage, I estimate equation (1) using consolidated leverage as a dependent variable and replacing *PBO* with *PostRetirementBenefitPlan* as an explanatory variable. The coefficient on this dummy variable is a measure of the difference in consolidated leverage of firms sponsoring a post-retirement plan compared to otherwise similar firms without such a plan. Results using country, industry and year fixed effects and clustering standard errors by country in column (1) of Panel B of Table 4 show that post-retirement plans lead on average to a statistically and economically significant increase in consolidated leverage of 6% of total assets or 23% of average leverage when comparing plan sponsors with non-sponsors controlling for other firm characteristics. While there is some variation of the size of the effect across subsamples, there is no clear pattern of the effect of excluding countries with many firms. The inclusion of firm-fixed effects reduces the size of the coefficient to 4.9% of total assets, but has no effect on its statistical significance. Results controlling for self-selection are slightly smaller

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<sup>16</sup> Diagnostic tests suggest that controlling for self-selection is important. The results are robust to using selectivity adjusted pension obligations.

(6.0%), but still economically and statistically significant. This is an important finding that provides the bottom line of the role of post-retirement plans for corporate leverage: Plan sponsors have higher leverage after consolidating defined benefit plans, and while they use less regular debt, they do end up with higher total leverage compared to firms without post-retirement plans.

The role of post-retirement benefit plans and traditional firm characteristics as determinants of leverage is further investigated by conducting a variance decomposition of book leverage. Following Lemmon et al. (2008), several different models are estimated that include combinations of firm, country, industry and year fixed effects as well as various firm characteristics as determinants of leverage. For each model, Table 5 reports fractions of the total Type III partial sum of squares attributable to particular effects (e.g., firm, country, industry, year, size, market-to-book, etc.). The last row of the table reports the adjusted  $R^2$ . In line with their findings, firm-specific effects alone capture 81% of the variation in book leverage (model (1)), while time effects capture 1% of the variation (model (2)). Thus, the majority of the total variation in capital structure is due to time invariant factors. Column (4) shows that traditional determinants of capital structure (including country, industry and year fixed effects) yield an adjusted  $R^2$  of 0.352. The  $R^2$  increases to 0.843 when adding firm fixed effects in column (5). Models (6) and (7) add post-retirement obligations to models (4) and (5), and the  $R^2$  rises to 0.364 and 0.844, respectively. Thus, defined benefit obligations account for about 2.5%  $(0.364 - 0.352) / (0.843 - 0.352)$  of the firm fixed effect, implying that post-retirement benefits may be one of the time-invariant factors identified by Lemmon et al. (2008), since they tend to be in place for long periods of time (Shivdasani and Stefanescu, 2010).

#### 5.4.2 *Multivariate Results by Country*

While the pooled results are important in themselves, it is interesting to explore possible differences in the role of occupational post-retirement plans for leverage across countries. To this end, the regression models are estimated by country as well as separately for firms in developed and developing countries (defined based on the MSCI classification as of June 2006). While the results in Table 4 control for country (as well as industry and year) fixed effects, the by-country analysis allows investigating the extent to which the direction and strength of the effects conform or differ across countries. The results are shown in Table 6, with separate columns for regular leverage and consolidated leverage. The underlying regression framework is the same multivariate set-up as in Table 4, but the estimation is performed by country, and the table only reports the coefficients and associated  $p$ -values of *PBO* for regular leverage and of *PostRetirementPlan* for consolidated leverage.

The results in the first column of Table 6 show that the effect of post-retirement obligations on regular leverage is negative in all but one country. At the same time, the size of the effect varies significantly across countries. In some countries, such as Taiwan (-1.170), Austria (-0.903), Hong Kong (-0.870), Malaysia (-0.798), India (-0.687) and Indonesia (-0.657), post-retirement obligations are effectively perfect substitutes for regular debt since the coefficient estimates are not significantly different from -1. In contrast, the effect is small and not significantly different from zero in other countries, such as Norway (-0.138), Switzerland (-0.103), Canada (-0.054), Finland (-0.011) and Denmark (0.915), suggesting that there is no substitution effect between PBO and regular debt in these countries. The coefficient of -0.243 for the United States is of a similar order of magnitude as the estimate of -0.36 that Shivdasani and Stefanescu (2010) obtain for just pension obligations of their sample of U.S. firms in an earlier period. The effect is significant in both developed and developing countries, but fifty percent larger in the latter.

While the results in Panel B of Table 4 show that firms with post-retirement plans have on average higher consolidated leverage, the results in Table 6 show that there is significant variation underlying this average: In 8 out of 20 countries, plan sponsors have significantly higher consolidated leverage, while the effect is insignificant otherwise. In countries where sponsors have significantly higher consolidated leverage, such as the United Kingdom, Switzerland and the Netherlands, consolidating defined benefit plans leads to large increases in leverage due to the high popularity of defined benefit schemes and large post-retirement obligations in these countries. In contrast, while there is a significant substitution effect between regular leverage and post-retirement obligations, the degree of substitution is too low, resulting in the average plan sponsor ending up with up to 57% (e.g. in the UK) higher leverage than non-sponsors.

While countries, where the indicator variable of having a defined benefit plan is insignificant, are not entirely homogenous with regards to plan characteristics, they tend to have smaller obligations and higher substitution rates (they are not significantly different from -1 in five countries). In fact, the coefficients from the columns for regular leverage and consolidated leverage in Table 6 are positively correlated, i.e. consolidated leverage of plan sponsors is larger in countries with lower rates of substitution. This combination of modest plan size and high rates of substitution yields an effective leverage for plan sponsors no different from that of non-sponsors. These relationships are also borne out when comparing countries by degree of development: Developing countries have smaller, less frequent plans, and firms reduce their regular leverage by more for every dollar of post-retirement obligation.

As a result, the difference in effective leverage between firms with and without defined benefit plans is insignificant in these countries.

Figure 3 shows international evidence on the variance decomposition of leverage. In particular, it is based on model (7) in Table 5 and shows the percentage of the total Type III partial sum of squares for a particular effect in the model. For expositional clarity, the graph omits the percentage of firm fixed effects, since they account for the lion's share of the effect. The figure shows that the importance of individual firm characteristics varies significantly across countries. To illustrate, negative book equity is particularly important in France, Hong Kong, the Netherlands, South Africa, the United Kingdom and United States, while firm size explains more variation in leverage in Australia, Canada, Germany, India, Indonesia and Malaysia. Book-to-Market and tangible assets account for higher percentages in Norway and Finland, respectively, and year fixed effects are particularly large in Canada, Finland, Japan, Switzerland and Taiwan. At the same time, despite this international heterogeneity, firm fixed effects account for at least 84% of the variation in leverage, suggesting that most of the variation in capital structure across countries arises from time-invariant factors rather than temporal variation in capital structure determinants.

#### *5.4.3 Substitution Rates and Country Characteristics*

In order to investigate which country characteristics are systematically related to the extent of substitution, Table 7 estimates substitution rates for firms in countries with high and low values for various country characteristics. In particular, a dummy variable is created for each country characteristic that indicates whether the country is above or below the median in a particular year for that characteristics. This indicator variable is then interacted with projected benefit obligations (PBO/Total Assets) to estimate the difference in the substitution rate for firms in countries with high country characteristic. All regressions include the same firm-level variables as in Panel A of Table 4. The first column stacks results from fourteen regressions using one country variable and its interaction with projected benefit obligations at a time, while columns two to eight show results from regressions with combinations of several country characteristics. Country variables are selected to capture different characteristics, but also to ensure good coverage across specifications.

The results show that the substitution rates are significantly larger for firms in countries where corporate income tax rates are high, as predicted given the larger tax incentives for post-retirement obligations compared to regular debt. These results are robust to different sources and measurements of corporate tax rates (e.g. top marginal statutory rate, effective average/marginal tax rate).

Whitehouse (2005) classifies countries into four groups based on the generosity of the tax treatment of pensions, considering the taxation of contributions to the fund, of investment income and capital gains that accrue to the fund, and of benefit distributions to retired plan members. This variable is not significant, which might reflect the challenges of assessing the incentive effects of taxation on pensions given the diversity of taxes, allowances and deductions. Moreover, the calculations consider neither the fact that individuals often face lower taxes in retirement than before, nor the sensitivity of the tax burden to inflation (Whitehouse, 2005). Similarly, it is difficult to assess the effective limits on the tax deductibility of contributions to post-retirement plans and the extent to which they are binding.

The table also shows results for a number of proxies related to expected bankruptcy costs and the role of DB plans in financial distress of the plan sponsor. Based on the classifications by Secunda (2014) and Stewart (2007a), countries are classified according to whether they have a pension guarantee scheme and the priority they award to unfunded pension liabilities. However, neither variable is important empirically, and in only one specification there is (marginal) evidence of substitution rates being lower in countries with a higher priority of pension claims in default. Variables measuring creditor rights (from Djankov et al., 2007), rule of law (from the WGI database), and law and order (PRS Group) are used to characterize the legal environment of firms. The signs of the coefficients on all three variables are negative. Rule of law is significant, with an economically large coefficient between -0.15 and -0.19 across specifications. Thus, the rates of substitution between regular debt and post-retirement obligations are much larger in an environment with a high quality of contract enforcement, where post-retirement claims may be easier to enforce and thus lenders less willing to provide funds to companies with significant post-retirement liabilities. This could be the case because post-retirement claims may generally be harder to pursue, and thus they may particularly benefit from a legal environment that is supportive of contract enforcement.

The availability of external capital is captured by the size of private credit and the private bond market (Beck and Demirgüç-Kunt, 2009). As hypothesized, the coefficients on both variables are positive (and marginally significant), since lower substitution rates mean that firms rely more on regular debt for leverage, and consequently are associated with larger private bond market capitalization and private credit. The effect of private credit on substitution rates (0.106) is about fifty percent larger than that of the private bond market (0.073).

Variables characterizing the labor market are indices capturing the degree of labor market flexibility (from Lawson and Bierhanzl, 2004), several dimensions of employment protection against

dismissal (OECD), several measures of protection of labor and employment laws (Botero et al., 2004), and the degree of unionization (Botero et al., 2004). Firms in countries with lower labor market freedom, stronger employment protection, stricter employment laws and higher union density have significantly higher substitution rates, as employees are better protected. The coefficient on labor market freedom is largest in economic magnitude (0.115), followed by that on employment protection (-0.114). Finally, the results show that substitution rates are lower in countries with large pension fund assets (as measured by the OECD), i.e. better funding, *ceteris paribus*.

Specifications (2) to (8) employ combinations of country characteristics to assess their relative economic magnitude side-by-side. The specifications include variables that are important in the regressions with one country variable and that capture different economic aspects. The signs of significant variables are very consistent across specifications. Overall, rule of law has the largest impact on the substitution rate, with statistically significant and economically large coefficients in all specifications, followed by labor market freedom and taxes. Supply of external capital is also significant in several specifications and in these cases economically large. In contrast, there is little evidence that a pension guarantee or priority in bankruptcy is important for the substitution rates between regular debt and post-retirement obligations, which might be the result of frequent deviations from priority and significant cuts in guaranteed benefits.

## **5.5 Robustness Tests**

The results in my paper are robust to a number of variations to methodology and data. In particular, the results are robust to splitting the sample by industry, into quintiles by the size of the post-retirement obligations or alternatively the funding level (both scaled by total assets). The results are also unaffected by limiting the sample to U.S. GAAP or IAS compliant firms, by employing various fixed effects (e.g. for accounting standards and year) to control for potential differences across accounting standards and time, and/or by analyzing different time periods (such as the subperiods before and after 2006). They are also robust to constraining the analysis to the sub-sample of firms for which subsidiaries of any type are consolidated, to exclude the possibility of firms hiding debt in unconsolidated subsidiaries, and they can be replicated for U.S. firms using data from CRSP and Compustat. Moreover, the analysis tries to avoid omitted-variable biases by including large sets of control variables, but the results also hold for larger samples that result from relaxing the restrictions on data availability. Details on these and a number of other robustness tests are provided in the Appendix.

## 6 Conclusion

This paper is the first international study of occupational defined benefit plans. It shows that post-retirement benefit plans play an economically important role for the financial leverage of non-financial corporations around the world. The analysis shows that consolidated leverage ratios are on average 20-70% higher than regular leverage ratios. While firms with large post-retirement obligations typically have lower regular leverage, the substitution is imperfect, so that firms with post-retirement plans end up with around 23% higher consolidated leverage than similar firms that do not sponsor such plans. However, consolidating defined benefit plans has no effect on leverage for firms in about half the sample countries, and the extent to which firms substitute regular debt with projected benefit obligations varies between 0% and 100% across countries. Overall, plan sponsors are left with higher consolidated leverage, in some cases by 40%-60%, compared to otherwise similar firms without a defined benefit plan. Moreover, contributions to defined benefit plans are sizable and provide plan sponsors with significant tax shield benefits that are as large as a third of the tax shield offered by interest expenses.

Across countries, substitution rates between regular debt and post-retirement obligations vary as a function of tax incentives and bankruptcy costs. The most important driver of substitution rates is rule of law, followed by labor market freedom and taxes, where countries with a better rule of law, less labor market freedom (as well as stricter employment law, better employment protection, higher union density), and higher marginal corporate tax rates show higher substitution rates. In contrast, pension guarantee schemes and the priority of unfunded pension liabilities in bankruptcy are less important. These differences illustrate that it is important to consider post-retirement benefit arrangements across countries in order to understand capital structure internationally. At the same time, despite this international heterogeneity, the majority of variation in leverage across countries appears to be driven by unobserved time-invariant effects, suggesting that empirical models of capital structure remain a fruitful area for future research.

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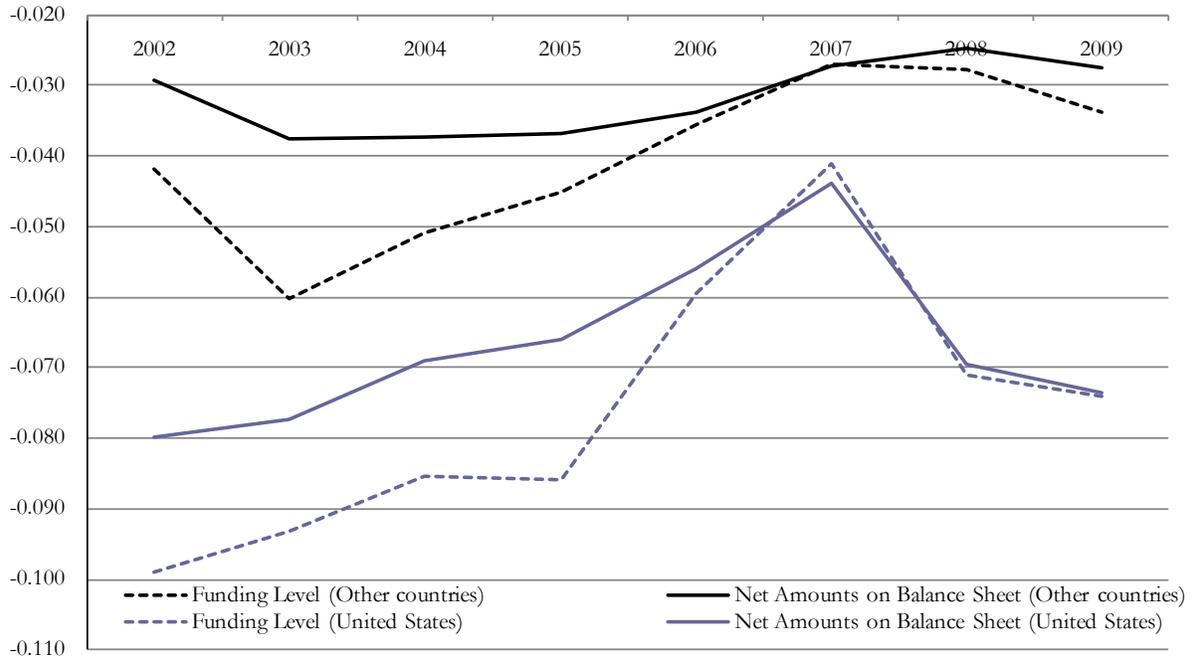
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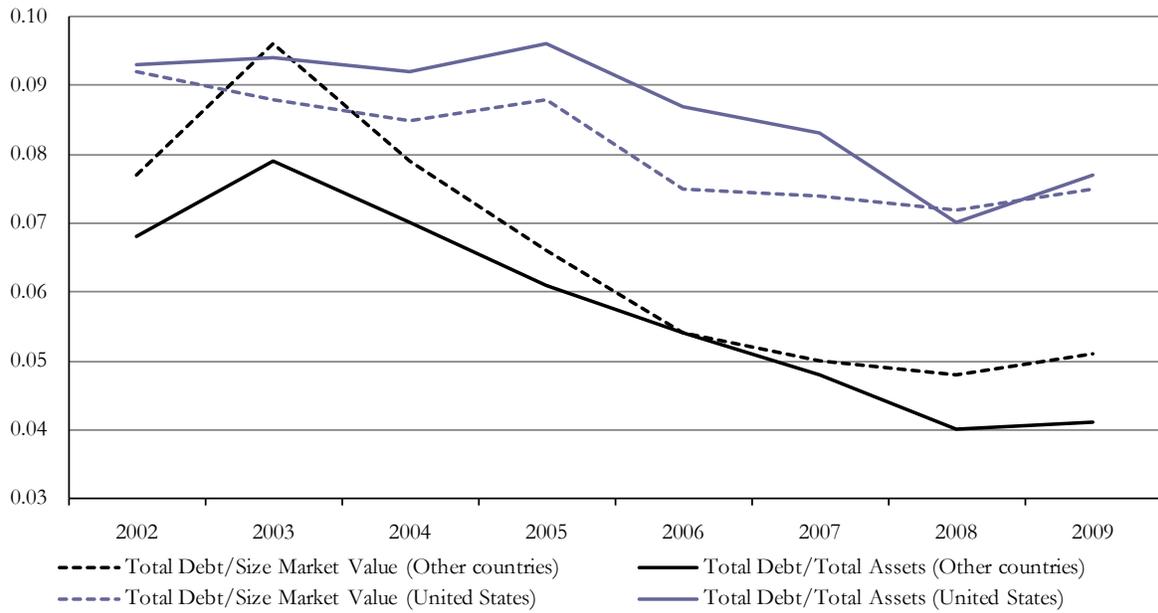
**Figure 1: Funding Level and Recognition on the Balance Sheet**

The figure shows the average funding level and recognition of net pension liabilities on the balance sheet for the period 2002-2009. The funding level is calculated as the difference between fair value of plan assets and projected benefit obligation of pension and health care benefits, scaled by total assets. It is shown as dotted lines. The amount recognized on the balance sheet is prepaid post-retirement costs (including intangible pension asset where applicable) minus accrued post-retirement costs (including additional minimum liabilities where applicable), scaled by total assets. It is shown as solid lines. Results are shown by year and separately for U.S. firms (blue lines) and firms in countries other than the United States (black lines).



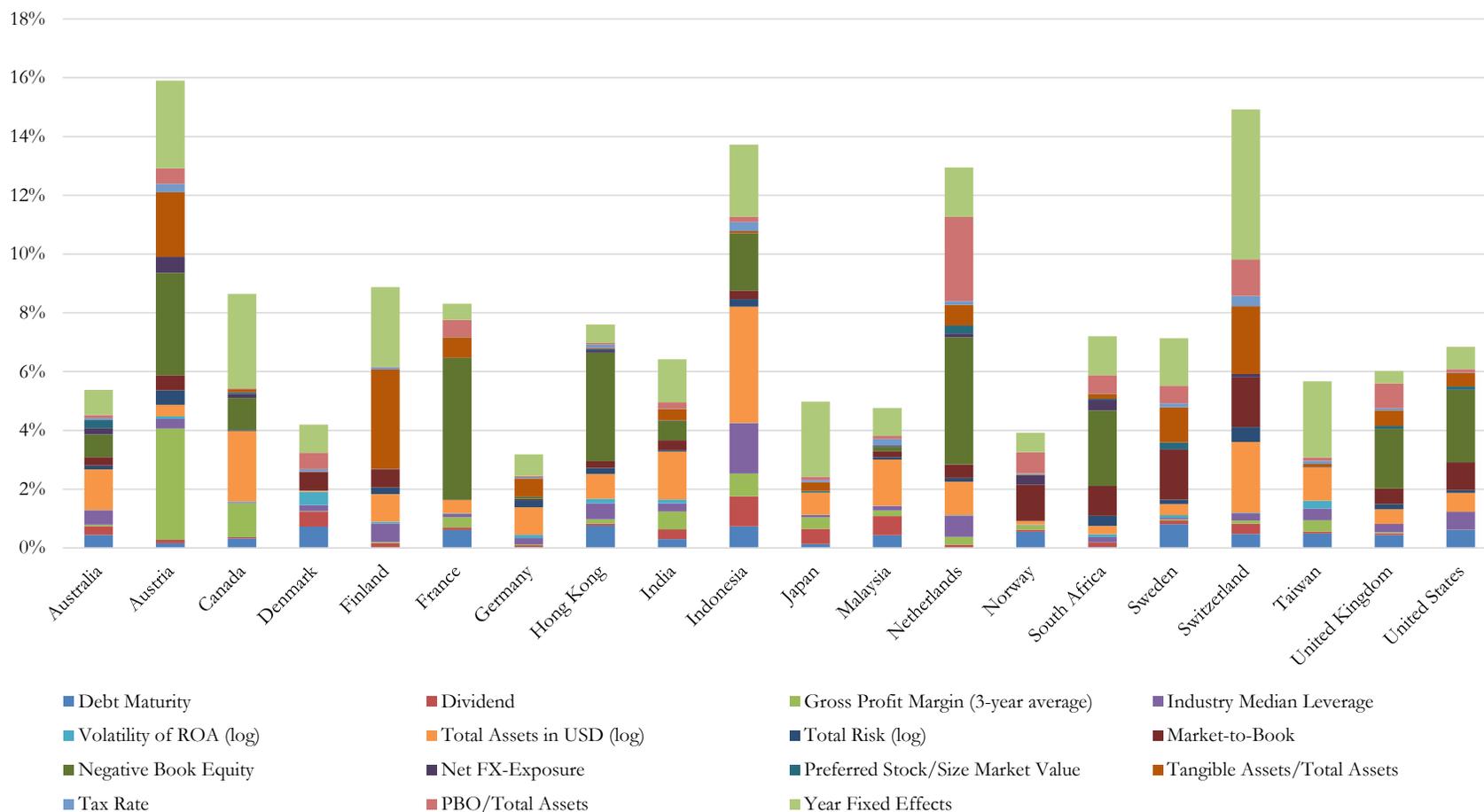
**Figure 2: Differences Between Consolidated and Regular Leverage**

The figure shows the differences between consolidated leverage and regular leverage by year for the period 2002-2009. Leverage is calculated as Total Debt divided by Size Market Value (the sum of total debt, preferred stock, and market value of equity) (dotted lines) and Total Debt divided by Total Assets (solid lines), respectively. For all firms with post-retirement benefits, consolidated leverage ratios are calculated by subtracting accrued post-retirement costs (including additional minimum liabilities where applicable) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (including intangible pension asset where applicable) from size and adding fair value of plan assets. The figure shows the difference in mean values of consolidated and regular leverage. Results are shown by year and separately for U.S. firms (blue lines) and firms in countries other than the United States (black lines).



### Figure 3: Variance Decomposition By Country

The figure shows the variance decomposition of book leverage by country. The methodology follows Lemmon, Roberts, and Zender (2008) and calculates the Type III partial sum of squares for each effect in the model and then normalizes each estimate by the sum across effects. The figure shows the fractions for all effects except for firm fixed effects, which account for the remainder (i.e. the difference between the sum of the effects shown in the graph and 100%). Definitions of all variables are provided in Supplemental Appendix B.



### **Table 1: Importance and Characteristics of Post-Retirement Benefit Plans**

The table shows averages of the importance and further characteristics of post-retirement benefit plans. Panel A shows results by country, separately for firms in developed and developing countries (defined based on the MSCI classification as of June 2006), as well as for firms in all countries. In particular, it shows the number of firms, the percentage of firms with defined benefit post-retirement benefit plan, pension plan and health care plan, as well as the ratios of projected benefit obligations (PBO) to total assets, the plan funding level to total assets, and the net recognition of post-retirement benefit plans on the balance sheet to total assets. It also shows the discount rate and the expected return on plan assets as well as the percentage of plan assets invested in equities, bonds, property or other assets. The funding level is calculated as the difference between fair value of plan assets and projected benefit obligations of pension and health care benefits, scaled by total assets. The amounts recognized on the balance sheet are prepaid post-retirement costs (including intangible pension asset where applicable) minus accrued post-retirement costs (including additional minimum liabilities where applicable), scaled by total assets. Averages are calculated by country (or by degree of development, or for all firms), first averaging across firms, then across years. The observations are sorted in descending order by the relative frequency of defined benefit post-retirement benefit plans. Panel B shows statistics on the same measures by industry based on 48 Fama/French industries. Averages are calculated by industry, first averaging across firms, then across years. The observations are sorted in descending order by the relative frequency of defined benefit post-retirement benefit plans. Panel C shows statistics by year. Averages are calculated separately for U.S. and non-U.S. firms, first averaging across firms by country and year, then across countries. Definitions of all variables are provided in Supplemental Appendix B.

*(continued)*

**Table 1: Importance and Characteristics of Post-Retirement Benefit Plans (continued)**

**Panel A: Results by Country**

	Number of Firms	Percentage of Firms			PBO/Total Assets	Funding Level/ Total Assets	Net Amounts on Balance Sheet/ Total Assets	Discount Rate (%)	Expected Return on Plan Assets (%)	Asset Allocation (%)			
		Post-Retirement Benefit Plan	Pension Plan	Health Care Plan						Equities	Bonds	Property	Other
Switzerland	173	61.9	61.7	6.5	0.206	-0.032	-0.026	3.9	4.5	31.5	42.6	11.2	14.7
Austria	56	57.6	57.6	0.3	0.069	-0.052	-0.036	5.0	5.2	32.2	45.1	5.1	17.6
Ireland	46	54.4	54.4	4.4	0.167	-0.050	-0.033	5.3	5.7	61.5	26.6	4.9	7.0
Mexico	104	48.1	48.1	1.5	0.074	-0.017	-0.009	5.6	6.5	46.3	40.0	0.0	13.6
Philippines	122	45.0	45.0	0.0	0.026	-0.012	-0.011	10.1	8.8	33.7	33.0	4.1	29.1
Netherlands	121	42.7	42.7	7.3	0.220	-0.053	-0.046	5.3	6.2	41.8	46.2	4.8	7.2
Taiwan, Province Of China	1,396	38.5	38.5	0.0	0.022	-0.014	-0.011	3.2	3.0				
Pakistan	98	38.2	35.2	10.8	0.048	-0.007	-0.014	9.8	9.5	15.0	57.6	0.0	27.3
Luxembourg	8	38.0	38.0	2.6	0.038	-0.037	-0.038	5.9	4.4	61.0	36.2	0.0	2.8
Japan	3,601	37.6	37.6	0.0	0.098	-0.051	-0.040	2.3	2.5	44.0	31.4	0.3	24.3
Norway	190	36.5	36.5	0.6	0.065	-0.028	-0.018	5.1	6.1	28.4	51.5	10.1	10.0
Germany	691	29.3	29.3	1.5	0.099	-0.072	-0.068	5.2	5.4	40.0	40.6	5.6	13.8
Finland	114	29.0	29.0	4.6	0.088	-0.023	-0.018	5.1	5.5	40.3	43.7	6.0	10.0
Belgium	104	28.1	28.1	3.5	0.116	-0.045	-0.046	5.2	5.4	33.4	27.1	1.0	38.4
Indonesia	261	27.5	27.4	0.4	0.026	-0.021	-0.020	10.4	9.6				
United Kingdom	1,543	26.1	26.1	2.0	0.273	-0.079	-0.053	5.6	6.0	57.6	30.8	2.0	9.6
France	672	22.9	22.9	3.7	0.059	-0.029	-0.029	4.9	5.7	43.7	44.6	2.5	9.3
United States	4,899	21.1	20.0	13.7	0.153	-0.076	-0.067	6.0	7.8	58.3	32.2	1.7	7.8
Greece	256	20.9	20.9	0.7	0.018	-0.014	-0.012	4.9	4.5	54.9	26.5	6.1	12.5
Russian Federation	90	18.8	18.8	0.1	0.019	-0.018	-0.013	8.6	9.1	21.1	34.9	0.0	44.0
Portugal	49	17.7	17.7	5.6	0.063	-0.032	-0.033	5.0	4.9	27.9	51.9	9.1	11.0
Denmark	117	17.5	17.5	0.9	0.048	-0.011	-0.014	5.1	5.8	36.3	45.7	7.8	10.2
Sweden	345	17.3	17.3	1.1	0.105	-0.041	-0.031	4.9	5.7	43.3	43.6	2.7	10.5
South Africa	270	17.1	13.7	9.4	0.092	0.002	-0.015	8.9	8.8	52.6	25.7	1.7	20.1
India	1,236	13.1	13.0	0.7	0.023	-0.010	-0.012	6.9	7.0	8.0	45.2	0.3	46.5
Brazil	233	12.6	12.3	5.2	0.096	-0.016	-0.020	9.6	9.7	32.1	62.3	4.0	1.6
Canada	1,195	12.5	12.1	7.3	0.102	-0.033	-0.018	5.9	7.0	55.8	36.0	1.4	6.7
Israel	72	11.3	10.6	1.7	0.038	-0.010	-0.023	4.9	5.9	50.8	44.2	0.0	5.0
Iceland	8	10.7	10.7	0.0	0.077	-0.001	-0.001	5.6	7.0	74.0	17.9	5.9	2.1
Italy	206	9.8	9.8	2.0	0.049	-0.030	-0.028	4.9	7.0	51.6	31.2	2.0	15.3
Sri Lanka	19	9.5	9.5	0.0	0.014	-0.012	-0.011	11.0	9.0				
Malaysia	818	8.2	8.2	0.0	0.016	-0.013	-0.012	6.6	5.6				
Spain	100	7.1	7.1	0.0	0.021	-0.009	-0.009	7.7	6.7	40.6	26.1	16.6	16.7
Slovakia	11	6.8	6.8	0.0	0.003	-0.003	-0.003	6.3					
Hong Kong	847	4.8	4.8	0.3	0.044	-0.006	-0.008	4.6	5.6	63.0	18.9	0.3	17.8
Argentina	53	4.5	4.5	0.2	0.006	-0.004	-0.004	7.0	5.9	70.0	30.0	0.0	0.0
Venezuela	16	3.8	3.8	3.8	0.334	-0.239	-0.179	8.1	7.1	28.4	42.7	0.0	28.9
Australia	1,318	3.7	3.7	0.1	0.053	-0.005	-0.010	5.6	6.7	57.7	24.2	5.5	12.7
Morocco	15	3.3	3.3	2.4	0.013	-0.013	-0.018	4.8					
Turkey	176	3.0	3.0	0.0	0.015	-0.014	-0.013	7.2	7.1				
New Zealand	97	2.7	2.7	0.0	0.082	0.003	-0.011	4.8	5.7	42.6	27.7	8.7	21.1
Qatar	15	1.6	1.6	1.6	0.005	-0.002	-0.007	11.4	6.0				
Singapore	588	1.4	1.4	0.1	0.029	-0.009	-0.015	7.6	6.4	35.7	47.0	3.7	13.7
Peru	50	1.2	1.2	1.0	0.053	-0.020	-0.019	5.7	8.8	53.0	46.3	0.0	0.8
Kuwait	53	1.1	1.1	0.0	0.043	-0.010	-0.011	5.0	5.9				
Hungary	26	1.0	1.0	0.0	0.010	-0.010	-0.006	5.6					
Thailand	401	0.5	0.5	0.0	0.015	-0.015	-0.015	6.0					
Poland	240	0.2	0.2	0.0	0.014	-0.005	-0.005	5.3	3.5				
Korea, Republic Of	986	0.1	0.1	0.0	0.014	-0.002	-0.002	6.8	5.0				
China	1,249	0.0	0.0	0.0	0.001	-0.001	-0.001						
Developed countries	17,343	22.5	22.2	5.0	0.132	-0.056	-0.046	4.5	5.3	54.8	33.3	2.5	9.4
Developing countries	8,253	13.9	13.8	0.8	0.029	-0.014	-0.012	5.5	4.7	32.3	35.8	1.5	30.4
All countries	25,596	19.7	19.5	3.6	0.109	-0.047	-0.038	4.8	5.2	53.5	33.1	2.4	11.0

(continued)

**Table 1: Importance of Post-Retirement Benefit Plans (continued)**

**Panel B: Results by Industry**

	Number of Firms	Percentage of Firms				PBO/Total Assets	Funding Level/ Total Assets	Net Amounts on Balance Sheet/ Total Assets	Discount Rate (%)	Expected Return on Plan Assets (%)	Asset Allocation (%)			
		Retirement Benefit Plan	Pension Plan	Health Care Plan							Equities	Bonds	Property	Other
Aircraft	72	45.2	44.5	19.3	0.226	-0.098	-0.075	5.7	7.2	58.9	29.5	2.3	9.3	
Tobacco Products	31	44.3	43.1	22.5	0.181	-0.055	-0.050	6.2	7.3	48.3	35.5	2.2	14.0	
Shipping Containers	103	32.6	32.3	13.2	0.164	-0.063	-0.051	5.4	6.0	55.0	33.8	1.4	9.8	
Candy & Soda	140	32.2	30.9	9.5	0.135	-0.050	-0.037	5.3	6.0	60.2	29.3	2.0	8.5	
Automobiles	567	30.5	30.1	6.9	0.140	-0.075	-0.060	4.6	5.1	52.8	36.2	2.1	8.9	
Business Supplies	363	29.9	29.7	8.7	0.142	-0.059	-0.045	5.2	5.7	52.9	34.3	1.8	11.0	
Books	232	29.2	28.4	10.1	0.145	-0.047	-0.036	5.3	6.3	55.4	32.0	2.4	10.1	
Machinery	975	28.1	27.7	6.7	0.148	-0.071	-0.055	4.5	5.1	51.0	35.8	2.7	10.4	
Defense	22	27.6	27.6	11.1	0.343	-0.105	-0.080	5.4	7.3	53.6	33.3	3.4	9.7	
Transportation	881	26.7	26.3	5.3	0.119	-0.051	-0.039	5.0	5.6	53.7	34.1	3.9	8.3	
Chemicals	931	26.3	26.0	6.2	0.127	-0.054	-0.044	4.8	5.4	52.4	32.7	2.1	12.8	
Steel	773	26.3	26.2	5.0	0.120	-0.052	-0.041	4.9	5.2	52.3	35.6	2.7	9.4	
Construction	804	25.7	25.4	1.0	0.107	-0.044	-0.035	4.0	4.0	53.2	33.8	2.3	10.8	
Rubber	274	25.3	24.3	4.5	0.141	-0.064	-0.049	4.2	4.5	57.0	33.0	1.2	8.7	
Beer & Liquor	155	25.2	25.0	4.7	0.104	-0.039	-0.027	5.3	6.0	54.4	29.7	3.4	12.5	
Consumer Goods	526	23.9	23.7	4.2	0.158	-0.069	-0.056	4.9	5.4	51.1	34.0	2.3	12.6	
Retail	1,230	23.5	22.9	3.4	0.080	-0.028	-0.025	4.5	5.0	56.6	32.0	2.4	9.0	
Construction Materials	918	23.3	22.9	4.7	0.117	-0.051	-0.040	5.3	5.6	55.0	31.6	2.2	11.2	
Food Products	709	23.2	23.0	4.8	0.117	-0.049	-0.038	5.2	5.6	55.0	30.2	2.7	12.1	
Electrical Equipment	428	23.1	22.9	4.0	0.140	-0.065	-0.053	4.3	4.8	54.2	31.5	1.9	12.4	
Measuring and Control Equipment	318	22.8	22.5	3.8	0.139	-0.055	-0.045	4.3	4.9	46.2	36.3	3.1	14.4	
Telecom	721	22.6	22.1	6.6	0.096	-0.035	-0.028	6.0	6.9	53.3	35.1	2.9	8.6	
Electronic Equipment	1,630	21.9	21.8	1.8	0.075	-0.032	-0.027	3.8	3.9	52.5	33.0	2.9	11.7	
Fabricated Products	136	21.6	21.6	5.6	0.120	-0.057	-0.046	5.0	5.6	52.7	30.2	3.4	13.7	
Ships	73	21.2	21.2	4.6	0.126	-0.063	-0.042	5.0	6.2	56.6	30.6	1.4	11.4	
Wholesale	1,709	21.0	20.7	2.5	0.087	-0.031	-0.026	4.4	4.6	55.7	31.4	2.2	10.8	
Recreation	226	20.8	20.8	3.0	0.092	-0.045	-0.037	4.1	4.8	54.2	33.8	2.3	9.7	
Apparel	257	19.9	19.9	2.1	0.132	-0.044	-0.039	4.8	5.3	55.0	29.2	2.4	13.4	
Restaurants	494	19.3	18.9	2.6	0.070	-0.023	-0.022	4.9	5.4	53.6	31.5	1.7	13.2	
Textiles	509	18.9	18.8	1.2	0.082	-0.043	-0.036	4.9	4.5	48.2	34.3	0.9	16.6	
Coal	97	18.9	18.0	7.7	0.184	-0.110	-0.106	6.5	7.3	65.1	27.0	1.2	6.7	
Computers	803	18.8	18.8	1.7	0.087	-0.041	-0.032	3.7	3.8	55.3	30.3	2.4	12.1	
Medical Equipment	393	16.7	16.4	4.5	0.094	-0.035	-0.030	4.7	5.3	49.9	33.0	3.2	13.9	
Oil	875	15.1	14.9	6.5	0.064	-0.029	-0.026	5.9	7.0	53.4	34.2	2.3	10.0	
Personal Services	256	12.9	12.9	0.4	0.094	-0.043	-0.040	4.7	6.1	57.3	27.1	0.1	15.5	
Drugs	948	12.7	12.4	3.0	0.101	-0.044	-0.035	4.7	5.2	47.7	35.0	3.1	14.2	
Entertainment	460	12.6	12.5	0.9	0.036	-0.010	-0.013	4.7	4.9	58.3	27.9	1.3	12.5	
Agriculture	272	12.2	12.0	1.1	0.079	-0.023	-0.024	6.1	5.6	52.8	34.1	2.1	11.1	
Miscellaneous	154	11.7	11.2	1.5	0.100	-0.038	-0.037	4.2	4.6	52.5	33.4	0.8	13.3	
Business Services	3,318	11.6	11.4	1.5	0.111	-0.044	-0.038	4.8	5.2	54.5	32.8	2.4	10.2	
Real Estate	194	10.8	10.8	0.0	0.041	-0.019	-0.020	5.3	4.8	42.5	46.7	0.0	10.8	
Healthcare	268	9.2	9.1	0.7	0.061	-0.026	-0.025	5.2	6.1	57.9	25.5	3.0	13.6	
Mines	642	7.4	6.9	3.2	0.092	-0.033	-0.028	6.2	6.9	51.6	32.9	2.0	13.5	
Trading	197	4.8	4.8	0.5	0.182	-0.027	-0.021	6.8	6.5	27.4	57.0	1.9	13.7	
Precious Metals	515	2.5	2.1	1.3	0.025	-0.011	-0.011	7.0	7.5	46.9	44.7	0.6	7.9	

(continued)

**Table 1: Importance and Characteristics of Post-Retirement Benefit Plans (continued)**

		<b>Panel C: Results by Year</b>							
		2002	2003	2004	2005	2006	2007	2008	2009
Post-Retirement Plan (% of firms)	Non-U.S.	5.2	8.4	11.9	18.5	20.1	21.1	23.7	25.3
	United States	12.5	19.1	21.2	21.4	22.0	22.4	25.0	25.0
Pension Plan (% of firms)	Non-U.S.	5.2	8.3	11.7	18.3	19.9	20.9	23.6	25.2
	United States	11.9	18.1	19.8	20.3	20.8	21.3	23.8	23.9
Health Care Plan (% of firms)	Non-U.S.	0.4	0.9	1.4	2.1	2.2	1.9	2.4	2.6
	United States	8.4	12.2	13.5	14.0	14.5	14.6	16.2	15.9
PBO/Total Assets	Non-U.S.	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05
	United States	0.17	0.16	0.15	0.16	0.15	0.14	0.14	0.15
Funding Level/Total Assets	Non-U.S.	-0.03	-0.04	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02
	United States	-0.10	-0.09	-0.09	-0.09	-0.06	-0.04	-0.07	-0.07
Net Amounts on Balance Sheet/Total Assets	Non-U.S.	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02
	United States	-0.08	-0.08	-0.07	-0.07	-0.06	-0.04	-0.07	-0.07
Discount Rate (%)	Non-U.S.	6.6	6.2	6.0	5.6	5.7	6.1	6.6	6.2
	United States	6.6	6.1	5.9	5.5	5.6	5.9	6.2	5.9
Expected Return on Plan Assets (%)	Non-U.S.	6.8	6.6	6.3	6.2	6.1	6.1	6.4	5.9
	United States	8.5	8.0	7.9	7.8	7.6	7.6	7.5	7.4
Equities (%)	Non-U.S.	44.8	42.3	46.6	47.6	45.2	43.7	34.6	36.6
	United States	57.2	61.6	61.9	61.4	60.9	58.9	51.6	52.5
Bonds (%)	Non-U.S.	44.6	37.6	37.6	37.4	39.4	37.1	39.2	38.3
	United States	32.3	29.8	30.0	30.6	30.4	31.5	36.9	36.4
Property (%)	Non-U.S.	4.7	4.2	3.3	3.3	3.9	3.9	4.9	4.1
	United States	1.7	1.3	1.4	1.4	1.6	1.9	2.2	1.7
Other (%)	Non-U.S.	6.0	15.9	12.5	11.7	11.5	15.4	21.4	21.0
	United States	8.8	7.2	6.8	6.6	7.1	7.7	9.4	9.3
Number of Firms	Non-U.S.	18,356	19,456	20,499	21,020	22,209	22,067	21,390	20,575
	United States	5,389	5,459	5,429	5,329	5,100	4,698	4,004	3,785

**Table 2: Differences between Regular and Consolidated Leverage**

The table shows the results of tests of differences between regular and consolidated leverage for firms with defined benefit post-retirement benefit plans. Panel A shows tests for selected measures of market value leverage, i.e. alternatively total debt, long-term debt plus preferred stock, or long-term debt, divided by Size Market Value (the sum of market capitalization, preferred stock and total debt). It also shows tests for selected measures of book value leverage, which are the same measures of debt as for market value leverage divided by Total Assets. While the top part of Panel A shows gross leverage measures, the bottom part of the panel shows leverage measures where cash and short-term investments (with missing values set to zero) are subtracted from both the numerator and denominator of gross leverage ratios. For consolidated leverage ratios, accrued post-retirement costs (including additional minimum liabilities where applicable) are subtracted from the respective measure of debt, and projected benefit obligations are added. Similarly, prepaid post-retirement costs (including intangible pension asset where applicable) are subtracted from the measure of firm size, and the fair value of plan assets is added. For each measure, the panel shows the number of observations, the mean, median and standard deviation of both consolidated and regular leverage, the difference in means and medians, as well as *p*-values of *t*-tests and Wilcoxon tests. Panel B shows tests of differences between consolidated leverage and regular leverage by country. For each country, the table shows the number of firm/year observations as well as the average difference between consolidated and regular leverage using alternatively total debt, long-term debt plus preferred stock, or long-term debt, divided by alternatively Size Market Value (i.e. the sum of market capitalization, preferred stock and total debt) or Total Assets. The panel also shows significance levels based on non-parametric Wilcoxon tests. \* (\*\*, \*\*\*) denotes significance at the 10% (5%, 1%) significance level. Definitions of all variables are provided in Supplemental Appendix B.

**Panel A: Alternative Measures of Leverage**

	Consolidated Leverage			Regular Leverage			Difference		<i>p</i> -values		
	N	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Means	Medians	<i>t</i> -Test	Wilcoxon
<b>Gross Leverage</b>											
Total Debt/Total Assets	38,387	0.317	0.304	0.190	0.257	0.236	0.184	0.060	0.067	[0.00]	[0.00]
(Long-Term Debt + Preferred Stock)/Total Assets	35,481	0.245	0.210	0.181	0.180	0.144	0.166	0.065	0.066	[0.00]	[0.00]
Long-Term Debt/Total Assets	35,311	0.241	0.208	0.178	0.176	0.142	0.158	0.065	0.066	[0.00]	[0.00]
Total Debt/Size Market Value	37,024	0.367	0.333	0.245	0.302	0.255	0.234	0.065	0.078	[0.00]	[0.00]
(Long-Term Debt + Preferred Stock)/Size Market Value	34,266	0.270	0.228	0.206	0.197	0.154	0.178	0.073	0.073	[0.00]	[0.00]
Long-Term Debt/Size Market Value	34,101	0.267	0.225	0.203	0.193	0.152	0.173	0.073	0.073	[0.00]	[0.00]
<b>Leverage Net of (Cash + Short-Term Investments)</b>											
Total Debt/Total Assets	38,387	0.210	0.238	0.289	0.126	0.158	0.358	0.084	0.079	[0.00]	[0.00]
(Long-Term Debt + Preferred Stock)/Total Assets	35,481	0.137	0.134	0.266	0.050	0.058	0.311	0.087	0.076	[0.00]	[0.00]
Long-Term Debt/Total Assets	35,311	0.133	0.131	0.263	0.046	0.056	0.307	0.088	0.075	[0.00]	[0.00]
Total Debt/Size Market Value	36,830	0.251	0.253	0.350	0.145	0.165	0.457	0.106	0.087	[0.00]	[0.00]
(Long-Term Debt + Preferred Stock)/Size Market Value	34,123	0.146	0.142	0.313	0.029	0.059	0.424	0.116	0.083	[0.00]	[0.00]
Long-Term Debt/Size Market Value	33,958	0.142	0.139	0.310	0.025	0.057	0.421	0.116	0.082	[0.00]	[0.00]

(continued)

**Table 2: Differences between Regular and Consolidated Leverage (continued)**

**Panel B: Results By Country**

Country	N	Consolidated Leverage - Regular Leverage					
		Total Debt/ Size Market Value	(Long-Term Debt + Preferred Stock)/Size Market Value	Long-Term Debt/Size Market Value	Total Debt/ Total Assets	(Long-Term Debt + Preferred Stock)/ Total Assets	Long-Term Debt/Total Assets
Argentina	18	0.004	0.004	0.004	0.003	0.003	0.003
Australia	382	0.027 **	0.027 **	0.028 ***	0.032 ***	0.030 ***	0.030 ***
Austria	244	0.034 *	0.037 **	0.037 **	0.030 **	0.031 ***	0.031 ***
Belgium	231	0.047 **	0.049 ***	0.049 ***	0.043 ***	0.043 ***	0.042 ***
Brazil	225	0.048 **	0.060 ***	0.060 ***	0.053 ***	0.059 ***	0.059 ***
Canada	1,137	0.066 ***	0.072 ***	0.073 ***	0.068 ***	0.071 ***	0.071 ***
Denmark	158	0.019	0.021	0.021	0.021	0.024	0.024
Finland	255	0.044 **	0.052 ***	0.052 ***	0.048 ***	0.054 ***	0.054 ***
France	1,161	0.026 ***	0.031 ***	0.031 ***	0.023 ***	0.025 ***	0.025 ***
Germany	1,523	0.028 ***	0.032 ***	0.032 ***	0.025 ***	0.028 ***	0.028 ***
Greece	396	0.006	0.009	0.009	0.005	0.007	0.007
Hong Kong	295	0.031 *	0.039 ***	0.039 ***	0.028 **	0.032 ***	0.032 ***
India	1,822	0.011	0.014 **	0.013 **	0.009	0.009 **	0.011 **
Indonesia	536	0.008	0.009	0.009	0.002	0.005	0.006
Ireland	189	0.104 ***	0.105 ***	0.105 ***	0.102 ***	0.096 ***	0.098 ***
Israel	65	0.013	0.015	0.017	0.010	0.007	0.010
Italy	160	0.019	0.023	0.023	0.018	0.020	0.020
Japan	9,962	0.069 ***	0.080 ***	0.080 ***	0.052 ***	0.057 ***	0.057 ***
Luxembourg	24	0.000	0.001	0.001	0.004	0.005	0.005
Malaysia	512	0.005	0.007	0.007	0.004	0.005	0.005
Mexico	340	0.019	0.022	0.023	0.017	0.019	0.019
Netherlands	379	0.129 ***	0.132 ***	0.134 ***	0.132 ***	0.136 ***	0.137 ***
New Zealand	22	0.032	0.035	0.035	0.044	0.047	0.047
Norway	525	0.034 **	0.038 ***	0.039 ***	0.034 ***	0.037 ***	0.037 ***
Pakistan	251	0.017	0.015 *	0.015	0.024	0.023 **	0.021 **
Philippines	380	0.019	0.025 *	0.027 **	0.013	0.017 **	0.017 **
Portugal	66	0.019	0.022	0.022	0.020	0.023	0.023
Russian Federation	149	0.008	0.008	0.008	0.007	0.007	0.007
Singapore	69	0.002	0.016	0.016	0.006	0.011	0.011
South Africa	350	0.057 ***	0.074 ***	0.072 ***	0.061 ***	0.074 ***	0.075 ***
Spain	53	0.003	0.005	0.007	0.005	0.006	0.006
Sweden	466	0.053 ***	0.058 ***	0.057 ***	0.055 ***	0.057 ***	0.057 ***
Switzerland	791	0.142 ***	0.158 ***	0.158 ***	0.148 ***	0.159 ***	0.159 ***
Taiwan, Province Of China	3,952	0.011 **	0.013 ***	0.013 ***	0.010 ***	0.011 ***	0.011 ***
Turkey	40	0.006	0.006	0.006	0.005	0.005	0.005
United Kingdom	2,984	0.204 ***	0.214 ***	0.218 ***	0.195 ***	0.199 ***	0.202 ***
United States	7,586	0.081 ***	0.089 ***	0.089 ***	0.087 ***	0.089 ***	0.091 ***

**Table 3: Tax Benefits and Post-Retirement Benefit Plans**

The table shows the tax benefits of interest expense on debt and contributions to post-retirement benefit plans, based on firm-level average tax rates Panel A) and country-level effective marginal tax rates (from Bilicka, Devereux, and Fuest, 2011), respectively. In particular, the table shows separately for post-retirement benefit plans, pension plans, and health care benefit plans the number of observations (N), the interest expense ratio (ratio of consolidated interest expense to regular interest expense), the ratio of tax benefits to total assets (assuming perpetual tax shields discounted at 5%), the ratio of tax benefits to total assets (assuming perpetual tax shields discounted at the estimated average interest rate on debt), the ratio of tax benefits to market capitalization (assuming perpetual tax shields discounted at 5%), and the ratio of tax benefits to market capitalization (assuming perpetual tax shields discounted at the estimated average interest rate on debt). The table shows the median interest expense ratio and average values of tax benefits by year, the mean, median and standard deviation of all variables across all years, as well as the median interest expense ratio and the average tax benefits for firms in the United States and for firms in all other countries. Definitions of all variables are provided in Supplemental Appendix B.

Year	Post-Retirement Benefit Plans						Pension Plans						Health Care Plans						
	N	Interest Expense	Tax Benefits (5%)/Total	Tax Benefits (Avg)/Total	Tax Benefits (5%)/Market Cap	Tax Benefits (Avg)/Market Cap	N	Interest Expense	Tax Benefits (5%)/Total	Tax Benefits (Avg)/Total	Tax Benefits (5%)/Market Cap	Tax Benefits (Avg)/Market Cap	N	Interest Expense	Tax Benefits (5%)/Total	Tax Benefits (Avg)/Total	Tax Benefits (5%)/Market Cap	Tax Benefits (Avg)/Market Cap	
		Ratio	Assets	Assets	Assets	Assets		Ratio	Assets	Assets	Assets	Assets		Ratio	Assets	Assets	Assets	Assets	
Panel A: Average Tax Rate																			
2002	1,930	1.12	0.11	0.13	0.28	0.36	1,896	1.10	0.15	0.12	0.34	0.25	564	1.09	0.10	0.13	0.27	0.35	
2003	3,831	1.44	0.14	0.24	0.38	0.75	3,773	1.40	0.15	0.11	0.27	0.20	853	1.10	0.14	0.24	0.37	0.75	
2004	4,497	1.49	0.13	0.23	0.27	0.56	4,423	1.46	0.13	0.10	0.21	0.15	950	1.09	0.13	0.23	0.26	0.56	
2005	5,096	1.31	0.10	0.19	0.20	0.42	5,026	1.28	0.12	0.09	0.19	0.14	1,019	1.07	0.10	0.19	0.19	0.42	
2006	5,156	1.30	0.11	0.18	0.18	0.33	5,089	1.30	0.12	0.09	0.16	0.12	1,018	1.05	0.11	0.18	0.17	0.33	
2007	5,256	1.38	0.13	0.18	0.22	0.35	5,194	1.37	0.12	0.09	0.19	0.14	969	1.04	0.12	0.18	0.22	0.36	
2008	5,828	1.11	0.10	0.14	0.30	0.45	5,769	1.11	0.12	0.10	0.28	0.22	985	1.04	0.09	0.13	0.30	0.45	
2009	5,840	1.17	0.11	0.16	0.36	0.55	5,784	1.17	0.11	0.09	0.20	0.17	940	1.03	0.11	0.16	0.36	0.55	
Mean	37,434	4.77	0.11	0.18	0.27	0.46	36,954	4.79	0.13	0.10	0.22	0.17	7,298	1.25	0.11	0.18	0.26	0.47	
Median	37,434	1.27	0.08	0.10	0.10	0.13	36,954	1.25	0.09	0.08	0.09	0.08	7,298	1.06	0.08	0.09	0.10	0.13	
Std. Dev.	37,434	15.3	0.17	0.31	0.53	1.01	36,954	15.6	0.14	0.08	0.42	0.28	7,298	0.67	0.17	0.31	0.53	1.01	
United States	7,522	1.13	0.14	0.12	0.23	0.19	7,183	1.10	0.13	0.11	0.23	0.17	5,122	1.07	0.13	0.11	0.22	0.19	
Other Countries	29,912	1.33	0.11	0.20	0.28	0.53	29,771	1.32	0.11	0.08	0.20	0.15	2,176	1.04	0.11	0.20	0.28	0.53	
Panel B: Effective Marginal Tax Rate																			
Mean	37,434	4.77	0.09	0.12	0.27	0.40	36,954	4.79	0.10	0.07	0.41	0.25	7,298	1.25	0.08	0.12	0.27	0.40	
Median	37,434	1.27	0.07	0.08	0.10	0.13	36,954	1.25	0.08	0.06	0.09	0.08	7,298	1.06	0.07	0.08	0.10	0.12	
Std. Dev.	37,434	15.3	0.12	0.19	0.63	0.85	36,954	15.6	0.09	0.05	1.50	0.72	7,298	0.67	0.12	0.19	0.61	0.84	
United States	7,522	1.13	0.11	0.08	0.31	0.26	7,183	1.10	0.11	0.08	0.49	0.29	5,122	1.07	0.10	0.08	0.30	0.24	
Other Countries	29,912	1.33	0.08	0.14	0.26	0.45	29,771	1.32	0.08	0.06	0.24	0.16	2,176	1.04	0.08	0.14	0.26	0.45	

#### **Table 4: Regression Analysis of Post-Retirement Plans and Leverage**

The table reports results from estimations of multivariate regression models with regular leverage (Panel A) and consolidated leverage (Panel B), respectively, as dependent variable. Regular leverage is measured by the ratio of total debt to consolidated total assets. Consolidated leverage is calculated by subtracting accrued post-retirement costs (including additional minimum liabilities where applicable) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (including intangible pension asset where applicable) from total assets and adding fair value of plan assets. For each specification, the table shows the estimated coefficients and associated  $p$ -values, the use of firm, country, industry or year fixed effects, information on the clustering of standard errors (SE), as well as the R-squared and the number of observations. Industry fixed effects are based on 4-digit SIC codes. Specifications (1)-(4) show results from regressions with country, industry and year fixed effects, alternatively for the full sample or subsamples excluding the countries with the largest number of observations. Specification (5) shows results from regressions with firm and year fixed effects. Specification (6) shows results from estimating a treatment effects model where the probability of a firm having a defined benefit plan is a function of the natural logarithm of the number of employees, the market-to-book ratio, the three-year average of the return on assets, and the natural logarithm of the volatility for the return on assets, the ratio of tangible assets to total assets, employee tenure, unionization, as well as country, industry and year fixed effects. All standard errors are clustered at the country level. Definitions of all variables are provided in Supplemental Appendix B.

*(continued)*

**Table 4: Regression Analysis of Post-Retirement Plans and Leverage (continued)**

<b>Panel A: Regular Leverage</b>												
	(1)		(2)		(3)		(4)		(5)		(6)	
	Country, Industry and Year Fixed Effects								Firm and Year Fixed Effects		Treatment Effects Model	
	Full Sample Excluding											
	Full Sample		United States		U.S. and Japan		U.S., Japan and UK		Full Sample		Full Sample	
	Coef	<i>p</i> -value	Coef	<i>p</i> -value	Coef	<i>p</i> -value	Coef	<i>p</i> -value	Coef	<i>p</i> -value	Coef	<i>p</i> -value
PBO/Total Assets	-0.218	[0.00]	-0.217	[0.00]	-0.221	[0.00]	-0.239	[0.00]	-0.155	[0.00]	-0.211	[0.00]
Market-to-Book	0.007	[0.00]	0.005	[0.00]	0.004	[0.00]	0.003	[0.01]	0.004	[0.00]	0.007	[0.00]
Volatility of ROA (log)	-0.010	[0.00]	-0.009	[0.00]	-0.012	[0.00]	-0.012	[0.00]	0.000	[0.78]	-0.015	[0.00]
Total Risk (log)	0.053	[0.00]	0.052	[0.00]	0.047	[0.00]	0.048	[0.00]	0.019	[0.00]	0.052	[0.00]
Tax Rate	0.026	[0.03]	0.032	[0.01]	0.019	[0.07]	0.019	[0.09]	0.024	[0.00]	0.028	[0.02]
Total Assets in USD (log)	0.013	[0.00]	0.015	[0.00]	0.014	[0.00]	0.016	[0.00]	0.057	[0.00]	0.019	[0.00]
Dividend	-0.031	[0.03]	-0.057	[0.00]	-0.049	[0.00]	-0.053	[0.00]	-0.027	[0.03]	-0.030	[0.03]
Tangible Assets/Total Assets	-0.148	[0.00]	-0.134	[0.00]	-0.121	[0.00]	-0.137	[0.00]	-0.166	[0.00]	-0.135	[0.00]
Net FX-Exposure	-0.037	[0.00]	-0.029	[0.00]	-0.023	[0.00]	-0.029	[0.00]	-0.005	[0.48]	-0.038	[0.00]
Debt Maturity	0.104	[0.00]	0.098	[0.00]	0.100	[0.00]	0.099	[0.00]	0.046	[0.00]	0.103	[0.00]
Gross Profit Margin (3-year average)	-0.064	[0.00]	-0.073	[0.00]	-0.064	[0.00]	-0.082	[0.00]	-0.093	[0.01]	-0.070	[0.00]
Preferred Stock/Size Market Value	-0.248	[0.00]	-0.287	[0.03]	-0.250	[0.08]	-0.113	[0.62]	-0.445	[0.00]	-0.247	[0.00]
Negative Book Equity	0.443	[0.00]	0.345	[0.00]	0.367	[0.00]	0.465	[0.00]	0.276	[0.00]	0.444	[0.00]
Industry Median Leverage	0.309	[0.00]	0.268	[0.00]	0.299	[0.00]	0.326	[0.00]	0.278	[0.00]	0.307	[0.00]
Intercept	-0.003	[0.89]	0.402	[0.00]	-0.210	[0.00]	0.243	[0.00]	-0.381	[0.00]	-0.024	[0.52]
Firm fixed effects	no		no		no		no		yes		no	
Country fixed effects	yes		yes		yes		yes		no		yes	
Industry fixed effects	yes		yes		yes		yes		no		yes	
Year fixed effects	yes		yes		yes		yes		yes		yes	
SE Cluster	Country		Country		Country		Country		Country		Country	
R <sup>2</sup>	0.38		0.37		0.39		0.39		0.89		0.38	
Observations	32,854		23,637		18,250		15,370		32,854		32,854	

*(continued)*

**Table 4: Regression Analysis of Post-Retirement Plans and Leverage (continued)**

**Panel B: Consolidated Leverage**

	(1)		(2)		(3)		(4)		(5)		(6)	
	Country, Industry and Year Fixed Effects								Firm and Year Fixed Effects	Treatment Effects Model		
	Full Sample Excluding								Full Sample		Full Sample	
	Full Sample		United States		U.S. and Japan		U.S., Japan and UK		Full Sample		Full Sample	
	Coef	p-value	Coef	p-value	Coef	p-value	Coef	p-value	Coef	p-value	Coef	p-value
Post-Retirement Benefit Plan	0.061	[0.00]	0.056	[0.02]	0.061	[0.04]	0.023	[0.02]	0.049	[0.00]	0.060	[0.00]
Market-to-Book	0.008	[0.00]	0.006	[0.00]	0.005	[0.00]	0.003	[0.01]	0.004	[0.00]	0.008	[0.00]
Volatility of ROA (log)	-0.007	[0.02]	-0.005	[0.18]	-0.007	[0.04]	-0.011	[0.00]	0.000	[0.92]	-0.005	[0.20]
Total Risk (log)	0.046	[0.00]	0.046	[0.00]	0.041	[0.00]	0.046	[0.00]	0.016	[0.00]	0.046	[0.00]
Tax Rate	0.027	[0.05]	0.032	[0.04]	0.016	[0.17]	0.022	[0.07]	0.026	[0.00]	0.026	[0.06]
Total Assets in USD (log)	0.016	[0.00]	0.018	[0.00]	0.016	[0.00]	0.018	[0.00]	0.049	[0.00]	0.014	[0.00]
Dividend	-0.027	[0.08]	-0.056	[0.00]	-0.047	[0.00]	-0.050	[0.00]	-0.027	[0.03]	-0.027	[0.09]
Tangible Assets/Total Assets	-0.116	[0.00]	-0.097	[0.00]	-0.088	[0.00]	-0.130	[0.00]	-0.160	[0.00]	-0.120	[0.00]
Net FX-Exposure	-0.034	[0.00]	-0.028	[0.02]	-0.020	[0.03]	-0.026	[0.00]	0.001	[0.93]	-0.034	[0.00]
Debt Maturity	0.103	[0.00]	0.096	[0.00]	0.098	[0.00]	0.100	[0.00]	0.046	[0.00]	0.103	[0.00]
Gross Profit Margin (3-year average)	-0.082	[0.00]	-0.094	[0.00]	-0.087	[0.00]	-0.083	[0.00]	-0.110	[0.00]	-0.077	[0.00]
Preferred Stock/Size Market Value	-0.268	[0.00]	-0.288	[0.07]	-0.209	[0.16]	-0.117	[0.64]	-0.423	[0.02]	-0.274	[0.00]
Negative Book Equity	0.480	[0.00]	0.381	[0.00]	0.406	[0.00]	0.474	[0.00]	0.291	[0.00]	0.479	[0.00]
Industry Median Leverage	0.308	[0.00]	0.267	[0.00]	0.293	[0.00]	0.324	[0.00]	0.266	[0.00]	0.308	[0.00]
Intercept	0.028	[0.20]	0.016	[0.58]	0.039	[0.53]	0.050	[0.47]	-0.266	[0.01]	0.084	[0.04]
Firm fixed effects	no		no		no		no		yes		no	
Country fixed effects	yes		yes		yes		yes		no		yes	
Industry fixed effects	yes		yes		yes		yes		no		yes	
Year fixed effects	yes		yes		yes		yes		yes		yes	
SE Cluster	Country		Country		Country		Country		Country		Country	
R <sup>2</sup>	0.40		0.38		0.38		0.36		0.89		0.40	
Observations	32,854		23,637		18,250		15,370		32,854		32,854	

**Table 5: Variance Decomposition**

The table reports the variance decomposition of book leverage. The methodology follows Lemmon, Roberts, and Zender (2008) and calculates the Type III partial sum of squares for each effect in the model and then normalizes each estimate by the sum across effects. Industry fixed effects are based on 4-digit SIC codes. Definitions of all variables are provided in Supplemental Appendix B.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Firm Fixed Effects	1.00	0.99			0.96		0.96
Country Fixed Effects			0.12	0.13		0.09	
Industry Fixed Effects			0.87	0.27		0.25	
Year Fixed Effects		0.01	0.00	0.01	0.01	0.01	0.01
PBO/Total Assets						0.05	0.00
Market-to-Book				0.04	0.00	0.05	0.00
Volatility of ROA (log)				0.01	0.00	0.01	0.00
Total Risk (log)				0.05	0.00	0.04	0.00
Tax Rate				0.00	0.00	0.00	0.00
Total Assets in USD (log)				0.02	0.01	0.04	0.01
Dividend				0.02	0.00	0.01	0.00
Tangible Assets/Total Assets				0.05	0.00	0.04	0.00
Net FX-Exposure				0.01	0.00	0.01	0.00
Debt Maturity				0.11	0.00	0.11	0.00
Gross Profit Margin (3-year average)				0.01	0.00	0.01	0.00
Preferred Stock/Size Market Value				0.00	0.00	0.00	0.00
Negative Book Equity				0.25	0.01	0.27	0.01
Industry Median Leverage				0.01	0.00	0.01	0.00
Adjusted R <sup>2</sup>	0.808	0.812	0.187	0.352	0.843	0.364	0.844

**Table 6: Regression Analysis by Country**

The table reports results from estimations of multivariate regression models with leverage as dependent variable. Regular leverage is measured by the ratio of total debt to consolidated total assets. Consolidated leverage is calculated by subtracting accrued post-retirement costs (including additional minimum liabilities where applicable) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (including intangible pension asset where applicable) from total assets and adding fair value of plan assets. The regression setup is the same as in column one of Table 4, but the table shows for each country only the estimated coefficients and associated  $p$ -values of projected benefit obligations for regular leverage and of post-retirement plans for consolidated leverage. The model is estimated by country and separately for developed and developing countries (defined based on the MSCI classification as of June 2006). For regular leverage, the regression coefficient on the size of the post-retirement obligations is tested against zero ( $H_0=0$ ) and minus one ( $H_0=-1$ ). Countries are sorted by the size of the coefficient in the Consolidated Leverage column. All models include year and industry fixed effects (based on 4-digit SIC codes). Models for firms in developed and developing countries also include country fixed effects. Standard errors are clustered at the industry level for regressions by country and at the country level for regressions for groups of countries. Definitions of all variables are provided in Supplemental Appendix B.

	Regular Leverage			Consolidated Leverage	
	Coef	$H_0=0$	$H_0=-1$	Coef	$p$ -value
		$p$ -value	$p$ -value		
United Kingdom	-0.174	[0.00]	[0.00]	0.180	[0.00]
Netherlands	-0.206	[0.08]	[0.00]	0.128	[0.00]
Sweden	-0.195	[0.00]	[0.00]	0.112	[0.00]
Switzerland	-0.103	[0.30]	[0.00]	0.105	[0.00]
South Africa	-0.178	[0.09]	[0.00]	0.072	[0.13]
Canada	-0.054	[0.60]	[0.00]	0.062	[0.00]
United States	-0.243	[0.00]	[0.00]	0.061	[0.00]
Australia	-0.437	[0.07]	[0.02]	0.057	[0.01]
Japan	-0.102	[0.02]	[0.00]	0.048	[0.00]
Denmark	0.915	[0.16]	[0.00]	0.014	[0.55]
Hong Kong	-0.870	[0.31]	[0.88]	0.011	[0.65]
Indonesia	-0.657	[0.00]	[0.10]	0.010	[0.77]
Finland	-0.011	[0.97]	[0.00]	0.010	[0.82]
Germany	-0.192	[0.01]	[0.00]	0.002	[0.89]
Norway	-0.138	[0.72]	[0.03]	-0.001	[0.98]
Malaysia	-0.798	[0.14]	[0.70]	-0.009	[0.72]
France	-0.401	[0.04]	[0.00]	-0.025	[0.36]
Taiwan, Province Of China	-1.170	[0.00]	[0.49]	-0.026	[0.59]
India	-0.687	[0.00]	[0.21]	-0.033	[0.16]
Austria	-0.903	[0.02]	[0.80]	-0.047	[0.37]
Developed countries	-0.217	[0.00]	[0.00]	0.068	[0.00]
Developing countries	-0.327	[0.01]	[0.00]	0.008	[0.52]

**Table 7: Substitution Rates by Country Characteristics**

The table reports results from estimations of multivariate regression models with regular leverage as dependent variable. In addition to the independent firm-level variables in Table 4, the regressions include country variables and their interactions with PBO/Total Assets. For each country characteristic, a dummy variable takes the value 1 if the country is above the median country in that year by that characteristic, and zero otherwise. The dummy variable is interacted with PBO/Total Assets to estimate the difference in the substitution rate for firms in countries with high country characteristic. The regression setup is the same as in column one of Table 4, but the table shows only the estimated coefficients and associated  $p$ -values of selected variables. In particular, column (1) stacks results from fourteen regressions, each of which include all firm-level variables of Table 4. In addition, each regression includes one selected country characteristic and the corresponding interaction variable with projected benefit obligations. The column shows the average coefficient and  $p$ -value of PBO/Total Assets, the average number of observations, and average adjusted R<sup>2</sup>. In addition, it shows the estimate and  $p$ -value of the interaction term of the respective country characteristic with PBO/Total Assets. Columns (2)-(8) show results for individual regressions, each of which employ the same firm-level variables as well as permutations of multiple country variables and their corresponding interaction effects. The columns display the coefficient and  $p$ -value on projected benefit obligations, i.e. the substitution effect, as well as the coefficients and  $p$ -values of the high country characteristic dummy variable interacted with PBO/Total Assets, as well as the number of observations and adjusted R<sup>2</sup>. Regular leverage is measured by the ratio of total debt to consolidated total assets. All models include year and industry fixed effects (based 4-digit SIC codes). All standard errors are clustered at the country level. Definitions of all variables are provided in Supplemental Appendix B.

	One country variable		Multiple country variables													
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	Coef	$p$ -value	Coef	$p$ -value	Coef	$p$ -value	Coef	$p$ -value	Coef	$p$ -value	Coef	$p$ -value	Coef	$p$ -value	Coef	$p$ -value
PBO/Total Assets	-0.244	[0.00]	-0.116	[0.16]	-0.095	[0.31]	-0.128	[0.12]	-0.176	[0.01]	-0.146	[0.10]	-0.196	[0.00]	-0.176	[0.02]
Indicator variables interacted with PBO/Total Assets																
Corporate Tax Rate	-0.027	[0.46]	-0.087	[0.00]	-0.060	[0.00]	-0.078	[0.00]	-0.074	[0.01]	-0.054	[0.01]	-0.077	[0.00]	-0.073	[0.01]
Pension Tax Generosity	-0.019	[0.61]														
Guarantee	0.015	[0.77]	0.002	[0.97]	-0.013	[0.79]	0.034	[0.45]							0.016	[0.80]
Priority of Unfunded Pension	0.026	[0.58]							-0.029	[0.61]	-0.027	[0.69]	-0.074	[0.16]	-0.031	[0.61]
Rule of Law	-0.207	[0.00]	-0.193	[0.00]	-0.175	[0.00]	-0.175	[0.00]	-0.148	[0.00]	-0.154	[0.00]	-0.154	[0.00]	-0.151	[0.00]
Law and Order	-0.048	[0.37]														
Creditor Rights	-0.005	[0.82]														
Private Credit/GDP	0.106	[0.10]	0.047	[0.50]	0.064	[0.41]	0.061	[0.37]	0.047	[0.41]	0.081	[0.28]	0.122	[0.00]	0.039	[0.54]
Private Bond Market Capitalization/GDP	0.073	[0.14]														
Labor Market Freedom	0.115	[0.02]	0.053	[0.24]					0.078	[0.03]					0.077	[0.07]
Employment Protection	-0.114	[0.02]			-0.069	[0.09]					-0.055	[0.16]				
Employment Laws	-0.069	[0.06]														
Union Density	-0.075	[0.09]					-0.040	[0.40]					-0.014	[0.73]		
Pension Fund Assets/GDP	0.087	[0.09]	0.054	[0.11]	0.039	[0.17]	0.042	[0.16]	0.064	[0.27]	0.058	[0.38]	0.132	[0.01]	0.059	[0.32]
Observations	27,690		27,553		27,553		27,553		27,553		27,553		27,553		27,553	
Adj. R <sup>2</sup>	0.40		0.40		0.40		0.40		0.40		0.40		0.40		0.40	

## Appendix

### **U.S. and EU Regulation on Priority of DB Plans in Default of Plan Sponsor**

In the United States, outstanding employer contributions to DB plans for amounts due within 180 days and up to \$12,475 receive priority. In contrast, bankruptcy law does not recognize the priority creditor rights given to pensions by the ERISA pension legislation in the 1970s, so that unfunded pension liabilities typically have the standing of general unsecured claims. However, the PBGC has the power to place a lien on a non-bankrupt plan sponsor's assets if it misses pension contributions, and it can impose involuntary terminations on corporations in a difficult financial situation. It pays employees a guaranteed amount up to a statutory cap and is subrogated to the rights of the employee in bankruptcy (Secunda, 2014). However, the PBGC does not cover wage claims, and there is no wage guarantee fund in the United States. While retirees' medical liabilities do not enjoy the same protection under ERISA, if the benefits are owed under the terms of a labor contract, the company's voiding of the contract in bankruptcy would give rise to a general unsecured claim by employees and retirees.<sup>17</sup> The appendix to FAS 106 notes that case law has not been unequivocal about the legal enforceability or lack thereof of promises to provide postretirement benefits other than pensions, although the legal enforceability of certain claims has been demonstrated.

The legislation of the European Union offers protection for employees in the case of the bankruptcy of their employer, covering areas such as wages, outstanding holiday, sick leave and maternity leave (which receive priority rankings). Under EU Directive 2008/94/EC, member states are required to meet a minimum standard concerning the protection of employees in the event of the insolvency of their employer and to set up an institution to guarantee some or all employee claims with regards to pensions or other types of wage-related benefits (see Stewart, 1997a; Secunda, 2014). Convention C173 (Protection of Workers Claims (Employer's Insolvency), 1992) of the International Labour Organization (ILO), which updated the Protection of Wages Convention from 1949, is also

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<sup>17</sup> In the United States, the Health Coverage Tax Credit (HCTC), a federally funded program administered by the Internal Revenue Service, used to pay a portion (the most recent figure was 72.5%) of health-insurance premiums for retirees whose benefits had been reduced or eliminated in bankruptcy proceedings and whose pensions had been taken over by the PBGC. The program paid for comprehensive major medical coverage, including prescription drugs and dental and vision care, if they were included in that coverage. In 2009, Congress expanded HCTC coverage to include benefits sponsored by Voluntary Employee Benefit Associations (VEBA), which are trust funds established during the bankruptcy process to provide retiree health benefits. On January 1, 2014 the legislation that authorized the HCTC expired.

concerned with the protection of workers' (wage-related) claims during an employer's insolvency, either through priority status or a state-sponsored guarantee scheme, but some of the largest OECD economies have not ratified it. Some countries, such as the Netherlands, have dealt with benefit protection via strong funding rules.

### **Comparison of Firms With and Without DB Plan**

It is interesting to consider how firms with post-retirement benefit plans compare to firms without such plans in general and with regards to leverage in particular. Given that the economic effect of considering off-balance sheet defined benefit plans is higher effective leverage on average, firms with such plans might take out less regular debt. Interestingly, the results in Table A1 suggest that, *prima facie*, this does not seem to be the case: Even before considering the effect of consolidating off-balance sheet assets and liabilities of post-retirement benefit plans, firms with DB plans actually have significantly higher regular leverage by all measures. Moreover, given higher regular leverage as well as additional leverage via post-retirement plans, one would expect that plan sponsors are able to lower their taxes via interest payments and plan contributions. Nevertheless, they actually have higher average tax rates, a finding similar to Shivdasani and Stefanescu (2010) for the United States.

In this context it is important to consider that the two groups of firms are significantly different along many important dimensions, as the statistics on the bottom of the table document. In particular, plan sponsors have higher and more stable returns on assets, have less risk (total risk, market risk and idiosyncratic risk), are larger, have fewer growth options (smaller market/book ratio), undertake more real investment (in terms of R&D and capital expenditures), have more property, plant and equipment (PPE), are more likely to pay dividends, have higher Z-Scores, and are older. Thus, firms with DB plans share characteristics that allow them to bear more debt (such as larger size, higher Z-Score and profitability, see Graham, 2000) and thus do not necessarily have lower tax rates. These differences in firm characteristics call for a multivariate analysis of leverage ratios that controls for other firm characteristics.

### **Univariate Results and Correlations**

Table A2 presents firm characteristics based on sorting observations into 5 groups from low to high, as well as tests between the extreme portfolios (high and low). Panel A shows results where quintiles are formed based on the size of the post-retirement benefit plan as measured by projected benefit obligations (scaled by consolidated total assets). The panel shows that with larger benefit plans, the fair value of the plan assets also increases, but to a lesser degree, resulting in larger plans also showing

larger deficits (consistent with the evidence in Table 1). Moreover, there is an increase in the interest expense ratio across quintiles, and the total tax benefits from both plan contributions and interest expenses on debt increase also. As post-retirement liabilities increase, regular leverage tends to decrease, while consolidated leverage tends to increase. This suggests an imperfect substitution effect between financial debt and post-retirement obligations, where firms with large projected benefit obligations reduce regular leverage, but less than by what it increases through post-retirement plans.

Results in Panel B of Table A2 are based on sorting observations by consolidated leverage. As consolidated leverage increases, both regular leverage and post-retirement obligations increase, despite the earlier negative relation between PBO and regular leverage. Across quintiles, the interest expense ratio drops suggesting that high levels of consolidated leverage require substantial financial debt as well, while, as one would expect, the total tax shield benefits increase. Finally, results in Panel C are based on using regular leverage as the sorting characteristic. Since regular leverage contributes to consolidated leverage, the latter increases across quintiles, while PBO tends to decrease.

Before investigating the relations between post-retirement benefit plans and leverage in a regression framework, it is useful to take a look at the correlations between variables to be used in the analysis. These are shown in Table A3. In line with the results from portfolio sorts, the relation between regular leverage and PBO is negative, but small (-0.011), while the relation between consolidated leverage and PBO is positive (0.386).<sup>18</sup> While regular and consolidated leverage are highly correlated (0.907) and often show similar associations with other variables, there are cases, such as the correlation with Age or PBO, where the size and the sign differ.

### **Robustness Tests**

A number of additional tests are undertaken to verify the robustness of the results. Rajan and Zingales (1995) note that for capital structure tests in an international context, attention has to be paid to requirements to report consolidated accounting data. Companies without consolidated accounts could hide debt in a subsidiary that is not being consolidated and would thus appear to have lower leverage than otherwise similar companies with fully consolidated accounts. While the availability of infor-

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<sup>18</sup> Since the equity to debt ratio is one component of the *Z-Score*, the correlations between *Z-Score* and *Leverage* are high (-0.53), so that I do not include *Z-Score* in the *Leverage* equation. Similarly, *NetPPE* and *CapEx* are highly correlated (0.55), as are *PBO* and *PostRetirementBenefitPlan* (0.55), so that I do not include these variables at the same time either.

mation on the degree of consolidation is limited, a robustness test is conducted that restricts the sample to firm-year observations where subsidiaries of any type, significant or not, domestic and foreign, are consolidated. The results are reported in Supplemental Appendix D and are very similar to the earlier results (in Table 4), both in terms of the size of the coefficients as well as their significance levels. In further robustness tests, I also perform a separate estimation of the models for firms reporting under U.S. GAAP, IAS/IFRS<sup>19</sup> (Supplemental Appendix E). Alternatively, I estimate the models on the full sample when including additional fixed effects for the respective accounting standards used to prepare an annual report. The results are comparable, and the main findings of the paper maintain economic and statistical significance of similar magnitude.

The large set of exogenous variables in the regression models ensures that the results are as robust as possible to omitted variable biases, but it comes at the expense of a reduction in the number of observations with non-missing values of all variables. To this end, Supplemental Appendix F shows results for an alternative specification where the variables that have the biggest effect on sample size are excluded, namely the tax rate, net FX exposure, and the number of employees. This increases the number of observations from 32,854 to 128,492. The results are robust to this variation, which a somewhat larger (smaller) the coefficient on post-retirement obligations (defined-benefit plans).

Another potential concern is the use of the firm-level average tax rate as a proxy for the corporate marginal tax rate. While it seems difficult to determine the marginal tax rate for each firm in the sample, I conduct robustness tests using the effective marginal tax rates from Bilicka et al. (2011). The results show that this variation has no effect on the conclusions of the paper, as the sign, size and significance levels of the variables of interest are not affected by this substitution.

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<sup>19</sup> Barth, Landsman, and Lang (2008) show that across firms from 21 countries firms reporting under IAS show higher accounting quality than those that do not. IFRS firms have greater accounting system and value relevance comparability with U.S. firms when they apply IFRS as opposed to domestic standards, especially if IFRS adoption is mandatory and in more recent years (Barth, Landsman, Lang, and Williams, 2012).

**Table A1: Characteristics of Firms with and without Post-Retirement Benefit Plan**

The table shows various characteristics of firms with and without post-retirement benefit plan. For each characteristic, the table shows the number of observations (N), the mean, median and standard deviation for firms with post-retirement benefit plan and those without. In addition, it reports the difference in means and medians, as well as  $p$ -values of  $t$ -tests and non-parametric Wilcoxon tests. The table shows statistics for several measures of leverage, i.e. total debt divided by alternatively Size Market Value (market capitalization plus preferred stock plus total debt) or Total Assets. In addition to regular leverage, consolidated leverage ratios are calculated for all firms with post-retirement benefits by subtracting accrued post-retirement costs (including additional minimum liabilities where applicable) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (including intangible pension asset where applicable) from size and adding fair value of plan assets. The table also shows results for the average corporate income tax rate, the average return on assets over three years (ROA), the natural logarithm of the volatility of the return on assets (calculated as the standard deviation of the return on assets over the prior five years), the natural logarithm of total assets in U.S. Dollars, the natural logarithm of annualized idiosyncratic risk (calculated as the standard deviation of residuals from regressions with local market, world market, world and regional SMB and HML), the natural logarithm of annualized market risk (calculated as the square root of the difference between total risk squared and idiosyncratic risk squared), the natural logarithm of total risk (calculated as the standard deviation of weekly returns in U.S. Dollars), the ratio of market value of equity to book value of equity, the ratio of research and development expenses (with missing values set to zero) to total assets, the ratio of capital expenditures (with missing values set to zero) to total assets, net property, plant and equipment (PPE) to total assets, a dummy variable with value of one if book equity is negative (and zero otherwise), a dummy variable with value one if the firms pays a dividend (and zero otherwise), the Altman (2000) Z-Score, and the natural logarithm of firm age.

	Firms with Post-Retirement Benefit Plan				Firms without Post-Retirement Benefit Plan				Difference		$p$ -value	
	N	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.	Means	Medians	$t$ -Test	Wilcoxon
Gross Leverage												
Total Debt/Size Market Value	39,230	0.28	0.23	0.24	147,410	0.24	0.15	0.26	0.04	0.08	[0.00]	[0.00]
Total Debt/Size Market Value (consolidated)	36,514	0.37	0.33	0.25								
Total Debt/Total Assets	40,603	0.24	0.22	0.19	163,093	0.22	0.17	0.23	0.02	0.05	[0.00]	[0.00]
Total Debt/Total Assets (consolidated)	37,780	0.32	0.30	0.19								
Leverage Net of (Cash + Short-Term Investments)												
Total Debt/Size Market Value	38,946	0.10	0.14	0.51	144,614	-0.01	0.05	0.66	0.11	0.09	[0.00]	[0.00]
Total Debt/Size Market Value (consolidated)	36,412	0.25	0.25	0.35								
Total Debt/Total Assets	40,602	0.08	0.14	0.47	162,791	-0.25	0.05	1.40	0.33	0.08	[0.00]	[0.00]
Total Debt/Total Assets (consolidated)	37,780	0.21	0.24	0.29								
Tax Rate	31,535	0.34	0.33	0.18	98,099	0.29	0.28	0.20	0.05	0.05	[0.00]	[0.00]
ROA (3-year average)	40,118	0.05	0.05	0.10	153,571	-0.04	0.03	0.26	0.09	0.01	[0.00]	[0.00]
Volatility of ROA (log)	39,471	-3.61	-3.61	1.02	161,163	-3.04	-3.04	1.28	-0.57	-0.57	[0.00]	[0.00]
Idiosyncratic Risk (log)	37,901	-1.26	-1.28	0.47	159,625	-0.76	-0.81	0.65	-0.49	-0.47	[0.00]	[0.00]
Market Risk (log)	37,901	-1.47	-1.49	0.53	159,625	-1.28	-1.29	0.62	-0.19	-0.20	[0.00]	[0.00]
Total Risk (log)	37,901	-0.97	-0.99	0.46	159,625	-0.58	-0.62	0.62	-0.39	-0.38	[0.00]	[0.00]
Total Assets in USD (log)	40,602	13.4	13.4	1.76	163,291	11.1	11.2	1.92	2.31	2.18	[0.00]	[0.00]
Market-to-Book	39,236	2.05	1.47	3.18	147,609	2.34	1.41	4.90	-0.29	0.06	[0.00]	[0.00]
R&D Expense/Total Assets	40,617	0.02	0.00	0.03	285,093	0.01	0.00	0.05	0.00	0.00	[0.00]	[0.00]
Capital Expenditures/Total Assets	40,617	0.05	0.04	0.05	285,093	0.03	0.00	0.06	0.02	0.03	[0.00]	[0.00]
Net PPE/Total Assets	40,596	0.32	0.29	0.20	162,374	0.30	0.25	0.24	0.02	0.04	[0.00]	[0.00]
Negative Book Equity	40,617	0.03	0.00	0.17	285,093	0.04	0.00	0.19	-0.01	0.00	[0.00]	[0.00]
Dividend (dummy)	40,617	0.77	1.00	0.42	285,093	0.26	0.00	0.44	0.50	1.00	[0.00]	[0.00]
Z-Score	37,397	2.49	2.49	2.45	138,197	1.04	1.80	4.43	1.45	0.69	[0.00]	[0.00]
Firm Age (log)	40,616	2.84	3.00	0.70	284,966	2.40	2.57	0.76	0.44	0.43	[0.00]	[0.00]

**Table A2: Portfolio Sorts of Post-Retirement Plans and Leverage**

The table shows characteristics of corporate post-retirement benefit plans, tax benefits of post-retirement benefit plans, regular leverage, and consolidated leverage. Observations are sorted into five groups (Low to High) based on the ratio of projected benefit obligations of post-retirement benefit plans to total assets (Panel A), consolidated leverage (Panel B), and regular leverage (Panel C), respectively. For each group, the table reports average characteristics of post-retirement benefit plans, i.e. the ratio of projected benefit obligations to consolidated total assets, the ratio of plan assets to consolidated total assets, and the ratio of the funding level to total assets. It further reports characteristics related to the tax benefits of post-retirement benefit plans and interest expense on debt, i.e. the median interest expense ratio, the average ratio of tax benefits to total assets (assuming perpetual tax shields discounted at 5%), the average ratio of tax benefits to total assets (assuming perpetual tax shields discounted at the estimated average interest rate on debt), the average ratio of tax benefits to market capitalization (assuming perpetual tax shields discounted at 5%), and the average ratio of tax benefits to market capitalization (assuming perpetual tax shields discounted at the estimated average interest rate on debt). The table also reports average regular and consolidated leverage ratios, i.e. total debt divided by alternatively Total Assets or Size Market Value (market capitalization plus preferred stock plus total debt). For consolidated leverage ratios, accrued post-retirement costs (including additional minimum liabilities where applicable) are subtracted from the respective measure of debt, and projected benefit obligations are added. Similarly, prepaid post-retirement costs (including intangible pension asset where applicable) are subtracted from the measure of firm size, and the fair value of plan assets is added. The table also reports the difference between the high group and the low group, as well as *p*-values of non-parametric Wilcoxon tests.

**Panel A: Sorts by Size of Post-Retirement Obligations**

	PBO/Total Assets					High-Low	<i>p</i> -value
	Low	2	3	4	High		
Post-Retirement Plans							
PBO/Total Assets	0.01	0.02	0.06	0.13	0.32	0.32	[0.00]
Fair Value of Plan Assets/Total Assets	0.00	0.01	0.03	0.08	0.23	0.23	[0.00]
Funding Level/Total Assets	0.00	-0.01	-0.03	-0.05	-0.12	-0.11	[0.00]
Tax Benefits							
Interest Expense Ratio	1.04	1.14	1.46	2.02	2.01	0.97	[0.00]
Tax Benefits (5%)/Total Assets	0.08	0.08	0.11	0.13	0.16	0.08	[0.00]
Tax Benefits (Avg)/Total Assets	0.10	0.11	0.19	0.25	0.24	0.14	[0.00]
Tax Benefits (5%)/Market Capitalization	0.21	0.21	0.28	0.31	0.34	0.13	[0.04]
Tax Benefits (Avg)/Market Capitalization	0.28	0.29	0.56	0.63	0.56	0.28	[0.00]
Regular Leverage							
Total Debt/Total Assets	0.26	0.24	0.24	0.24	0.23	-0.04	[0.01]
Total Debt/Size Market Value	0.29	0.28	0.29	0.29	0.27	-0.02	[0.43]
Consolidated Leverage							
Total Debt/Total Assets	0.29	0.27	0.29	0.32	0.45	0.16	[0.00]
Total Debt/Size Market Value	0.32	0.31	0.35	0.38	0.50	0.18	[0.00]

*(continued)*

**Table A2: Portfolio Sorts of Post-Retirement Plans and Leverage (continued)**

**Panel B: Sorts by Consolidated Leverage**

	Total Debt / Total Assets					High-Low	<i>p</i> -value
	Low	2	3	4	High		
Consolidated Leverage							
Total Debt/Total Assets	0.08	0.21	0.31	0.41	0.61	0.53	[0.00]
Total Debt/Size Market Value	0.11	0.26	0.37	0.49	0.64	0.53	[0.00]
Regular Leverage							
Total Debt/Total Assets	0.05	0.16	0.25	0.34	0.49	0.44	[0.00]
Total Debt/Size Market Value	0.08	0.21	0.31	0.41	0.52	0.44	[0.00]
Post-Retirement Plans							
PBO/Total Assets	0.05	0.08	0.10	0.13	0.20	0.15	[0.00]
Fair Value of Plan Assets/Total Assets	0.02	0.05	0.06	0.09	0.14	0.12	[0.00]
Funding Level/Total Assets	-0.03	-0.03	-0.04	-0.05	-0.07	-0.05	[0.00]
Tax Benefits							
Interest Expense Ratio	1.94	1.40	1.23	1.23	1.16	-0.78	[0.00]
Tax Benefits (5%)/Total Assets	0.06	0.09	0.12	0.15	0.21	0.15	[0.00]
Tax Benefits (Avg)/Total Assets	0.11	0.17	0.18	0.20	0.25	0.14	[0.00]
Tax Benefits (5%)/Market Capitalization	0.11	0.19	0.27	0.38	0.59	0.48	[0.00]
Tax Benefits (Avg)/Market Capitalization	0.24	0.37	0.45	0.58	0.83	0.59	[0.00]

**Panel C: Sorts by Regular Leverage**

	Total Debt / Total Assets					High-Low	<i>p</i> -value
	Low	2	3	4	High		
Regular Leverage							
Total Debt/Total Assets	0.01	0.12	0.22	0.33	0.53	0.51	[0.00]
Total Debt/Size Market Value	0.02	0.16	0.28	0.40	0.57	0.54	[0.00]
Consolidated Leverage							
Total Debt/Total Assets	0.10	0.20	0.30	0.38	0.56	0.46	[0.00]
Total Debt/Size Market Value	0.13	0.25	0.35	0.45	0.60	0.47	[0.00]
Post-Retirement Plans							
PBO/Total Assets	0.11	0.12	0.12	0.10	0.09	-0.02	[0.16]
Fair Value of Plan Assets/Total Assets	0.07	0.08	0.08	0.07	0.06	-0.02	[0.02]
Funding Level/Total Assets	-0.04	-0.05	-0.05	-0.04	-0.04	0.00	[0.79]
Tax Benefits							
Interest Expense Ratio	4.35	1.73	1.34	1.19	1.09	-3.27	[0.00]
Tax Benefits (5%)/Total Assets	0.06	0.09	0.12	0.14	0.20	0.13	[0.00]
Tax Benefits (Avg)/Total Assets	0.13	0.16	0.17	0.19	0.24	0.11	[0.00]
Tax Benefits (5%)/Market Capitalization	0.10	0.17	0.25	0.35	0.59	0.48	[0.00]
Tax Benefits (Avg)/Market Capitalization	0.25	0.35	0.41	0.54	0.85	0.59	[0.00]

**Table A3: Correlation Analysis**

The table shows correlations (in percentages) between the main variables used in the empirical analysis. Definitions of all variables are provided in Supplemental Appendix B. Suffixes a (b, c) indicate significance at the 1% (5%, 10%) significance level. Regular leverage is the ratio of total debt to total assets. For consolidated leverage, accrued post-retirement costs (including additional minimum liabilities where applicable) are subtracted from total debt, and projected benefit obligations are added. Similarly, prepaid post-retirement costs (including intangible pension asset where applicable) are subtracted from the measure of firm size, and the fair value of plan assets is added. For capital expenditures to total assets and research and development expenses to total assets, missing values of capital expenditures and research and development expenses are set to zero. For projected benefit obligations, missing values of PBO to total assets are set to zero.

	Consolidated		Industry			Capital Expenditures/	R&D Expense/	ROA (3-		Volatility	Age	Tax	Total Assets in	Net	Tangible	Net	Gross Profit	Preferred	Convertible	
	PBO/Total Assets	ated Leverage	Regular Leverage	Median Leverage	Total Risk (log)	Total Assets	Total Assets	Employees (log)	Market-to-Book	year average)	of ROA (log)	Rate	USD (log)	PPE/Total Assets	Assets/Total Assets	FX-Exposure	Margin (3-year average)	Stock/Size Market Value	Debt/Size Market Value	Negative Book Equity
Consolidated Leverage	38.6 a																			
Regular Leverage	-1.1 b	90.7 a																		
Industry Median Leverage	3.0 a	30.4 a	32.1 a																	
Total Risk (log)	-18.3 a	0.0	7.6 a	-6.6 a																
Capital Expenditures/Total Assets	-9.1 a	5.7 a	9.6 a	11.0 a	3.6 a															
R&D Expense/Total Assets	9.2 a	-11.3 a	-15.9 a	-28.1 a	3.4 a	-9.3 a														
Employees (log)	27.4 a	17.4 a	8.4 a	6.5 a	-25.4 a	0.8	-0.4													
Market-to-Book	2.3 a	0.1	-0.6	-11.0 a	-4.5 a	5.8 a	10.0 a	5.6 a												
ROA (3-year average)	-5.5 a	-12.6 a	-11.6 a	-1.8 a	-10.6 a	17.4 a	-6.8 a	8.8 a	19.4 a											
Volatility of ROA (log)	-5.6 a	-6.8 a	-5.6 a	-18.7 a	31.0 a	1.7 a	15.6 a	-23.8 a	9.7 a	-4.3 a										
Age (log)	29.6 a	9.7 a	-1.6 a	8.3 a	-23.9 a	-11.8 a	4.3 a	25.7 a	-7.2 a	-10.7 a	-14.9 a									
Tax Rate	7.1 a	4.8 a	3.0 a	1.2 b	-4.6 a	-6.3 a	-2.3 a	4.3 a	-4.5 a	-14.7 a	-13.6 a	9.7 a								
Total Assets in USD (log)	26.8 a	22.7 a	14.8 a	7.9 a	-27.4 a	0.4	1.6 a	79.0 a	5.4 a	5.8 a	-27.5 a	29.0 a	8.7 a							
Net PPE/Total Assets	-4.6 a	20.1 a	23.8 a	34.4 a	-7.1 a	54.5 a	-22.1 a	2.9 a	-8.6 a	1.8 a	-12.4 a	3.2 a	-3.4 a	6.5 a						
Dividend	15.2 a	-1.6 a	-7.7 a	12.0 a	-31.1 a	1.8 a	-10.9 a	22.8 a	-3.1 a	19.5 a	-31.8 a	14.2 a	-1.4 b	24.0 a	10.4 a					
Tangible Assets/Total Assets	-5.7 a	-11.5 a	-10.1 a	17.1 a	3.4 a	20.8 a	-6.3 a	-12.6 a	-8.2 a	2.6 a	-8.4 a	5.1 a	-4.3 a	-16.0 a	38.7 a	17.0 a				
Net FX-Exposure	8.6 a	-3.8 a	-7.8 a	-12.8 a	-0.2	-7.5 a	22.4 a	7.0 a	3.2 a	0.5	9.3 a	5.0 a	-4.0 a	8.8 a	-14.8 a	-6.5 a	-8.0 a			
Debt Maturity	9.9 a	28.1 a	26.6 a	5.5 a	-6.3 a	10.8 a	0.3	20.2 a	6.2 a	2.9 a	0.7	6.8 a	4.3 a	29.7 a	13.6 a	-9.3 a	-30.3 a	6.3 a		
Gross Profit Margin (3-year average)	-2.7 a	-6.1 a	-5.6 a	-20.3 a	-6.8 a	3.3 a	30.4 a	-3.1 a	16.5 a	21.5 a	9.3 a	-4.6 a	2.2 a	6.1 a	-3.4 a	-9.7 a	-26.6 a	10.9 a	17.0 a	
Preferred Stock/Size Market Value	0.9	6.1 a	6.0 a	0.0	8.4 a	-2.3 a	2.3 a	-5.4 a	-4.5 a	-10.5 a	8.8 a	1.7 a	-1.9 a	-5.3 a	-1.5 a	-6.5 a	-3.7 a	-0.3	3.3 a	-0.4
Convertible Debt/Size Market Value	-3.6 a	13.1 a	15.8 a	-4.9 a	4.3 a	-1.9 a	8.0 a	3.7 a	-1.9 a	-9.0 a	5.4 a	2.1 a	2.3 a	7.3 a	-4.5 a	-11.5 a	-6.7 a	6.3 a	16.9 a	4.5 a
Negative Book Equity	7.8 a	27.9 a	28.0 a	0.5	11.6 a	-2.6 a	3.1 a	-4.1 a	-30.7 a	-6.4 a	13.7 a	-2.1 a	-1.9 a	-6.3 a	-2.9 a	-11.6 a	-2.4 a	0.40	4.2 a	2.0 a
(Cash + Short-Term Investments)/Total Assets (log)	-4.2 a	-30.9 a	-31.7 a	-24.5 a	4.6 a	-12.6 a	23.6 a	-2.4 a	8.6 a	5.1 a	13.3 a	-7.2 a	-4.2 a	-3.6 a	-30.8 a	0.5	15.5 a	12.3 a	-16.2 a	13.5 a

## Supplemental Appendix A: Accounting Standards for Post-Retirement Plans

The table summarizes accounting standards for defined benefit plans by country (for countries with available information). The information is hand collected and compiled from various accounting standards (to the extent available in English).

Accounting Standard	Recognition and Disclosure
Australia	AASB 1028 and IAS 19 The following must be disclosed in the notes: (1) accrued benefits, (2) net market value of plan assets, (3) funded status, and the (4) vested benefits. The discount rate used should be the yield on national government bonds. An expense is generally recognized as contributions are paid to the fund, unless the entity has a legal or constructive obligation to meet the short-fall of the fund. Post 1Jan2005: Listed entities must follow IAS 19.
Belgium	Belgian GAAP and IAS 19 Belgian entities are bound by law to fund their pension obligations with an independent pension fund or insurance company. There is no clear guidance under Belgian GAAP, and the usual practice is to not recognize a provision since premiums are paid regularly to the pension fund or the insurance company and expensed in the period. Post 1Jan2005: Listed entities must follow IAS 19.
Brazil	Brazilian GAAP and CPC 33 Plan assets were only recorded if there was clear evidence that the asset could reduce future contributions, or would be reimbursed by the employer. Normally, entities did not recognize a pension surplus. Actuarial gains/losses were recognized in income statement. Post 1Jan2008: CPC 33 has no significant differences with IAS 19.
Canada	Section 3461 In the balance sheet, the entity needs to disclose the accrued liability or benefit, which is the difference between the sum of current and prior years pension expense and accumulated contributions made by the employer to the plan. The entity is allowed to use either the projected unit credit method or the accumulated benefit method, depending on whether future salary levels affect the pension obligation. In the notes to the accounts, the following need to be disclosed: (1) book value and fair values of plan assets, (2) pension expense components, (3) the present value of obligations. The discount rate to be used should be the yield on high quality corporate bonds with the same maturity as the obligation.
China	ABSE 9 PRC GAAP: A liability is only recognized for salaries, bonuses, allowances and subsidies, staff welfare, union running costs and employee education costs. Other employee benefits are expensed when they are paid. Post 1Jan2006 (ASBE): Companies are required to recognize a liability in the period the services are provided at the amount of employee benefits payable for that service. They are also required to create a liability for compensation to employees for termination of their work when the company has a formal plan and can not withdraw from the plan. ABSE 9 does not specify further disclosure requirements pertaining to defined benefit plans.
France	French GAAP and IAS 19 The contributions made by entities are treated as an expense. Companies may choose whether to recognize obligations under defined benefit schemes. If such obligations are recognized, the company may choose whether to recognize them in full or on a partial basis. If the obligations are not recognized, the estimated unrecognized pension commitments have to be disclosed in the notes to the financial statements. Post 1Jan2005: Listed entities must follow IAS 19.
Germany	HGB 243 and IAS 19 In the balance sheet, the entity should recognize a defined benefit liability or asset, which shall be the net total of the present value of the DBO and the fair value of plan assets. A surplus should be recognized as a separate asset on the face of the balance sheet. No specific actuarial valuation method is specified. In most cases, pension accruals are traditionally calculated in accordance with tax regulations which specify actuarial methods and the basis for the calculation in accounting for pensions. German law generally fails to take account of future salary increases, future plan amendments and ignores employees under 30. German law also fixes the discount rate at 6%. This determines the minimum accrual that must be recognized in the financial statements. The amount of pension obligations recognized in the financial statements may be increased to take into account other valuation bases such as the present value, the cash value and the quoted cash value. Post 1Jan2005: Listed entities must follow IAS 19.
Hong Kong	SSAP 34 and HKAS 19 The defined benefit liability recognized on the balance sheet is the net total of the present value of the defined benefit obligation, plus unrecognized actuarial gains/losses, less any past service cost not recognized, less the fair value of the plan assets. The discount rate should be based on the yield on high quality corporate bonds and the projected unit credit method should be used. Entity should disclose the following: (1) present value of the defined benefit obligations, (2) the fair value of plan assets, (3) components of the pension expense, (4) actual return on plan assets and (5) assumptions about salary increases. Post 1Jan2005: As pre 2005, but the following must be disclosed in the footnotes: (1) the present value of the defined benefit obligation, (2) the components of the pension expense, (3) the fair value of plan assets, including the actual and expected rate of return on assets, (4) assumptions about salary increases, and (5) sensitivity analysis on the funded status of the plan.
IFRS	IAS 19 (amended in 2004) The amount recognized in the balance sheet should be the present value of the DBO, adjusted for unrecognized actuarial gains/losses and past service costs, less the fair value of plan assets. PBO should be determined by using the projected unit credit method. The discount rate should be based on the yield on high quality corporate debt. Entities must disclose the following: (1) the reconciliation of the present value of the DBO, (2) reconciliation of the fair value of plan assets, including expected and actual returns, (3) the pension expense recognized in the year, and the (4) the total amount recognized in comprehensive income in relation to the pension liability. IFRS required actuarial gains/losses to be recognized in profit or loss, either in the period they occur, or spread over the service life of employees. Post 1Jan2005: As pre 2005, but entities have the option to recognize actuarial gains/losses in full in the period in which they occur, outside of the profit and loss account, in the statement of comprehensive income.
India	AS 15 Similar to IFRS, except that a detailed actuarial valuation to determine the present value of the benefit obligation is carried out at least once every three years, and the fair value of plan assets are determined at each balance sheet date. Actuarial gains and losses should be recognized immediately in the profit and loss statement as an income or expense. Market yields at the balance sheet date on government bonds are used as discount rates. The disclosure rules are similar to IFRS except for the differences mentioned above.
Indonesia	PSAK 24 An entity should disclose in the balance sheet the total liabilities arising as a result of the difference between the amount of funding made by the employer to the fund and the recognized pension liabilities. The following must be disclosed: (1) total liabilities due to the defined benefit plan and the expense for the year, and (2) the fair value of assets and the funded status. Entities are not required to state the full funded status in the balance sheet but must disclose it in the notes. The liability must be calculated using the projected unit credit method, and the discount rate is the yield on high quality corporate debt.
Ireland	SSAP 24 and IAS 19 Requires projected unit credit method for defined benefit schemes. Actuarial gains and losses are recorded outside the P&L. Post 1Jan2005: Listed entities must follow IAS 19.

*(continued)*

## Supplemental Appendix A: Accounting Standards for Post-Retirement Plans (continued)

	Accounting Standard	Recognition and Disclosure
Japan	ASBJ 12	In the balance sheet, companies are required to recognize the net of the retirement benefit obligations adjusted for unrecognized liabilities for past service costs and unrecognized actuarial gains and losses, less the amount of pension assets. The PBO is computed by discounting the amount of the estimated retirement benefits that are deemed to have been incurred as of the balance sheet date at a certain discount rate and over the remaining service years. Liabilities for retirement benefits are computed by discounting the amount that is part of the estimated retirement benefit payments and recognized to have been incurred before the end of the accounting period using a certain discount rate over the remaining service lives of employees, adjusted for past service costs and unrecognized actuarial gains and losses, less the pension asset balance.
Korea, Republic Of	KFAS 27, interpretations 13-27, KAI opinion 05-2	The amount companies are required to recognize as retirement benefit obligation for existing employees is the lump sum payment to all existing employees assuming that they are terminated at the balance sheet date less the fair value of plan assets. Actuarial gains and losses have to be recognized immediately in the income statement. Assets valued at market values. The required discount rate must be the yield on national government debt.
Luxembourg	Lux GAAP and IAS 19	For defined benefit plans, provisions are usually provided if the plan is significantly unfunded. Plan assets are to be valued at the lower of cost or market value. A risk free rate is not required for discounting, a higher rate may be used. No specific rules regarding the treatment of actuarial gains/losses. Post 1Jan2005: Listed entities must follow IAS 19.
Malaysia	FRS 119	The amount recognized as a liability should be the net total of the present value of the DBO less the fair value of plan assets. Actuarial gains/losses are recognized immediately in the statement of total recognized gains and losses and are not recycled in the P&L. An entity is required to disclose the following in the financial statements: (1) the present value of the DBO, (2) fair value of assets, (3) net actuarial gains/losses not recognized in the balance sheet, (4) total pension expense recognized in the year, and (5) the expected and actual return on plan assets. The discount rate used should be the yield on high quality corporate bonds.
Mexico	NIF D-3	Entities are required to recognize on the balance sheet the defined benefit obligation plus or minus any unrecognized actuarial gains/losses or prior-service costs and less the fair value of plan assets. Mexican FRS permits companies to either: 1) record an expense for actuarial gains/losses in the period incurred within the statement of operations, or 2) defer such costs through the use of the corridor approach (or any systematic method that results in faster recognition than the corridor approach). Whether actuarial gains/losses are recognized immediately or are amortized in a systematic way, they are ultimately recorded within the statement of operations as components of the net pension cost. Mexican FRS permits companies to either: 1) record prior-service cost in the period incurred within the statement of operations, or 2) defer such costs through the use of the corridor approach (or any systematic method that results in faster recognition than the corridor approach). Whether prior-services cost is recognized immediately or is amortized in a systematic way, they are ultimately recorded within the statement of operations as components of net periodic pension expense. Plan assets should always be measured at fair value, and the fair value should be used to determine the expected return on plan assets. However, the expected rate of return should be consistent with the selection of the discount rate. All components of the net pension cost must be aggregated and presented as a net amount in the income statement.
Netherlands	DAS 271 and IAS 19	Dutch GAAP applies a liability approach to pension accounting. The pension contributions payable by the employer to the pension fund are expensed. Under Dutch GAAP, entities have no requirement to use or disclose a discount rate, or the fair value of plan assets. Entities are also not required to use an actuarial method to value the pension liability. And there is no requirement to disclose the expected return on plan assets. Post 1Jan2005: Listed entities must follow IAS 19.
New Zealand	FRS 32 and IAS 19	The balance sheet should show the assets of the plan, the liabilities, and disclose the liability for accrued benefits and other liabilities by class of liabilities. The notes to the accounts should include a summary of the scheme, details of investments, vested benefits, movement in accrued benefits, any benefits that have been guaranteed, the method used to determine net market value. Accrued benefits are measured at the end of each reporting period as the amount of benefits paid to participants adjusted for any change in the amount of accrued benefits during the period. Post 1Jan2005: Listed entities must follow IAS 19.
South Africa	AC 116 and IAS 19	Defined benefit liability recognized shall be the net total of the following amounts: (1) present value of defined benefit obligation at end of the period; (2) minus the fair value of any plan assets at end of the period out of which the obligations are to be settled directly (if any); (3) plus (minus) any unrecognized actuarial gains (losses); (4) minus any unrecognized past service costs. The actuarial method used must be the Projected Unit Credit Method. Actuarial gains/losses choice: (1) recognize immediately in profit or loss; or (2) recognize in profit or loss, but defer using corridor method (or a method resulting in faster recognition); or (3) recognize immediately in other comprehensive income. Post 1Jan2005: Listed entities must follow IAS 19.
Switzerland	Swiss GAAP FER 26 (from 1Jan2004, revised 1Jan2009).	Components of the cost of a plan are any contributions paid plus/minus the difference between the estimated benefit/obligation at the beginning and at the end of the period. Any difference between the estimated benefit/obligation at the beginning and at the end of the period are directly recognized in the income statement. Companies have to disclose a surplus or a deficit as well as a separately recognized employer contribution reserve, together with the contractual regulations. Swiss GAAP also allows the alternative adoption of IFRS or U.S. GAAP in presenting the economic impact of pension obligations. Entities applying this option only use respective prescriptions for pension obligations. Starting with annual reports for 2005 and interim reports for 2006, most Swiss companies whose equity shares are listed on the main board of the Swiss Exchange are required to prepare their financial statements using either IFRS or U.S. GAAP. Swiss GAAP will not be permitted. The only exception is for Swiss companies listed on the main board that are not multinational (that is, operate primarily in Switzerland). Those companies may continue to use the Swiss GAAP, or they may choose IFRS or U.S. GAAP. Foreign listed companies may continue to use a national GAAP that the exchange deems to be equivalent to IFRS or U.S. GAAP.
Russian Federation	RAR 10/99, RAR 15/01	Contributions to the Russian Federation Pension Fund are accrued as expenses at the same time as salaries and transferred to the Pension Fund as the salaries are paid. Entities do not create pension assets. Additional obligations taken by entities under contracts with non-governmental pension funds are accrued and recognized as expenses when contributions become due under the contract. Liabilities related to pension benefits in the future are not recognized for accounting and reporting purposes.

*(continued)*

## Supplemental Appendix A: Accounting Standards for Post-Retirement Plans (continued)

	Accounting Standard	Recognition and Disclosure
United Kingdom	FRS 17 and IAS 19	The surplus/deficit in a defined benefit scheme is the excess/shortfall of the value of the plan assets over/below the present value of the scheme liabilities. The employer should recognize a surplus as an asset to the extent that it is able to recover a surplus either through reduced contributions in the future or through refunds from the scheme. The employer should recognize a deficit as a liability to the extent that it reflects its legal or constructive obligation. The liability should be analyzed into the following components: The current service cost, interest cost, expected return on assets, actuarial gains and losses, past service costs and gains/losses on settlements. Actuarial gains/losses should be recognized in the statement of total recognized gains and losses for the period. Companies have to disclose the expected rate of return on the plan assets. Pension liabilities are discounted at the current rate of return on a high quality corporate bond of equivalent term and currency to the liability. Post 1Jan2005: Listed entities must follow IAS 19.
United States	SFAS 87, 88, 106, 132 (revised in 2003) and 158	SFAS 87 requires an entity recognize a liability (unfunded accrued pension cost) if the net periodic pension cost recognized exceeds the amounts the employer has contributed to the plan. An asset (prepaid pension cost) is recognized if net periodic pension cost is less than amounts the employer has contributed to the plan. If the accumulated benefit obligation exceeds the fair value of plan assets, the employer shall recognize in the statement of financial position a liability (including unfunded accrued pension cost) that is at least equal to the unfunded accumulated benefit obligation. Recognition of an additional minimum liability is required if an unfunded accumulated benefit obligation exists and (a) an asset has been recognized as prepaid pension cost, (b) the liability already recognized as unfunded accrued pension cost is less than the unfunded accumulated benefit obligation, or (c) no accrued or prepaid pension cost has been recognized. If an additional minimum liability is recognized pursuant to above, an equal amount shall be recognized as an intangible asset, provided that the asset recognized shall not exceed the amount of unrecognized prior service cost. SFAS 132 requires the following: (1) a reconciliation of the beginning and ending PBO, (2) a reconciliation of the beginning and ending fair value of plan assets, (3) a reconciliation of the funded status of the plan and that reported in the financial statements (under SFAS 87 and 106). SFAS 158 requires: (1) recognition of the funded status of a benefit plan - measured as the difference between plan assets at fair value (with limited exceptions) and the benefit obligation - in its statement of financial position, (2) recognition as a component of other comprehensive income, net of tax, the gains or losses and prior service costs or credits that arise during the period but are not recognized as components of net periodic benefit cost pursuant to FASB Statement No. 87, (3) measurement of defined benefit plan assets and obligations as of the date of the employer's fiscal year-end statement of financial position, (4) disclosure in the notes to financial statements of additional information about certain effects on net periodic benefit cost for the next fiscal year that arise from delayed recognition of the gains or losses, prior service costs or credits, and transition asset or obligation. SFAS 158 eliminated the disclosure rule concerning the company's 'minimum pension liability'.

## Supplemental Appendix B: Variable Definitions

The table shows the definitions of the main variables used in the analysis. Panel A refers to firm-level variables, while Panel B refers to country-level variables.

Variable	Definition
<b>Panel A: Firm Characteristics</b>	
Age (log)	Natural logarithm of Firm Age
Capital Expenditures/Total Assets	Capital Expenditures/Total Assets with missing values of Capital Expenditures set to zero
(Cash + Short-Term Investments)/Total Assets (log)	Natural logarithm of (Cash + Short-Term Investments)/(Total Assets - (Cash + Short-Term
Convertible Debt/Size Market Value	Convertible Debt/Size Market Value
Debt Maturity	Long-Term Debt (due more than one year)/Total Debt
Discount Rate	Discount rate represents the annual rate at which the projected future pension liabilities are discounted back to the present date. It reflects combined plans data where multiple plans exist.
Dividend	Dummy variable with value one if a dividend was paid and zero otherwise
Employees (log)	Natural logarithm of the number of both full and part time employees of the company. It excludes seasonal employees and emergency employees.
Expected Return on Plan Assets	Expected Return on Plan Assets represents an estimate of the rate of return to be earned over the period until all pension benefits under the plan have been paid. It reflects combined plans data where multiple plans exist.
Fair Value of Plan Assets	Fair Value of Plan Assets represents the value of the investments in the plan at a particular point in time, alternatively for Pension Plans, Health Care Plans or total Post-Retirement Plans. It reflects combined plans data where multiple plans exist.
Fair Value of Plan Assets/Total Assets	Fair Value of Plan Assets/Consolidated Total Assets
Funding Level/Total Assets	(Fair Value of Plan Assets - Projected Benefit Obligations)/Total Assets
Gross Profit Margin (3-year average)	Average of up to 3 years of Gross Profit Margin
Health Care Plan	Indicator variable with value one if firm has a Defined Benefit Health Care Plan and zero otherwise
Idiosyncratic Risk (log)	Natural logarithm of annualized standard deviation of residuals of regression of returns on local market, world market, world and regional SMB and HML
Industry Median Leverage	Industry median book leverage at the four-digit SIC level
Interest Expense Ratio	(Interest Expense On Debt + Contributions)/Interest Expense On Debt, alternatively with Pension Contributions, Health Care Contributions or total Post-Retirement Contributions
Long-Term Debt/Net Total Assets	Long-Term Debt/(Total Assets - Accounts Payable - Other Liabilities)
Long-Term Debt/Net Total Assets Market Value	Long-Term Debt/(Total Assets - Book Value of Common Equity + Market Capitalization - Accounts Payable - Other Liabilities)
Long-Term Debt/Size Book Value	Long-Term Debt/(Book Value of Common Equity + Preferred Stock + Total Debt)
Long-Term Debt/Size Market Value	Long-Term Debt/(Market Capitalization + Preferred Stock + Total Debt)
Long-Term Debt/Total Assets	Long-Term Debt/Total Assets
Long-Term Debt/Total Assets Market Value	Long-Term Debt/(Total Assets - Book Value of Common Equity + Market Capitalization)
(Long-Term Debt + Preferred Stock)/Net Total Assets	(Long-Term Debt + Preferred Stock)/(Total Assets - Accounts Payable - Other Liabilities)
(Long-Term Debt + Preferred Stock)/Net Total Assets Market Value	(Long-Term Debt + Preferred Stock)/(Total Assets - Book Value of Common Equity + Market Capitalization - Accounts Payable - Other Liabilities)
(Long-Term Debt + Preferred Stock)/Size Book Value	(Long-Term Debt + Preferred Stock)/(Book Value of Common Equity + Preferred Stock + Total Debt)
(Long-Term Debt + Preferred Stock)/Size Market Value	(Long-Term Debt + Preferred Stock)/(Market Capitalization + Preferred Stock + Total Debt)
(Long-Term Debt + Preferred Stock)/Total Assets	(Long-Term Debt + Preferred Stock)/Total Assets
(Long-Term Debt + Preferred Stock)/Total Assets Market Value	(Long-Term Debt + Preferred Stock)/(Total Assets - Book Value of Common Equity + Market Capitalization)
Market Risk (log)	Natural logarithm of square root of the difference between total risk squared and idiosyncratic risk squared
Market-to-Book	Market Capitalization/Book Value of Common Equity
Negative Book Equity	Dummy variable with value one if Book Value of Common Equity or Book Value Per Share is negative and zero otherwise
Net FX-Exposure	(Foreign Sales/Total Sales) - (Foreign Assets/Total Assets)
Net Amounts on Balance Sheet/Total Assets	(Pre-Paid Post-Retirement Costs - Accrued Post-Retirement Costs)/Total Assets
Net PPE/Total Assets	Property, Plant and Equipment (net)/Total Assets
PBO/Total Assets	Projected Benefit Obligations/Consolidated Total Assets with missing values of PBO set to zero
Pension Plan	Indicator variable with value one if firm has a Defined Benefit Pension Plan and zero otherwise
Post-Retirement Benefit Plan	Indicator variable with value one if firm has a Defined Benefit Pension or Health Care Plan and zero otherwise
Preferred Stock/Size Market Value	Preferred Stock/(Market Capitalization + Preferred Stock + Total Debt)
Projected Benefit Obligation (PBO)	Projected Benefit Obligation (PBO) represents a measure of a plan's liability at the calculation date assuming that the plan is ongoing and will not terminate in the foreseeable future, alternatively for Pension Plans, Health Care Plans or total Post-Retirement Plans. It reflects combined plans data where multiple plans.
R&D Expense/Total Assets	Research & Development Expenses/Total Assets with missing values of R&D set to zero
ROA (3-year average)	Average of up to 3 years of Return On Assets

*(continued)*

## Supplemental Appendix B: Variable Definitions (continued)

Variable	Definition
Size Book Value	Book Value of Common Equity + Preferred Stock + Total Debt
Size Market Value	Market Capitalization + Preferred Stock + Total Debt
Tangible Assets/Total Assets	(Total Assets - Intangible Assets)/Total Assets
Tax Benefits (5%)/Market Capitalization	Tax Benefits using 5% as discount rate/Market Capitalization, alternatively for Pension Contributions, Health Care Contributions or total Post-Retirement Contributions in addition to Interest Expenses on
Tax Benefits (5%)/Total Assets	Tax Benefits using 5% as discount rate/Total Assets, alternatively for Pension Contributions, Health Care Contributions or total Post-Retirement Contributions in addition to Interest Expenses on Debt
Tax Benefits (Avg)/Market Capitalization	Tax Benefits using as discount rate the estimated average interest rate on debt (Interest Expense on Debt/(Short-Term Debt + Current Portion of Long-Term Debt + Long-Term Debt))/Market Capitalization, alternatively for Pension Contributions, Health Care Contributions or total Post-Retirement Contributions in addition to Interest Expenses on Debt
Tax Benefits (Avg)/Total Assets	Tax Benefits using as discount rate the estimated average interest rate on debt (Interest Expense on Debt/(Short-Term Debt + Current Portion of Long-Term Debt + Long-Term Debt))/Total Assets, alternatively for Pension Contributions, Health Care Contributions or total Post-Retirement Contributions
Tax Rate	Corporate Tax Rate (Income Taxes/Pre-Tax Income)
Total Assets	Total Assets
Total Assets in USD (log)	Natural logarithm of Total Assets (in USD)
Total Debt	Total Debt
Total Risk (log)	Natural logarithm of annualized standard deviation of stock returns in U.S. Dollars
Total Assets Market Value	Total Assets - Book Value of Common Equity + Market Capitalization
Total Debt/Net Total Assets	Total Debt/(Total Assets - Accounts Payable - Other Liabilities)
Total Debt/Net Total Assets Market Value	Total Debt/(Total Assets - Book Value of Common Equity + Market Capitalization - Accounts Payable - Other Liabilities)
Total Debt/Size Book Value	Total Debt/(Book Value of Common Equity + Preferred Stock + Total Debt)
Total Debt/Size Market Value	Total Debt/(Market Capitalization + Preferred Stock + Total Debt)
Total Debt/Total Assets	Total Debt/Total Assets
Total Debt/Total Assets Market Value	Total Debt/(Total Assets - Book Value of Common Equity + Market Capitalization)
Volatility of ROA (log)	Natural logarithm of the standard deviation of return on assets over prior 5 years
Z-Score	Altman(2000) Z-Score
<b>Panel B: Country Characteristics</b>	
Corporate Tax Rate	Top marginal corporate income tax rate (OECD)
Creditor Rights	An index aggregating creditor rights (from Djankov, McLiesh and Shleifer, 2007)
Employee Tenure	Average employee tenure for dependent employment (OECD)
Employment Laws	Measures the protection of labor and employment laws (from Botero, Djankov, La Porta, Lopez de Silanes and Shleifer, 2004)
Employment Protection	Average of 21 dimensions of employment protection with regards to individual and collective dismissal (regular and temporary contracts) (OECD)
Guarantee	Indicator variable with value 1 if country has post-retirement guarantee fund; 0 otherwise (from Secunda, 2014; Stewart, 2007a)
Labor Market Freedom	Labor market flexibility index (from Lawson and Bierhanzl, 2004)
Law and Order	Index of strength and impartiality of the legal system and popular observance of the law (PRS Group)
Pension Fund Assets/GDP	Pension Fund Assets of DB plans/ GDP (from OECD)
Pension Tax Generosity	Classification into four groups based on generosity of tax treatment of pensions (Whitehouse, 2005)
Priority of Unfunded Pension	Classification of countries by seniority of unfunded pension obligations (Secunda, 2014)
Private Bond Market Capitalization/GDP	Private domestic debt securities issued by financial institutions and corporations as a share of GDP (from Financial Structure Dataset by Beck and Demirgüç-Kunt (2009), updated November 2010)
Private Credit/GDP	Private credit by deposit money banks and other financial institutions to GDP (from Financial Structure Dataset by Beck and Demirgüç-Kunt (2009), updated November 2010)
Rule of Law	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence (from WGI database, 2011 update)
Union Density	Measures the percentage of the total work force affiliated to labor unions in 1997 (from Botero, Djankov, La Porta, Lopez de Silanes and Shleifer, 2004)
Unionization	Ratio of wage and salary earners that are trade union members divided by the total number of wage and salary earners (OECD)

## Supplemental Appendix C: Summary Statistics

The table shows summary statistics of the main variables used in the analysis. Definitions of all variables are provided in Supplemental Appendix B.

	Observations	Mean	Std. Dev.	Skewness	Kurtosis	Minimum	Percentiles								
							1st	5th	25th	Median	75th	95th	99th	Maximum	
Post-Retirement Benefit Plan	325,710	0.12	0.33	2.27	3.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00
Pension Plan	325,710	0.12	0.33	2.30	3.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00
Health Care Plan	325,710	0.02	0.15	6.39	38.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00
PBO/Total Assets	325,710	0.01	0.06	6.35	47.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.31	0.64
Fair Value of Plan Assets/Total Assets	40,610	0.07	0.10	2.25	5.2	0.00	0.00	0.00	0.00	0.03	0.09	0.30	0.51	0.51	0.51
Funding Level/Total Assets	40,611	-0.04	0.06	-2.36	6.79	-0.33	-0.33	-0.17	-0.05	-0.02	0.00	0.00	0.06	0.06	0.06
Net Amounts on Balance Sheet/Total Assets	41,288	-0.03	0.05	-2.46	6.92	-0.25	-0.25	-0.13	-0.04	-0.01	0.00	0.00	0.02	0.02	0.02
Total Risk (log)	197,526	-0.65	0.61	0.33	-0.05	-2.05	-2.03	-1.58	-1.08	-0.69	-0.28	0.47	0.94	0.94	0.94
Idiosyncratic Risk (log)	197,526	-0.86	0.65	0.37	-0.03	-2.36	-2.31	-1.84	-1.31	-0.91	-0.46	0.37	0.85	0.85	0.85
Market Risk (log)	197,526	-1.32	0.61	0.07	-0.23	-2.79	-2.77	-2.30	-1.73	-1.33	-0.91	-0.28	0.14	0.20	0.20
Capital Expenditures/Total Assets	325,710	0.03	0.06	2.89	9.47	0.00	0.00	0.00	0.00	0.01	0.04	0.16	0.34	0.34	0.34
R&D Expense/Total Assets	325,710	0.01	0.05	5.01	27.0	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.33	0.33	0.33
Employees (log)	164,534	6.35	2.11	-0.23	0.11	0.69	0.69	2.56	5.09	6.40	7.74	9.79	11.2	11.2	11.2
Market-to-Book	186,845	2.28	4.59	2.77	19.0	-15.1	-14.9	-0.03	0.75	1.43	2.69	8.00	29.8	31.1	31.1
ROA (3-year average)	189,144	-0.02	0.21	-2.54	7.52	-1.00	-1.00	-0.49	-0.02	0.03	0.08	0.18	0.28	0.40	0.40
Volatility of ROA (log)	200,634	-3.15	1.25	-0.16	0.05	-9.56	-6.16	-5.17	-4.00	-3.18	-2.27	-1.06	-0.60	-0.01	-0.01
Age (log)	325,582	2.45	0.76	-0.69	0.22	0.00	0.00	1.10	1.95	2.56	3.00	3.61	3.71	3.83	3.83
Tax Rate	129,634	0.30	0.20	1.10	2.33	0.00	0.00	0.00	0.17	0.30	0.39	0.65	1.00	1.00	1.00
Total Assets in USD (log)	203,893	11.60	2.10	-0.03	0.19	5.86	5.89	8.11	10.3	11.6	12.9	15.2	16.9	16.9	16.9
Z-Score	175,594	1.35	4.13	-1.81	5.29	-17.6	-17.2	-6.52	0.09	1.98	3.73	6.44	8.20	12.1	12.1
Net PPE/Total Assets	202,970	0.30	0.24	0.71	-0.32	0.00	0.00	0.01	0.10	0.26	0.45	0.76	0.92	0.92	0.92
Tangible Assets/Total Assets	193,939	0.90	0.16	-2.21	4.39	0.25	0.25	0.51	0.89	0.99	1.00	1.00	1.00	1.00	1.00
Dividend	325,710	0.33	0.47	0.74	-1.45	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00
Net FX-Exposure	84,256	0.08	0.21	1.37	4.20	-1.00	-0.39	-0.12	0.00	0.00	0.11	0.54	0.85	1.00	1.00
Debt Maturity	171,702	0.48	0.35	0.00	-1.42	0.00	0.00	0.00	0.12	0.49	0.80	1.00	1.00	1.00	1.00
Gross Profit Margin (3-year average)	188,199	0.24	0.26	-1.21	5.57	-1.00	-0.90	-0.08	0.12	0.23	0.37	0.66	0.84	0.89	0.89
Preferred Stock/Size Market Value	185,688	0.00	0.02	7.29	54.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.20	0.20
Convertible Debt/Size Market Value	128,890	0.01	0.04	4.87	24.6	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.28	0.28	0.28
(Cash + Short-Term Investments)/Total Assets (log)	201,083	-2.21	1.57	-0.96	1.88	-15.7	-7.00	-5.01	-3.08	-2.05	-1.10	0.00	0.00	0.00	0.00
Negative Book Equity	325,710	0.04	0.19	4.88	21.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00
Industry Median Leverage	322,992	0.18	0.11	0.45	0.6	0.00	0.00	0.02	0.10	0.17	0.25	0.35	0.45	1.00	1.00
Gross Leverage															
Total Debt/Size Book Value	192,401	0.28	0.25	0.56	-0.70	0.00	0.00	0.00	0.03	0.25	0.47	0.75	0.91	0.92	0.92
(Long-Term Debt + Preferred Stock)/Size Book Value	192,034	0.15	0.19	1.37	1.23	0.00	0.00	0.00	0.00	0.07	0.25	0.55	0.78	0.79	0.79
Long-Term Debt/Size Book Value	192,034	0.15	0.18	1.37	1.23	0.00	0.00	0.00	0.00	0.07	0.24	0.54	0.76	0.77	0.77
Total Debt/Total Assets	203,696	0.23	0.22	1.22	1.53	0.00	0.00	0.00	0.03	0.18	0.35	0.64	1.00	1.00	1.00
(Long-Term Debt + Preferred Stock)/Total Assets	203,229	0.13	0.19	2.33	6.52	0.00	0.00	0.00	0.00	0.05	0.19	0.49	1.00	1.00	1.00
Long-Term Debt/Total Assets	203,229	0.12	0.17	2.07	4.92	0.00	0.00	0.00	0.00	0.05	0.18	0.46	0.86	0.87	0.87
Total Debt/Net Total Assets	202,036	0.27	0.29	2.07	6.92	0.00	0.00	0.00	0.03	0.21	0.41	0.73	1.73	1.75	1.75
(Long-Term Debt + Preferred Stock)/Net Total Assets	201,584	0.15	0.22	2.65	9.28	0.00	0.00	0.00	0.00	0.06	0.22	0.55	1.32	1.33	1.33
Long-Term Debt/Net Total Assets	201,584	0.14	0.19	2.03	4.86	0.00	0.00	0.00	0.00	0.06	0.21	0.51	0.98	0.99	0.99
Total Debt/Size Market Value	186,640	0.25	0.25	0.91	-0.20	0.00	0.00	0.00	0.02	0.17	0.41	0.76	0.92	0.93	0.93
(Long-Term Debt + Preferred Stock)/Size Market Value	186,514	0.13	0.17	1.67	2.47	0.00	0.00	0.00	0.00	0.05	0.20	0.51	0.77	0.79	0.79
Long-Term Debt/Size Market Value	186,514	0.12	0.17	1.67	2.42	0.00	0.00	0.00	0.00	0.05	0.19	0.49	0.73	0.76	0.76
Total Debt/Total Assets Market Value	176,934	0.18	0.18	0.99	0.17	0.00	0.00	0.00	0.01	0.12	0.28	0.54	0.69	0.71	0.71
(Long-Term Debt + Preferred Stock)/Total Assets Market Value	176,747	0.09	0.12	1.71	2.73	0.00	0.00	0.00	0.00	0.04	0.14	0.36	0.55	0.57	0.57
Long-Term Debt/Total Assets Market Value	176,747	0.09	0.12	1.71	2.72	0.00	0.00	0.00	0.00	0.04	0.14	0.35	0.54	0.56	0.56
Total Debt/Net Total Assets Market Value	176,925	0.20	0.21	0.97	0.03	0.00	0.00	0.00	0.02	0.14	0.33	0.63	0.79	0.80	0.80

*(continued)*

## Supplemental Appendix C: Summary Statistics (continued)

	Observations						Percentiles							
	Mean	Std. Dev.	Skewness	Kurtosis	Minimum	1st	5th	25th	Median	75th	95th	99th	Maximum	
(Long-Term Debt + Preferred Stock)/Net Total Assets Market Value	176,738	0.10	0.14	1.65	2.41	0.00	0.00	0.00	0.00	0.04	0.16	0.40	0.61	0.63
Long-Term Debt/Net Total Assets Market Value	176,738	0.10	0.14	1.65	2.39	0.00	0.00	0.00	0.00	0.04	0.16	0.40	0.60	0.62
<b>Leverage Net of (Cash + Short-Term Investments)</b>														
Total Debt/Size Book Value	186,677	-0.33	1.92	-5.34	32.4	-14.3	-14.0	-2.47	-0.29	0.11	0.40	0.72	0.90	0.91
(Long-Term Debt + Preferred Stock)/Size Book Value	186,343	-0.50	1.91	-5.46	33.5	-14.5	-14.3	-2.58	-0.39	-0.06	0.15	0.50	0.75	0.76
Long-Term Debt/Size Book Value	186,343	-0.51	1.92	-5.47	33.6	-14.6	-14.4	-2.59	-0.39	-0.06	0.14	0.49	0.73	0.74
Total Debt/Total Assets	203,393	-0.19	1.28	-5.19	31.4	-9.34	-9.34	-1.59	-0.20	0.07	0.29	0.61	1.00	1.00
(Long-Term Debt + Preferred Stock)/Total Assets	202,931	-0.30	1.24	-5.34	32.8	-9.25	-9.25	-1.61	-0.26	-0.04	0.11	0.44	1.00	1.00
Long-Term Debt/Total Assets	202,931	-0.32	1.27	-5.43	33.5	-9.55	-9.55	-1.65	-0.26	-0.04	0.10	0.41	0.83	0.85
Total Debt/Net Total Assets	200,205	-0.21	1.45	-4.97	29.4	-10.41	-10.41	-1.87	-0.24	0.09	0.34	0.69	1.70	1.74
(Long-Term Debt + Preferred Stock)/Net Total Assets	199,767	-0.34	1.38	-5.15	30.8	-10.18	-10.18	-1.89	-0.31	-0.04	0.13	0.50	1.29	1.31
Long-Term Debt/Net Total Assets	199,767	-0.37	1.43	-5.31	32.2	-10.65	-10.65	-1.94	-0.32	-0.05	0.12	0.46	0.94	0.95
Total Debt/Size Market Value	183,560	0.02	0.64	-3.27	16.0	-3.88	-3.75	-0.85	-0.12	0.07	0.34	0.74	0.91	0.93
(Long-Term Debt + Preferred Stock)/Size Market Value	183,438	-0.13	0.63	-4.05	21.6	-4.29	-4.13	-0.98	-0.18	-0.03	0.12	0.46	0.75	0.77
Long-Term Debt/Size Market Value	183,438	-0.14	0.63	-4.12	22.1	-4.31	-4.15	-0.98	-0.19	-0.03	0.11	0.44	0.71	0.74
Total Debt/Total Assets Market Value	175,946	0.01	0.40	-2.56	11.13	-2.24	-2.17	-0.59	-0.11	0.04	0.22	0.50	0.67	0.69
(Long-Term Debt + Preferred Stock)/Total Assets Market Value	175,761	-0.09	0.37	-3.24	15.5	-2.33	-2.27	-0.63	-0.15	-0.03	0.08	0.32	0.53	0.55
Long-Term Debt/Total Assets Market Value	175,761	-0.09	0.37	-3.27	15.7	-2.33	-2.27	-0.64	-0.15	-0.03	0.07	0.31	0.52	0.54
Total Debt/Net Total Assets Market Value	175,341	0.01	0.49	-2.84	12.90	-2.84	-2.77	-0.71	-0.12	0.05	0.26	0.59	0.77	0.78
(Long-Term Debt + Preferred Stock)/Net Total Assets Market Value	175,158	-0.11	0.46	-3.55	17.5	-2.99	-2.92	-0.78	-0.17	-0.03	0.09	0.36	0.59	0.61
Long-Term Debt/Net Total Assets Market Value	175,158	-0.11	0.46	-3.58	17.6	-2.99	-2.93	-0.79	-0.17	-0.03	0.09	0.35	0.57	0.60
<b>Consolidated Leverage</b>														
Total Debt/Total Assets	37,780	0.32	0.19	0.56	0.08	0.01	0.01	0.04	0.17	0.30	0.43	0.66	0.90	0.90
Total Debt/Size Market Value	36,514	0.37	0.24	0.51	-0.58	0.00	0.00	0.03	0.17	0.33	0.54	0.82	0.97	0.97
<b>Consolidated Leverage Net of (Cash + Short-Term Investments)</b>														
Total Debt/Total Assets	37,780	0.21	0.29	-0.63	1.17	-0.78	-0.77	-0.29	0.05	0.24	0.39	0.64	0.89	0.89
Total Debt/Size Market Value	36,412	0.25	0.35	-0.70	1.75	-1.10	-1.10	-0.30	0.05	0.25	0.48	0.80	0.97	0.97
<b>Post-Retirement Benefits</b>														
Interest Expense Ratio	38,427	4.74	15.3	5.98	39.3	-11.7	-11.7	-0.66	1.01	1.26	2.65	18.4	121.5	121.5
Tax Benefits (5%)/Total Assets	32,126	0.11	0.17	1.79	6.91	-0.36	-0.36	-0.03	0.03	0.08	0.16	0.41	0.90	0.90
Tax Benefits (Avg)/Total Assets	29,540	0.18	0.30	3.14	13.1	-0.40	-0.40	-0.02	0.03	0.09	0.21	0.71	1.89	1.91
Tax Benefits (5%)/Market Capitalization	31,170	0.27	0.53	3.74	17.0	-0.51	-0.51	-0.03	0.02	0.10	0.29	1.17	3.49	3.50
Tax Benefits (Avg)/Market Capitalization	28,676	0.46	1.00	3.94	18.0	-0.62	-0.62	-0.02	0.03	0.13	0.42	2.21	6.58	6.58
<b>Pension Benefits</b>														
Interest Expense Ratio	37,879	4.77	15.5	6.00	39.6	-12.0	-12.0	-0.78	1.01	1.25	2.64	18.5	124.1	124.1
Tax Benefits (5%)/Total Assets	31,653	0.11	0.16	1.74	6.92	-0.37	-0.37	-0.03	0.02	0.08	0.16	0.41	0.90	0.90
Tax Benefits (Avg)/Total Assets	29,121	0.18	0.31	3.14	13.1	-0.41	-0.41	-0.03	0.03	0.09	0.21	0.72	1.92	1.92
Tax Benefits (5%)/Market Capitalization	30,713	0.27	0.54	3.73	17.0	-0.54	-0.54	-0.03	0.02	0.10	0.29	1.17	3.50	3.50
Tax Benefits (Avg)/Market Capitalization	28,270	0.46	1.01	3.93	17.9	-0.64	-0.64	-0.03	0.03	0.13	0.42	2.21	6.65	6.65
<b>Health Care Benefits</b>														
Interest Expense Ratio	7,392	1.25	0.67	4.85	27.0	0.41	0.41	0.96	1.01	1.06	1.20	2.09	5.86	5.86
Tax Benefits (5%)/Total Assets	5,955	0.13	0.14	3.01	12.0	0.00	0.00	0.00	0.05	0.09	0.15	0.37	0.91	0.91
Tax Benefits (Avg)/Total Assets	5,660	0.10	0.08	2.08	5.95	0.00	0.00	0.00	0.04	0.08	0.12	0.26	0.49	0.49
Tax Benefits (5%)/Market Capitalization	5,755	0.22	0.42	4.35	21.7	0.00	0.00	0.00	0.03	0.09	0.21	0.87	2.88	2.88
Tax Benefits (Avg)/Market Capitalization	5,484	0.17	0.28	4.14	20.1	0.00	0.00	0.00	0.04	0.08	0.17	0.61	1.94	1.94
Discount Rate (%)	39,071	4.8	2.2	0.8	0.7	1.5	1.5	2.0	2.5	5.0	6.0	8.5	12.0	12.0
Expected Return on Plan Assets (%)	32,026	5.1	2.5	0.1	-1.2	0.8	0.8	1.5	2.8	5.2	7.5	9.0	11.0	11.0
<b>Pension Asset Allocation</b>														
Equities (%)	13,893	52.4	21.3	-0.8	0.3	0.0	0.0	3.0	41.0	57.7	67.0	79.8	94.0	100
Bonds (%)	13,893	33.5	18.4	0.6	1.3	0.0	0.0	0.0	23.0	32.8	42.5	66.0	93.0	100
Property (%)	13,893	2.5	5.9	5.0	42.9	0.0	0.0	0.0	0.0	0.0	3.0	13.0	26.0	97.0
Other (%)	13,893	11.6	20.3	3.0	9.1	0.0	0.0	0.0	0.9	4.0	12.0	55.7	100	100

## Supplemental Appendix D: Results for Firms with Consolidated Accounts

The table reports results from estimations of multivariate regression models with leverage as dependent variable. Regular leverage is measured by the ratio of total debt to consolidated total assets. Consolidated leverage is calculated by subtracting accrued post-retirement costs (including additional minimum liabilities where applicable) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (including intangible pension asset where applicable) from total assets and adding fair value of plan assets. The regression setup is the same as in column one of Table 4, but the sample is limited to observations where the accounts confirm that all subsidiaries are consolidated. For each equation, the table shows the estimated coefficients and associated  $p$ -values, as well as the adjusted R-squared and the number of observations. All equations include year, country and industry fixed effects (based on 4-digit SIC codes). All standard errors are clustered at the country level. Definitions of all variables are provided in Supplemental Appendix B.

	Regular Leverage		Consolidated Leverage	
	Coef	$p$ -value	Coef	$p$ -value
PBO/Total Assets	-0.217	[0.00]		
Post-Retirement Benefit Plan			0.068	[0.00]
Market-to-Book	0.007	[0.00]	0.007	[0.00]
Volatility of ROA (log)	-0.010	[0.00]	-0.007	[0.03]
Total Risk (log)	0.051	[0.00]	0.043	[0.00]
Tax Rate	0.024	[0.01]	0.023	[0.04]
Total Assets in USD (log)	0.012	[0.00]	0.014	[0.00]
Dividend	-0.024	[0.04]	-0.021	[0.11]
Tangible Assets/Total Assets	-0.148	[0.00]	-0.117	[0.00]
Net FX-Exposure	-0.034	[0.00]	-0.030	[0.00]
Debt Maturity	0.102	[0.00]	0.100	[0.00]
Gross Profit Margin (3-year average)	-0.054	[0.00]	-0.072	[0.00]
Preferred Stock/Size Market Value	-0.229	[0.00]	-0.231	[0.00]
Negative Book Equity	0.443	[0.00]	0.481	[0.00]
Industry Median Leverage	0.315	[0.00]	0.309	[0.00]
Intercept	0.162	[0.00]	0.066	[0.01]
Country fixed effects	yes		yes	
Industry fixed effects	yes		yes	
Year fixed effects	yes		yes	
SE Cluster	Country		Country	
Adjusted R <sup>2</sup>	0.37		0.40	
Observations	27,282		27,282	

## Supplemental Appendix E: Results for U.S. GAAP and IAS Compliant Firms

The table reports results from estimations of multivariate regression models with leverage as dependent variable. Regular leverage is measured by the ratio of total debt to consolidated total assets. Consolidated leverage is calculated by subtracting accrued post-retirement costs (including additional minimum liabilities where applicable) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (including intangible pension asset where applicable) from total assets and adding fair value of plan assets. The regression setup is the same as in column one of Table 4, but the sample is limited to firms reporting under IAS/U.S. GAAP. For each equation, the table shows the estimated coefficients and associated  $p$ -values, as well as the adjusted R-squared and the number of observations. All equations include year, country and industry fixed effects (based on 4-digit SIC codes). All standard errors are clustered at the country level. Definitions of all variables are provided in Supplemental Appendix B.

	Regular Leverage		Consolidated Leverage	
	Coef	$p$ -value	Coef	$p$ -value
PBO/Total Assets	-0.244	[0.00]		
Post-Retirement Benefit Plan			0.065	[0.00]
Market-to-Book	0.008	[0.00]	0.009	[0.00]
Volatility of ROA (log)	-0.012	[0.00]	-0.008	[0.01]
Total Risk (log)	0.044	[0.00]	0.034	[0.00]
Tax Rate	0.015	[0.09]	0.013	[0.22]
Total Assets in USD (log)	0.009	[0.00]	0.012	[0.00]
Dividend	-0.008	[0.14]	-0.005	[0.45]
Tangible Assets/Total Assets	-0.146	[0.00]	-0.112	[0.00]
Net FX-Exposure	-0.039	[0.00]	-0.038	[0.00]
Debt Maturity	0.115	[0.00]	0.114	[0.00]
Gross Profit Margin (3-year average)	-0.040	[0.00]	-0.063	[0.00]
Preferred Stock/Size Market Value	-0.267	[0.00]	-0.290	[0.00]
Negative Book Equity	0.464	[0.00]	0.504	[0.00]
Industry Median Leverage	0.319	[0.00]	0.307	[0.00]
Intercept	0.094	[0.00]	0.045	[0.03]
Country fixed effects	yes		yes	
Industry fixed effects	yes		yes	
Year fixed effects	yes		yes	
SE Cluster	Country		Country	
Adjusted R <sup>2</sup>	0.45		0.46	
Observations	16,104		16,104	

## Supplemental Appendix F: Results for Alternative Model Specification

The table reports results from estimations of multivariate regression models with leverage as dependent variable. Regular leverage is measured by the ratio of total debt to consolidated total assets. Consolidated leverage is calculated by subtracting accrued post-retirement costs (including additional minimum liabilities where applicable) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (including intangible pension asset where applicable) from total assets and adding fair value of plan assets. The regression setup is the same as in column one of Table 4, but the variables that have the biggest effect on sample size are excluded, namely the tax rate, net FX exposure, and the number of employees to increase the sample size. For each equation, the table shows the estimated coefficients and associated  $p$ -values, as well as the adjusted R-squared and the number of observations. All equations include year, country and industry fixed effects (based on 4-digit SIC codes). All standard errors are clustered at the country level. Definitions of all variables are provided in Supplemental Appendix B.

	Leverage		Consolidated	
	Coef	$p$ -value	Coef	$p$ -value
PBO/Total Assets	-0.309	[0.00]		
Post-Retirement Benefit Plan			0.031	[0.09]
Market-to-Book	0.006	[0.00]	0.007	[0.00]
Volatility of ROA (log)	-0.005	[0.01]	-0.004	[0.06]
Total Risk (log)	0.054	[0.00]	0.051	[0.00]
Total Assets in USD (log)	0.015	[0.00]	0.018	[0.00]
Dividend	-0.046	[0.00]	-0.043	[0.00]
Tangible Assets/Total Assets	-0.081	[0.00]	-0.066	[0.00]
Debt Maturity	0.102	[0.00]	0.102	[0.00]
Gross Profit Margin (3-year average)	-0.042	[0.00]	-0.048	[0.00]
Preferred Stock/Size Market Value	-0.532	[0.00]	-0.555	[0.00]
Negative Book Equity	0.462	[0.00]	0.474	[0.00]
Industry Median Leverage	0.391	[0.00]	0.393	[0.00]
Intercept	0.029	[0.46]	-0.022	[0.53]
Country fixed effects	yes		yes	
Industry fixed effects	yes		yes	
Year fixed effects	yes		yes	
SE Cluster	Country		Country	
Adjusted R <sup>2</sup>	0.35		0.35	
Observations	128,492		128,492	