Post-Retirement Benefit Plans, Leverage, and Real Investment

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Abstract

This paper shows that off-balance sheet pension and health care benefit plans are important for firm leverage and real investment around the world. Post-retirement assets and liabilities of nonfinancial corporations are economically sizable in many countries (often more than in the U.S.), but are not fully reflected on the balance sheet despite plans generally being underfunded. While consolidating off-balance sheet post-retirement plans typically increases effective leverage by 32%, they do not matter for gearing of firms in about half the sample countries. Moreover, there is significant variation across countries with regards to the extent to which firms with large projected benefit obligations reduce their level of regular debt, ranging from no to perfect substitution. Since post-retirement benefit obligations have more flexible terms than regular debt, they can be used as an instrument to investigate the effect of financial flexibility on real investment. The results show that the relation is conditional on the type of investment opportunity (i.e. type of growth option). Post-retirement benefit obligations have a positive effect on R&D, which generates growth options, and a negative effect on capital expenditures, which exercises growth options. Compared to an otherwise similar firm without a post-retirement plan, the average plan sponsor has 5.4% less capital expenditures and 13.1% more research and development. The results are robust to other dimensions of financial policy, such as debt maturity, dividends, preferred stock, convertible debt, and leverage that also affect real investment.

Keywords: Capital Structure, post-retirement benefits, real investment, financial flexibility, pension, health care
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Abstract

This paper shows that off-balance sheet pension and health care benefit plans are important for firm leverage and real investment around the world. Post-retirement assets and liabilities of nonfinancial corporations are economically sizable in many countries (often more than in the U.S.), but are not fully reflected on the balance sheet despite plans generally being underfunded. While consolidating off-balance sheet post-retirement plans typically increases effective leverage by 32%, they do not matter for gearing of firms in about half the sample countries. Moreover, there is significant variation across countries with regards to the extent to which firms with large projected benefit obligations reduce their level of regular debt, ranging from no to perfect substitution. Since post-retirement benefit obligations have more flexible terms than regular debt, they can be used as an instrument to investigate the effect of financial flexibility on real investment. The results show that the relation is conditional on the type of investment opportunity (i.e. type of growth option). Post-retirement benefit obligations have a positive effect on R&D, which generates growth options, and a negative effect on capital expenditures, which exercises growth options. Compared to an otherwise similar firm without a post-retirement plan, the average plan sponsor has 5.4% less capital expenditures and 13.1% more research and development. The results are robust to other dimensions of financial policy, such as debt maturity, dividends, preferred stock, convertible debt, and leverage that also affect real investment.

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1 Introduction

In many countries around the world, recent years have witnessed an increasing attention to and debate of 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 67% of GDP on average across OECD countries in 2009, pension plans are economically very significant in many countries, particularly the Netherlands, Australia, the United Kingdom and the United States.

This paper considers defined benefit post-retirement plans for pension and health care benefits from a corporate perspective. In particular, its two main objectives are to investigate the role of these plans for corporate capital structure and real investment, based on a sample of more than 25,000 publically traded non-financial firms from 50 countries during the period 2002-2009. The paper shows that pension assets and liabilities of nonfinancial corporations are substantial in many countries. However, even though plans generally show deficits, they are not fully reflected on the balance sheet. Consolidating off-balance sheet plans for pension, health care and other post-retirement benefits typically increases effective leverage, but for firms in about half the countries, there is no significant difference between consolidated and regular leverage.[1] Even though the effect of post-retirement benefit plans on regular leverage is negative, i.e. companies with large post-retirement plans tend to have less regular leverage, countries differ significantly in the extent to which firms substitute projected benefit obligations for regular debt. While post-retirement obligations share several characteristics of regular debt, they typically have more flexible terms, and thus can be used to investigate how financial flexibility affects real investment. Controlling for other dimensions of financial policy, the results show that the relation is conditional on the type of investment opportunity: Post-retirement benefits have a positive effect on R&D and a negative effect on

[1] In a recent paper, Graham and Leary (2010) identify variable mis-measurement as one of the key challenges in capital structure research. For the United States, Shivdasani and Stefanescu (2010), Graham and Tucker (2006), and Graham, Lang, and Shackleford (2004) show that there are significant non-debt tax shields from pension contributions, executive stock options deductions, and other tax sheltering activities (such as leasing, transfer pricing, etc.).

capital expenditures, which generate and exercise growth options, respectively. Thus, the importance of post-retirement benefit plans extends beyond capital structure to the real operations of a company, and this is an important way in which financing and investment interact.

With regards to leverage, my paper is related to recent work by Shivdasani and Stefanescu (2010) who show that leverage ratios for U.S. firms with pension plans are 35% higher when pension assets and liabilities are incorporated into the capital structure. They estimate that the tax shields from pension contributions are a third of those from interest payments in the United States, though pension contributions have a modest effect on lowering firms' marginal tax rates. My paper adds to the insights of their paper by considering forms of post-retirement benefits other than pensions as well and by providing an international perspective on the capital structure implications of defined benefit plans. This is of particular interest since defined benefit post-retirement plans are often more popular and economically more important outside the United States. In countries such as Switzerland, Austria and Ireland, more than half of the firms have some form of defined benefit plan. With a frequency of 21.1%, the United States only ranks 18th in the world in terms of popularity of defined benefit plans. Nevertheless, it is the country where medical plans are with a frequency of 13.7% most common internationally. Moreover, there are significant cross-country differences regarding the implications of post-retirement benefit plans for capital structure and tax benefits, which have not been considered in the literature to date. Consequently, it is important to understand post-retirement benefit plans in order to understand capital structure globally.

The fact that contributions to post-retirement plans are tax-deductible and that the inability to make them can result in bankruptcy might suggest that post-retirement liabilities are a form of liability that is substituting for other forms of debt and that is 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).[2] In my international sample, firms have 20%-70% higher leverage for different measures of gearing once off-balance sheet assets and liabilities of defined benefit post-retirement plans are consolidated, which might help explain the observed conservative levels of leverage noted in the literature. However, while post-retirement obligations typically increase consolidated leverage, the effect is not significant

[2] See also Shivdasani and Stefanescu (2010), Jin, Merton and Bodie (2006), Barth, Beaver and Landsman (1992).

in about half of the countries (though never negative and significant). 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. While firms with large post-retirement obligations take out less regular debt, there are interesting differences between countries with regards to the extent to which projected benefit obligations substitute for regular debt. In some countries there is perfect substitution, while there is none in others, and there is a higher degree of substitution in developing countries compared to developed countries. Health care and particularly pension contributions also 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 present values of tax shields.

While post-retirement liabilities are corporate obligations that have many similarities with regular debt, they are more flexible in terms of their valuation and the level and timing of contributions. To illustrate, companies can manage their earnings through changes to post-retirement benefit plan assumptions. Given this optionality, post-retirement obligations can be used to investigate the relation between financial flexibility and real investment, which is the second main objective of the paper. Capital expenditures (CapEx) and research and development expenses (R&D) are both measures of corporate real investment. Nevertheless, they differ in that R&D pertains to generating real options, while CapEx entails exercising real options. A company might first generate options (e.g. a pharmaceutical company would carry out research to develop a new drug), and subsequently exercise them (e.g. build a plant/factory to produce and commercialize the drug). Since post-retirement benefits are a measure of financial flexibility, they represent a unique instrument to investigate whether different degrees of financial flexibility are associated with different types of growth options/investment opportunities.

While existing work on the interactions of financial flexibility and real investment is limited to date, in related work Childs et al. (2005) and MacKay (2003) also motivate the idea of different types of growth options of firms and suggest that they differ in the way they are affected by financial policy. In contrast, Modigliani and Miller (1958) propose that – in the absence of capital market imperfections – financial policies are irrelevant for a firm's investment and operating policies. In a similar vein, Mauer and Triantis (1994) predict that debt financing has a negligible impact on the firm's investment and operating policies, and that firms can thus determine the exercise timing decisions of their real options ignoring the effect of debt financing. My empirical results indicate that financial

policy does significantly affect real investment of firms. Importantly, the size of corporate post-retirement liabilities is positively related to R&D, and negatively related to capital expenditures, i.e. more optionality on the liability side of the balance sheet is related to more optionality on the asset side of the balance sheet. This entails more R&D, which generates real options, and less capital expenditure, which exercises and thus reduces options. The effect is not only statistically significant, but also economically sizable. With the obligations of the average post-retirement benefit plan totaling 11% of total assets, the typical plan sponsor has significantly less capital expenditures (by 5.4%) and more research and development (by 13.1%) compared to an otherwise similar non-sponsoring firm. The impact of financial flexibility on real investment is robust across countries and industries. Merck and Texas Instruments are examples of large pharmaceutical and technology companies that have large R&D programs and big post-retirement obligations. Thus, to the extent that post-retirement benefit plans increase financial flexibility, companies undertake more R&D. Additionally, other dimensions of financial policy also have an impact on firms' real investment, such as debt maturity, preferred stock, convertible debt, leverage and corporate payout. To illustrate, cash has a positive effect on real investment, while leverage has a negative effect.

Since existing theory models of financing and investment typically have simple structures of corporate assets (i.e., only assets-in-place), operating flexibility plays no role for financial policy, while financial flexibility typically entails lower initial debt levels as firms can increase leverage in the future (see, e.g., Titman and Tsyplakov, 2007; Goldstein et al., 2001; Leland, 1998). In contrast, Childs et al. (2005) distinguish between different types of growth options related to investment flexibility/asset substitution and production flexibility/asset expansion, and predict a positive and negative relation of these measures with corporate leverage, respectively. In particular, their model predicts that when future growth options increase risk, firms choose larger initial leverage when they have financial flexibility than when they do not. However, when growth options involve an expansion of assets-in-place, firms with financial flexibility choose lower initial leverage.

Moreover, they predict that firms with more financial flexibility have higher levels of leverage, while firms with a static debt policy have lower leverage. These predictions can be tested using corporate post-retirement benefit plans as a measure of financial flexibility, and capital expenditures and research and development as proxies for investment flexibility and asset expansion. In line with theory, firms with larger post-retirement schemes have higher consolidated leverage. Furthermore, leverage shows a positive (negative) relation to capital expenditures (research and development) as

predicted. The effects of CapEx and R&D on leverage exist in most countries and are larger in developing countries.

Overall, the results of this paper reveal a significant role of corporate defined benefit post-retirement schemes both for the liability side (i.e. leverage) as well as for the asset side (i.e. real investment) of non-financial corporations. These results have important implications for policy makers that currently have an interest in understanding and regulating corporate leverage (e.g. Volker commission in the United States). The paper documents that in most countries post-retirement liabilities are economically sizable and lead to higher effective leverage of firms once off-balance sheet plans are consolidated on the balance sheet. This result helps explain the low levels of leverage that have been documented in many countries, since off-balance sheet items such as pensions, medical plans, leasing, employee stock option plans, etc. are traditionally not incorporated into leverage ratios. Moreover, the paper contributes to our understanding of the interrelationships between financing and operating policies. It not only documents that various dimensions of financial policy affect firms' operations, but particularly reveals a relation between financial and operating flexibility. Given the implications of investment for economic growth, the result that financial flexibility impacts the type of real investment that companies undertake is an important insight.

The paper is organized as follows. Section 2 discussed the hypotheses, while the sample and data are covered in Section 3. Section 4 presents the results of the empirical analysis, and Section 5 concludes.

2 Hypotheses

Defined Benefit (DB) pension plans and Defined Contribution (DC) pension plans are the main types of institutional pension arrangements. For defined contribution pension plans, the employer has a legal obligation to make specific payments into the pension account. Consequently, the beneficiaries, i.e. the employees, bear the investment risk. In contrast, a defined benefit plan specifies the benefits of the employees at retirement, and the employer bears the investment risk. He 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 obligations of the employer are limited to pension contributions in the case of DC plans. While DB plans have been very common in the past, they have lost their popularity in recent years, due to reduced tax advantages, increased costs and competitive pressures given that few companies tend to adopt new DB plans.

Changes in demographics lead to longer working lives and thus higher contributions, while longer life expectancies imply higher valuations of pension obligations. Consequently, defined benefit pension plans have often reached the limits of their economic viability, and some employers have recently frozen their DB plans, for instance by closing schemes to new workers, while existing plans are being restructured, e.g. by limiting the benefits of existing members, and contribution levels are being raised.

Pension assets and liabilities are typically treated as off-balance sheet items. Pension contributions, however, show in the cash flow statement (as the actual payment to fund the pension assets), and the income statement shows the pension cost as an expense. It is typically 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. Companies are required to increase their contributions over a period of time if the plan is underfunded.

Annual reports contain information on the pension scheme both on- and off-balance sheet. The pension liability reflects the present value of the future benefits to the employees, referred to as the Projected Benefit Obligation (PBO). 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.[3] 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 is offset by an intangible asset and, for amounts in excess of unrecognized prior service costs, by a charge to book equity. Pension contributions are typically not reported, but can be inferred as the pension expense plus the change in net prepaid pension costs (Revsine et al., 2005). In addition to pension plans, companies may offer Other Post-retirement Employee Benefits

[3] IAS19 refers to this item as the Defined Benefit Obligation (DBO).

(OPEB), such as medical plans, insurance coverage, and other welfare benefits such as tuition assistance, day care, legal services, and housing subsidies provided after retirement. Provisions for these are largely similar to those for pensions. In particular, the footnotes of the annual report contain the estimated health care benefit obligation and the fair value of the plan assets.

In the United States, FAS 87 and 88 mandate 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, requires 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 as 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 publically 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 is required since 2005 for firms in Australia and South Africa, and it is used among many international firms. 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.

Given that pension, health care and other post-retirement benefits constitute legal obligations of a company, they should be recognized for corporate capital structure calculations even when they are reported off-balance sheet.[4] In fact, these liabilities may be senior to other claims.[5]

[4] 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 legal enforceability of certain claims has been demonstrated. Although employers may have a social or moral obligation to provide the postretirement benefits that have been earned, they may have retained the right to terminate or amend their postretirement benefit

Moreover, companies may be able to trade off other forms of compensation against post-retirement benefits. Consequently, I will consolidate the assets and liabilities of pension and health care plans in order to assess the corporate capital structure, following Shivdasani and Stefanescu (2010) and Jin, Merton and Bodie (2006).[6] 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 (the subsequent results show significant variation in the effect across countries). In addition, contributions to post-retirement benefit plans will 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).

There are a number of similarities between post-retirement obligations and regular financial debt, but 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, e.g. financial services). In the United States and the United Kingdom, for example, pensions are guaranteed by the Pension Benefit Guaranty Corporation (PBGC) and Pension Protection Fund, respectively, and, thus, companies do not bear the full costs of imposing high risk on pension beneficiaries. Moreover, pension assets cannot be easily 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 with payments to service regular debt. Companies can take advantage of this feature in order to maximize the asso-

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promises and not have a statutory requirement to provide those promised benefits, unlike their legal obligation to provide certain vested pension benefits.

[5] To illustrate, when the city of Vallejo in California declared bankruptcy, bondholders were offered 5-10 cents on the dollar, but pension benefits were left untouched.

[6] There is also an 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, Beaver and Landsman, 1992).

ciated tax shields by making larger contributions when marginal tax rates are high. Higher contributions will also reduce required minimum contributions in future years and thus increase flexibility.[7] At the same time, firms may sometimes reduce or even forgo funding of a period's pension expense, when possible, to meet competing investment or financing cash needs such as plan expansions, corporate acquisitions, debt retirement or dividend increases.

Moreover, the estimates of pension and health care liabilities rely on a number of assumptions, such as 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, per capita claims cost by age group, healthcare cost trend rate, medical coverage to be paid by governmental authorities and other providers of health care benefits, discount rates, expected long-term rate of return on plan assets, etc. Given the large size and long duration of pension obligations, small changes in the assumptions can have large effects on their valuations.[8] Companies can increase or decrease 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 maturity of those investments is typically much shorter. Similarly, there is some choice with regards to how and when to determine the fair value of the plan assets. 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, Desai and Rauh, 2006). Companies may even use changes to post-retirement plan assumptions to avoid violations on their other liabilities. Given this optionality, post-retirement obligations can be used as an instrument to investigate the effect of financial flexibility on real investment. At the same time, these differences suggest that projected benefit obligations are no perfect substitutes for other liabilities.

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[7] 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 to the plan sponsor, there is a tax incentive to overfund pension plans. In contrast, due to the lack of a tax-effective method in the United States for prefunding the promises to provide other post-retirement benefits, most post-retirement benefit plans other than pensions are unfunded.

[8] To illustrate, a one percent decrease in the discount rate will typically boost the estimated pension obligation by 10% to 15% (Revsine, Collins, and Johnson (2005), p. 777).

On the asset side, proxies for real investment are capital expenditures and research and development expenses. Capital expenditures might follow an earlier investment in R&D. To illustrate, companies may first invest in research and development in order to develop a new product. Once the research is completed and a product licensed, a technique patented or a drug approved, capital investment is required to set up a production facility to commercially exploit the result of the research. Thus, in principle, R&D leads to the generation of real options, while CapEx effectively exercises these options. Both measures of real investment affect the optionality of the assets of the firms, except that R&D increases the degree of optionality, while CapEx reduces it.

I hypothesize that there is a relation between the flexibility of a firm's assets and liabilities. Companies often try to match the characteristics of their assets, such as maturity, currency denomination, etc., with those of their financing, e.g. to hedge against risks such as currency and interest rate fluctuations. Similarly, I suggest that firms with more flexibility on the asset side of their balance sheet may want to have more flexibility on the financing side, i.e. flexibility matching. In contrast, firms with little or no flexibility on the asset side may not need as much financial flexibility. Thus, since post-retirement benefits are a measure of financial flexibility, they represent a unique instrument to investigate whether different degrees of financial flexibility are associated with different types of growth options/investment opportunities. Examples of companies with significant research and development expenses and big post-retirement benefit plans are large technology and pharmaceutical firms such as Johnson & Johnson, Merck, Nec, Novartis, Pfizer, Pioneer, Sanofi-Aventis, Roche, Texas Instruments, and Toshiba.

The literature motivates and supports the idea that different types of growth options relate differently to financial policy. To illustrate, in Childs, Mauer and Ott (2005), the effect of financial flexibility on the firm's initial debt level depends on the characteristics of the firm's growth option. When exercising the option replaces assets-in-place with a riskier asset underlying the growth option, a firm with dynamic debt will choose a larger initial level of debt than a firm with static debt. This is because the former has the flexibility to later reduce leverage when the growth option is exercised. In contrast, when exercising the growth option expands assets-in-place, a firm with dynamic debt is less aggressive with its choice of initial leverage because it has the flexibility to increase the debt level when the growth option is exercised. Consequently, the optimal debt level is conditional on the type

of growth option.[9] These predictions can be tested by relating capital expenditures and research and development as different types of growth opportunities to leverage.

3 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 (such as deposit insurance schemes) 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 is 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, 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 25,354 companies from 50 countries during the period 2002-2009.[10]

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. 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, and thus I also combine the off-balance sheet information into corresponding variables for all post-retirement plans. Proxies for contributions to defined benefit plans are calculated as the periodic expense (income) plus the change in net prepaid (accrued)

[9] In contrast, most models of corporate financing and investment, such as Titman and Tsyplakov (2007), Goldstein et al. (2001), and Leland (1998), do not allow for interactions between investment and financing flexibility and, consequently, predict that financial flexibility encourages lower initial debt levels since firms can increase leverage in the future.

[10] 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 asset) 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 (accrued costs, additional minimum liability). The consolidated interest expense is calculated as the sum of the regular interest expense and post-retirement contributions.

Worldscope utilizes consolidated account data when it is disclosed. In other cases, where there are no subsidiaries or no requirement to consolidate, only parent company accounts are available. Since information on the consolidation practice is available for only about 40% of all firm-year observations and since the vast majority of these indicate that all subsidiaries are consolidated, my main analysis is based on all observations. Nevertheless, I also perform robustness tests on the subsample of firm-years where the accounts confirm that subsidiaries of any type are consolidated. There may be significant variation across countries how the assets of a firm are valued (current value or historical cost), which cannot be easily corrected for, as discussed in more detail in Rajan and Zingales (1995). To address this concern, to the extent possible, a range of different alternative proxies is used for key variables, particularly leverage.

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, Hodrick and Zhang (2010). Market risk is the annualized square root of the difference between total

risk squared and idiosyncratic risk squared. Appendix A provides definitions of the main variables used in the paper, and Appendix B shows their summary statistics.

4 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. I also consider how firm characteristics differ across firms with and without post-retirement plans, and assess the tax benefits of these DB plans. Subsequently, I investigate how post-retirement benefit plans relate to leverage and real investment in univariate and multivariate analyses.

4.1 Importance of Post-Retirement Benefit Plans

Defined benefit plans for pensions and health care exist in many countries. Panel A of Table 1 shows 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. Switzerland is on top of the list, with 61.9% of all firms having some type of DB plan. More than 30% of firms have a DB plan in 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%). While these plans are also important in the United States, they are in fact more important in many other countries. 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 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 5. The second to last column in Panel A shows the degree of underfunding of post-retirement benefit plans, calculated as the difference between 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: only in Slovakia and China the average plan does not show a deficit. 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%), Netherlands (7.6%), Switzerland (7.2%), Ireland (5.3%), and the United States (5.2%). 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 asset) minus accrued post-retirement costs (including additional minimum liabilities), scaled by total assets. With a 2.3% deficit on average, these amounts tend to be smaller than the true economic levels of underfunding, particularly for plans in countries with the most underfunded plans.

Statistics are broken out by industry in Panel B of Table 1. There is significant variation in the popularity of defined benefit plans by this dimension as well: In the industries Aircraft (45.2%), Tobacco Products (44.3%), Shipping Containers (32.6%), Candy & Soda (32.2%), and Automobiles (30.5%) these types of post-retirement benefit plans are most common. In contrast, few firms in Healthcare (9.2%), Mines (7.4%), Trading (4.8%) or Precious Metals (2.5%) have such a plan. Again the frequencies are largely a function of defined benefit pension plans, while health care plans are only more popular with firms in the industries Tobacco Products (22.5%), Aircraft (19.3%), Shipping Containers (13.2%), Defense (11.1%) and Books (10.1%). The largest defined benefit plans exist on average in the industries Defense, Aircraft, Coal, Trading, Tobacco Products, Shipping Containers, and Consumer Goods, where projected benefit obligations amount to more than 15% of total assets. Plans are underfunded in all industries by 4.8%, and the amount recognized on the balance sheet is also negative in all industries (but a smaller deficit of 3.9%).

Panel C of Table 1 shows the development of post-retirement plans over the sample period of 2002-2009. DB post-retirement plans have been important in the United States for some time, but their occurrence in the sample of U.S. firms still doubled from 12.5% in 2002 to 25.0% in 2009, despite recent trends in policy towards defined contribution plans. Growth in non-U.S. countries is even more dramatic from 5.2% to 25.3%. The increase in frequency of DB post-retirement plans is mostly accounted for by the increase in DB pension plans.[11] DB heath care plans are insignificant outside the United States (2.6% of firms have such a plan in 2009), but 8.4% and 15.9% of U.S.

[11] 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 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. In contrast, the absolute number of non-U.S. firms with defined benefit post-retirement plans actually increases 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.

firms have such a plan in 2002 and 2009, respectively. The typical size of post-retirement liabilities of non-U.S. firms is on average about half of that of 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 over time. It illustrates that both, in the United States as well as 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.

Amid To summarize, off-balance sheet post-retirement benefit plans are important not just in the United States, but in fact much more in many other countries. DB post-retirement plans are often common and economically sizable, mostly because of pension promises, while health care plans hardly play a role outside the United States. Post-retirement liabilities are regularly not fully reflected on the balance sheet. This is an important finding since these plans are typically underfunded. Nevertheless, the degree of underfunding and the difference to what is recognized on the balance sheet appears to have decreased over time.

4.2 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 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 assets and liabilities of the post-retirement benefit plans are included instead.

Alternatively, one could consider netting the assets and liabilities of post-retirement plans and only reflecting the extent of underfunding (overfunding) as an additional liability (asset) on the balance sheet. Nevertheless, assets and liability are typically not netted on the balance sheet (e.g. receivables and payables) in order to preserve information about the actual size of the items. To illustrate, netting would not recognize the scale of pension and health care assets and liabilities relative to the rest of the balance sheet, which can misrepresent the actual risks associated with these plans, since net amounts could be small for large or small post-retirement benefit plans. Shivdasani and

Stefanescu (2010) suggest that post-retirement 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 to understand the economic implications of corporate post-retirement benefit plans (e.g. Franzoni and Marín, 2006; Coronado and Sharpe, 2003; Barth, Beaver and Landsman, 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, particularly for firms with large post-retirement plans. This effect will be larger the more a plan is underfunded.

To this end, Table 2 shows results for tests on 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 to calculate 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.[12] 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 by 67%. Similarly, the ratio of total debt to the sum of market capitalization, preferred stock

[12] Beyond the leverage measures in the table, other leverage ratios have been calculated e.g. based on total liabilities in the numerator, or dividing by alternatively Total Assets Market Value (total assets minus book value of common equity plus market value of common equity), Net Total Assets Market Value (total assets minus book value of common equity plus market value of common equity minus accounts payable minus other liabilities), Size Book Value (book value of common equity plus preferred stock plus total debt), and Net Total Assets (total assets minus accounts payable minus other liabilities). Results for these are similar to those reported.

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. Across 36 countries, there is no difference between consolidated and regular leverage for firms in about half the countries at conventional significance levels. Note, however, that there is no country where consolidated leverage is significantly less than regular leverage. Thus, 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 differs significantly across countries. The differences are typically largest in countries where defined benefit plans are most important, i.e. the United Kingdom, Switzerland, the Netherlands, Ireland, the United States and Canada. In the United States, consolidated leverage ratios are about twice regular leverage ratios (multiples of 1.7-2.2 depending on the measure of leverage), a slightly larger effect than the factor of 1.4 that Shivdasani and Stefanescu (2010) find just considering pensions for their larger sample of U.S. firms in the years 1991-2005. 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 as well as 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 between leverage with and without considering post-retirement benefit plans remain. For the entire sample, consolidated leverage is statistically significantly higher than regular leverage in every year for all leverage ratios. The differences tend to decrease over time, but remain statistically and economically significant (on average 8% of total assets in 2009).

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 3 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. Again, the effects are economically

meaningful: Firms with post-retirement benefit plans have 17% higher market leverage and 7% higher book leverage on average. Given higher regular leverage as well as additional leverage via post-retirement plans, one would expect that these firms are able to lower their taxes via interest payments and plan contributions. Nevertheless, plan sponsors 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.

Given the complexities of national tax systems, it is challenging to derive good measures of marginal tax rates for the sample of international firms. Nevertheless, a rough idea of the tax benefits plan sponsors derive from post-retirement benefit plans can be obtained using average tax rates, which are available on WorldScope for many firms. Table 4 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-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 alternatively by total assets or 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% or the estimated average interest rate on debt as 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 Table 4 show that both pension and health care plans provide companies with significant tax benefits. For pension benefits, non-U.S. firms have larger interest expense ratios (1.32) compared to U.S. firms (1.10) (which is similar to the ratio of 1.09 for pensions of U.S. firms in Shivdasani and Stefanescu (2010)), but the associated present values tend to be comparable. In contrast, 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 for pensions for firms outside the United States. Consequently, the tax benefits of health care plans are generally more modest, and there are a lot fewer companies that obtain these benefits, especially outside the United States.

Overall, these results show that considering the off-balance sheet assets and liabilities of post-retirement benefit plans is important to accurately determine firm leverage. On average, recognizing the effect of DB pension and health care plans increases the effective leverage of companies by 20%-70%, which might explain the conservative levels of leverage reported in the literature, though the significance of this effect varies across countries and the prevalence of defined benefit arrangements. In about half the sample countries, considering off-balance sheet post-retirement plans is not important for assessing corporate leverage. Nevertheless, while the difference between consolidated and regular leverage has overall slightly decreased over time, it remains economically and statistically significant. DB plan sponsors do not only have higher consolidated leverage than regular leverage, but they also have higher regular leverage in univariate comparisons with firms that do not sponsor a plan, which owes to them having fundamentally different characteristics along many other dimensions such as size, profitability etc. that afford them larger debt capacity. Compared to interest payments, contributions to defined benefit plans are economically significant for plan sponsors, amounting to around 30% of the interest expense on debt. With present values of tax shields from interest expenses and post-retirement benefit plan contributions combined in the order

of 11%-18% of total assets, the economic value associated with post-retirement plans is non-trivial for firms that have such arrangements.

4.3 Post-Retirement Obligations, Leverage and Real Investment

With regards to the liability side of the balance sheet, arrangements for defined benefit plans entail that plan sponsors have effective leverage that is often higher once considering off-balance sheet assets and liabilities. However, corporate plans for post-retirement benefits are of relevance not only for the financing dimension of firms, but also for corporate investment, i.e. the asset side of the balance sheet. A relation between post-retirement benefit plans and real investment is suggested based on the idea of flexibility or optionality. Off-balance sheet defined benefit plans are more flexible than regular debt in terms of valuation, contribution levels, etc., and can thus be used as a measure of financial flexibility. The fact that research and development creates flexibility by building options, while capital expenditures reduce flexibility by exercising options, suggests that the relations of these types of real investment with financial flexibility are of opposite sign.

In order to investigate these predicted relations, I first look at univariate results based on portfolio sorts and subsequently perform multivariate analyses. To this end, Table 5 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. 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. The panel also shows evidence of the hypothesized opposite effect of post-retirement benefit plans on different types of real investment: Capital expenditures decrease with larger defined benefit plans, while research and development expenses increase.

Results in Panel B of Table 5 are based on sorting observations by consolidated leverage. As consolidated leverage increases, both regular leverage and post-retirement obligations increase, de-

spite 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. Capital expenditures (research and development expenses) increase (decrease) with higher leverage. 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. As before, capital expenditures increase with leverage, while research and development expenses decrease. The results for real investment in this table can also be shown in dual sorts of leverage and the size of post-retirement obligations.

Before investigating the relations between post-retirement benefit plans, leverage and real investment in a multivariate setting, it is useful to take a look at the correlations between variables to be used in the analysis. These are shown in Table 6. In line with the results from portfolio sorts, CapEx and R&D show correlations with PBO of opposite sign and similar magnitude (-0.099 and 0.106, respectively), and the relation between regular leverage and PBO is negative, but small (-0.30), while the relation between consolidated leverage and PBO is positive (0.359). Comparing the correlations of CapEx and R&D with other variables, it is clear that these two dimensions of real investment capture different effects, as the sign of the relations with several variables are of opposite sign, such as ROA, Age, Z-Score, Net PPE, Dividends, Tangible Assets, Net FX-Exposure, Preferred Stock, Convertible Debt, Negative Book Equity, and Cash and Short-Term Investments.[13] 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.

For the multivariate analysis, a system of simultaneous equations model is estimated using the generalized method of moments (GMM) with *PostRetirementBenefitPlan*, *ProjectedBenefitObligations*, *Leverage* and *RealInvestment* that accounts for self-selection of adopting a defined benefit plan as well as for endogeneity. In particular, I estimate the following model:

$$Post\,\mathrm{Re}\,tirementBenefitPlans = a_0 + a_1 LogEmployees + a_2 MarketToBook + a_3 ROA + a_4 ROAVolatility + \varepsilon \quad (1)$$

[13] 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 PostRetirementBenefitPaln (0.55), so that I do not include NetPPE and PostRetirementBenefitPlan in the *Leverage* equation either.

$$PBO = b_0 + b_1 LogEmployees + b_2 MarketToBook + b_3 ROA + b_4 ROAVolatility + b_5 LogAge + b_6 Leverage + b_7 Post\,\text{Re}\,tirementBenefitPlans + b_8 LogTotalRisk + \nu \quad (2)$$

$$Leverage = c_0 + c_1 MarketToBook + c_2 ROAVolatility + c_3 LogTotalRisk + c_4 PBO + c_5 TaxRate + c_6 LogTotalAssetsUSD + c_7 Dividend + c_8 TangibleAssets + c_9 NetFXExposure + c_{10} DebtMaturity + c_{11} GrossProfitMargin + c_{12} PreferredStock + c_{13} RealInvestment + c_{14} NegativeBookEquity + \upsilon \quad (3)$$

$$RealInvestment = d_0 + d_1 MarketToBook + d_2 LogAge + d_3 Leverage + d_4 LogTotalRisk + d_5 PBO + d_6 LogTotalAssetsUSD + d_7 Dividend + d_8 TangibleAssets + d_9 NetFXExposure + d_{10} DebtMaturity + d_{11} GrossProfitMargin + d_{12} PreferredStock + d_{13} NetPPE + d_{14} ConvertibleDebt + d_{15} LogCashSTInvestment + \gamma \quad (4)$$

where *PostRetirementBenefitPlan* is a dummy variable with value 1 if the firm has a defined benefit plan, and zero otherwise. *LogEmployees* is the natural logarithm of the number of employees, *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 5 years, and *PBO* is the ratio of projected benefit obligations to consolidated total assets (with missing values set to zero).

LogAge is the natural logarithm of the age of the firm, *Leverage* is the ratio of total debt to consolidated total assets, *LogTotalRisk* is the natural logarithm of the annualized standard deviation of stock returns in U.S. Dollars, *TaxRate* is the average corporate tax rate, *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 more than 1 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), *RealInvestment* is either the ratio of capital expenditures to total assets or the ratio of research and development expenses to total assets, with missing values of CapEx and R&D set to zero, *NegativeBookEquity* is a dummy variable with value one if the book value of common equity is negative (and zero otherwise), *NetPPE* is the ratio of net property, plant and equipment to total assets, *ConvertibleDebt* is the ratio of convertible debt to total assets, and *LogCashSTInvestment* is natural logarithm of the ratio of cash and short-term investment to total assets.

The set of exogenous variables is motivated by theoretical and empirical research in the literature as well economic intuition. The literature suggests, for instance, that the adoption of a defined benefit plan is 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. Since data on the start of DB plans might not be very precise in the international sample, I use (the natural logarithm of) the age of the firm and expect a positive relation to the size of the pension obligations. With regards to leverage, Berk, Stanton and Zechner (2009) suggest that riskier firms choose lower leverage ratios. Other variables, such as firm size, the average tax rate, and the extent of tangible assets are included in the *Leverage* equation as controls. As identifying variables, firm-level instruments are used based on *a priori* judgments on what exogenous determinants of each factor are most likely to be uncorrelated with the other factors. All equations include year, industry and country dummy variables.

The multivariate results are presented in Table 7. Panel A uses capital expenditures, while Panel B uses research and development expenses as a proxy for real investment. The main results are, first, that the size of post-retirement liabilities 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 negative sign is in line with the portfolio sorting results in Table 5, but opposite the tests in Table 4, which highlights the importance of multivariate analyses. The coefficient of -0.232 indicates that both sources of leverage are far from being perfect substitutes (which would imply a coefficient of -1). In contrast, using consolidated leverage instead of regular leverage yields a positive relation between projected benefit obligations and leverage as post-retirement plans contribute to overall leverage, with a coefficient on PBO of 0.613 (results not reported).

Second, post-retirement benefit plans have a negative effect on capital expenditures (Panel A), but a positive effect on research and development (Panel B), where the coefficients are of the same absolute magnitude but opposite sign (-0.016 and +0.015, respectively). The effect is not only statistically significant, but also economically sizable. The average post-retirement plan obligation amounts to 11% of total assets. Compared to a firm without post-retirement benefit plan that has otherwise similar characteristics, the average plan sponsor has 5.4% less capital expenditures and 13.1% more research and development. This result is in line with the prediction that financial and operating flexibility are related. To the extent that larger post-retirement obligations entail more flexibility on the financing side, it induces more flexibility and optionality on the asset side, by creating

more real options via R&D and by executing fewer options via capital expenditures. Note that companies with a lot of research and development are not necessarily small start-up companies, but large pharmaceutical and technology companies. All companies in the sample are publically listed, and the analysis controls for many dimensions such as firm age, market-to-book, firm size, firm risk, profitability, leverage, net property, plant and equipment, etc.

Moreover, consistent with R&D and CapEx reflecting different types of growth opportunities, the sign of their relation with leverage is opposite: Capital expenditures have a positive coefficient (0.232), while research and development has a negative coefficient (-0.501). This finding is in line with predictions by Childs, Mauer and Ott (2005) that the optimal debt level is conditional on the type of investment opportunity and results in MacKay (2003) that leverage is positively related to measures of investment flexibility and negatively related to measures of production flexibility.

The *RealInvestment* equations also show that, contrary to some theoretical predictions of no or little effect of financial policy on operating policies, various facets of financial policy matter for real investment: Leverage, debt maturity, dividends, preferred stock, convertible debt and cash holdings are all significantly related to CapEx or R&D. Firms with lower levels of regular leverage, longer debt maturity, less preferred stock and more liquidity have higher capital expenditures, while firms with lower levels of regular leverage, smaller dividends, shorter debt maturity, more preferred stock, convertible debt and liquidity have more research and development.

The results in the *PostRetirementBenefitPlan* equation show that firms with a larger number of employees and lower ROA volatility are more likely to have a defined benefit plan for pensions or health care, while the market-to-book ratio is positive, and ROA is negative. In the *PBO* regression, firms have also larger projected benefit obligations when they have more employees, are older, have less leverage and risk, but also when they have larger market-to-book ratios, smaller ROA and higher volatility of ROA.

In order to investigate the regional variation in results, the model is estimated by country (for countries with at least 90 observations) as well as separately for firms in developed and developing countries (defined based on the MSCI classification as of June 2006). The results are shown in Table 8, with capital expenditures and research and development in Panels A and B, respectively. They suggest that the effect of post-retirement obligations on regular leverage is negative in most countries with sufficient observations. Still, the size of the effect varies significantly across countries. In some countries, such as Taiwan (-1.097), Norway (-0.764), Indonesia (-0.712) or Finland (-0.682),

post-retirement obligations are effectively perfect substitutes of regular debt since the coefficient estimates are not significantly different from -1 (tests not reported). In contrast, the effect is small and not significantly different from zero in other countries, such as Malaysia (-0.064), South Africa (-0. 072) and Denmark (0.356), 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 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 almost double in the latter. In contrast, the effect of PBO on consolidated leverage is positive in all but one country (not reported).

Defined benefit plans also have a negative relation to capital expenditures in most countries (16 out of 20) and for subsamples of firms split by the degree of development, even though the effect is not always significant (but it is never positive and significant). The countries with the largest coefficients are Finland (-0.206), Taiwan (-0.136), and Australia (-0.109). The effect appears stronger in developed countries, where the pooled coefficient is -0.020 and highly significant, while the coefficient for developing countries is of similar size (-0.018) but not significant. Similarly, the effect of PBO on R&D is positive in most countries, with large coefficients for Denmark (0.212), Taiwan (0.146) and Norway (0.055).[14] The effect is twice as large in developing countries (0.021) compared to developed countries (0.011), but significant in both sub-samples. Surprisingly, the coefficient for Switzerland is negative and significant. The different nature of CapEx and R&D as determinants of leverage is robust to the country analysis as well: Capital expenditures are positively related to leverage, while research and development is negatively related to leverage in most countries.

I also estimate the model by industry (but include year and country dummies). This is an interesting test since one would expect research and development and capital expenditures to cluster by industry, with less variation within industry, which makes it tough to demonstrate the relation between financial and operating flexibility. Nevertheless, the results confirm the earlier findings (not reported). There is a negative relation between post-retirement obligations and regular leverage in 33 of 36 industries with sufficient number of observations. The relation between post-retirement obligations and CapEx is typically negative (in 28 industries, in 13 of which it is significant at the 10% level or better), and the largest coefficients occur in Recreation (-0.075), Telecom (-0.072), and Med-

[14] The coefficient on PBO in the R&D equation is insignificant for the United States, which might be due to the fact that there are many other ways of financing R&D available to U.S. firms (such as venture capital and others).

ical Equipment (-0.067). The relation of post-retirement benefits with R&D is positive in 28 industries (and significant in 20 at the 10% level or better), with the largest coefficients in Oil (0.106), Drugs (0.084), Agriculture (0.068), Aircraft (0.065) and Measuring and Control Equipment (0.060). Finally, the relation between R&D (CapEx) and regular leverage is typically negative (positive). In the same vein, the results are robust to estimating the model separately for firms split into quintiles based on firm size.

Overall, the paper presents strong evidence for a role of post-retirement plans for both financial and operating policies of non-financial firms. As expected, firms with defined benefit plans typically have less regular leverage, but higher consolidated leverage, though off-balance sheet post-retirement benefit plans do not matter for gearing of firms in about half the sample countries. The paper shows that financial and operating flexibility are related: Financial flexibility is positively related to the creation of real options (via R&D) and negatively related to the exercise and thus elimination of real options (via CapEx). Similarly, the level of debt (based on regular or consolidated leverage ratios) is conditional on the type of growth options, i.e. R&D is negatively related to leverage, while CapEx is positively related, as predicted by financial theory. In contrast to some theoretical predictions that financial policy has no or limited effect on operating policies, the paper shows that various dimensions of financial policy are important determinants of capital expenditures and research and development.

4.4 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 information on the degree of consolidation is limited, a robustness test is conducted that restricts the sample to firm-year observations where WorldScope confirms that that subsidiaries of any type, significant or not, domestic and foreign, are consolidated. The results are reported in Appendix C and are very similar to the earlier results (in Table 7), both in terms of the size of the coefficients as well as their significance levels.

The large set of exogenous variables in the regression model ensures that the results are as robust as possible to omitted variable biases, but it comes at the expense of a reduction in the num-

ber of observations with non-missing values of all variables. To this end, Appendix D shows results for an alternative specification where the four variables that have the biggest effect on sample size are excluded, namely the tax rate, convertible debt, net FX exposure, and the number of employees. This increases the number of observations from 32,854 to 128,492. Remarkably, the results are very robust. The only change in the sign of a variable is with regards to the relations of ROA with PBO and PostRetirementBenefitPlan, which turn positive. All other results remain intact, with only small variation in the size of coefficients.

In further, untabulated robustness tests, I perform a separate estimation of the model only for firms reporting under U.S. GAAP, IAS/IFRS, all firms in the United States, as well as all firms in EU countries, Australia, and South Africa during the period 2005-2009. The results are comparable, and the main findings of the paper maintain economic and statistical significance of similar magnitude.

5 Conclusion

Corporate plans for pension, health care and other post-retirement benefits to employees are important in many countries around the world, both in terms of their popularity and their economic size. While 21.6% of U.S. firms have a defined benefit plan, these are much more common in many other countries, such as Switzerland, Austria or Ireland. Most benefits pertain to pension plans, whereas health care benefits do not play much of a role beyond the United States. Post-retirement liabilities can be sizable: In some countries such as the United Kingdom they represent more than 20% of total assets, on average. However, the fair value of assets and projected benefit obligations of defined benefit plans is reported off-balance sheet, and only net prepaid or accrued benefit costs are reflected on the books. In spite of the fact that these plans are generally underfunded, the net amounts recognized on the balance sheet are smaller, though the gap has slightly narrowed in recent years.

This paper shows that post-retirement benefit plans play an economically important role for non-financial corporations both for the liability side (i.e. leverage) as well as for the asset side (i.e. real investment). Similarities between regular debt and post-retirement obligations suggest that off-balance sheet assets and liabilities of post-retirement plans should be consolidated on the balance sheet. To the extent that companies perceive projected benefit obligations as substitutes for regular debt along some dimensions, recognizing them on the balance sheet would yield more realistic

measures of effective leverage. The analysis shows that consolidated leverage ratios are on average 20-70% higher than regular leverage ratios. However, while firms with large post-retirement obligations typically have lower regular leverage and higher consolidated leverage, the effect is not present in about half the countries. In fact, the extent to which firms substitute regular debt with projected benefit obligations varies by country between 0% and 100%. 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, 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 shields of interest expenses.

Given that post-retirement obligations have more flexible terms compared to regular debt, they can be used as an instrument to investigate the relation between financial flexibility and real investment. This relation is hypothesized to be conditional on the type of growth option. The empirical results show indeed a positive relation of post-retirement obligations with research and development (which enhances optionality on the asset side) and a negative relation with capital expenditures (which reduces optionality on the asset side). The typical plan sponsor has 5.4% less capital expenditures and 13.1% more research and development in comparison to a similar firm without post-retirement benefit plan. Consequently, post-retirement plans are important not just for capital structure, but also for the real operations of a company. More flexibility on the liability side of the balance sheet is related to more flexibility on the asset side of the balance sheet, which is an important way in which financing and investment interact. Moreover, other dimensions of financial policy, such as debt maturity, preferred stock, convertible debt, leverage and corporate payout, have an impact on firms' real investment, despite some theoretical predictions of a limited role of financial policies for operating policies. Additionally, leverage shows a positive (negative) relation to capital expenditures (research and development), which supports theoretical predictions that the nature of investment opportunities is relevant for the level of corporate debt. *In summa*, the paper documents that corporate defined benefit post-retirement schemes matter both for leverage and real investment. Future research should formalize the relation between financial and operating flexibility that is being revealed in this paper.

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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 (and intangible pension asset) minus accrued post-retirement costs (including additional minimum liabilities), 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).

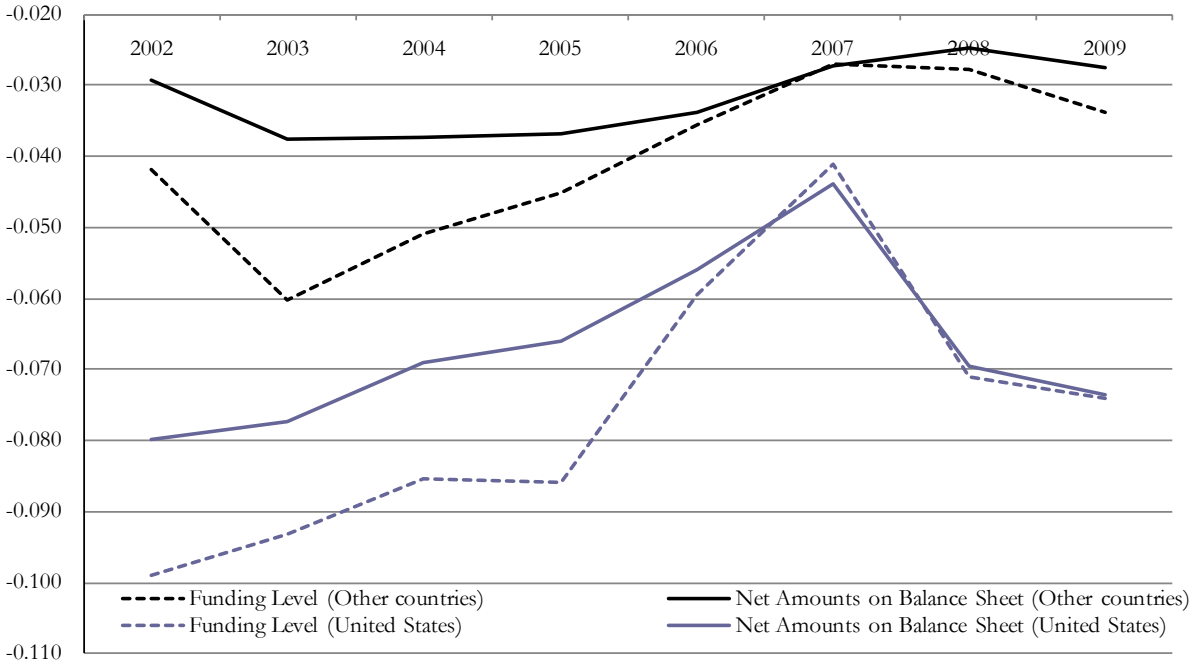

Figure 2: Differences Between Consolidated and Regular Leverage

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) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (and intangible pension asset) 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).

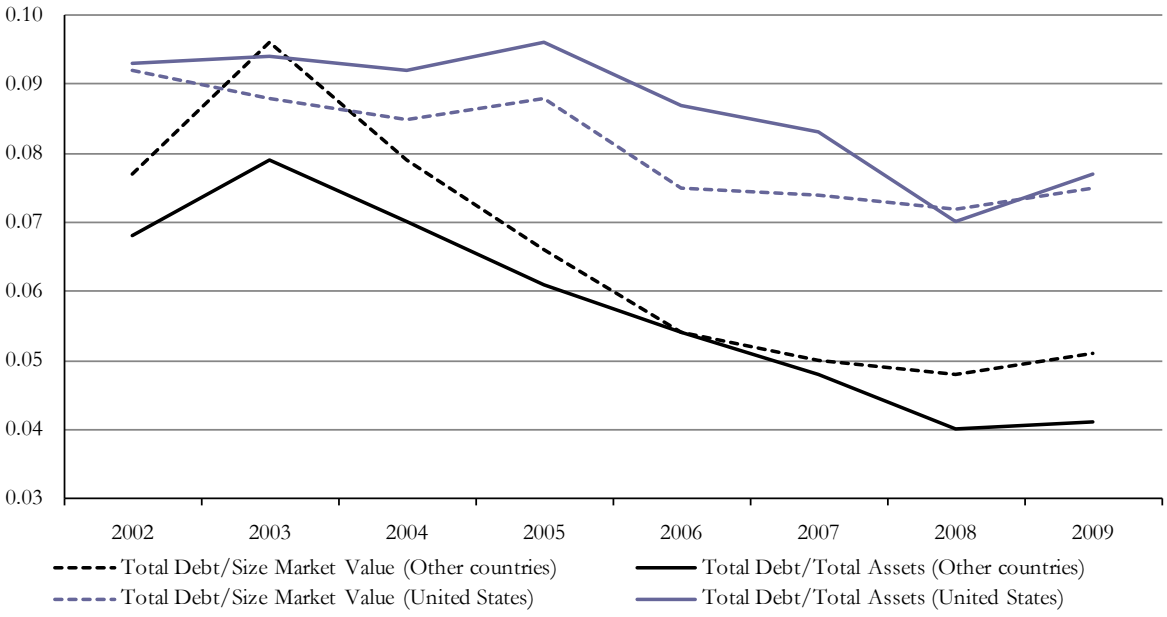

Table 1: Importance of Post-Retirement Benefit Plans

The table shows statistics on the importance of post-retirement benefit plans. Panel A shows results by country. 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. The funding 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 (and intangible pension asset) minus accrued post-retirement costs (including additional minimum liabilities), scaled by total assets. Averages are calculated by country, 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. 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 counties.

(continued)

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

Panel A: Results by Country

		Percentage of Firms					
	Number of Firms	Post-Retirement Benefit Plan	Pension Plan	HealthCare Plan	PBO/Total Assets	Funding Level/ Total Assets	Net Amounts on Balance Sheet/ Total Assets
Switzerland	173	61.9	61.7	6.5	0.206	-0.032	-0.026
Austria	56	57.6	57.6	0.3	0.069	-0.052	-0.036
Ireland	46	54.4	54.4	4.4	0.167	-0.050	-0.033
Mexico	104	48.1	48.1	1.5	0.074	-0.017	-0.009
Philippines	122	45.0	45.0	0.0	0.026	-0.012	-0.011
Netherlands	121	42.7	42.7	7.3	0.220	-0.053	-0.046
Taiwan, Province Of China	1,396	38.5	38.5	0.0	0.022	-0.014	-0.011
Pakistan	98	38.2	35.2	10.8	0.048	-0.007	-0.014
Luxembourg	8	38.0	38.0	2.6	0.038	-0.037	-0.038
Japan	3601	37.6	37.6	0.0	0.098	-0.051	-0.040
Norway	190	36.5	36.5	0.6	0.065	-0.028	-0.018
Germany	691	29.3	29.3	1.5	0.099	-0.072	-0.068
Finland	114	29.0	29.0	4.6	0.088	-0.023	-0.018
Belgium	104	28.1	28.1	3.5	0.116	-0.045	-0.046
Indonesia	261	27.5	27.4	0.4	0.026	-0.021	-0.020
United Kingdom	1543	26.1	26.1	2.0	0.273	-0.079	-0.053
France	672	22.9	22.9	3.7	0.059	-0.029	-0.029
United States	4,899	21.1	20.0	13.7	0.153	-0.076	-0.067
Greece	256	20.9	20.9	0.7	0.018	-0.014	-0.012
Russian Federation	90	18.8	18.8	0.1	0.019	-0.018	-0.013
Portugal	49	17.7	17.7	5.6	0.063	-0.032	-0.033
Denmark	117	17.5	17.5	0.9	0.048	-0.011	-0.014
Sweden	345	17.3	17.3	1.1	0.105	-0.041	-0.031
South Africa	270	17.1	13.7	9.4	0.092	0.002	-0.015
India	1,236	13.1	13.0	0.7	0.023	-0.010	-0.012
Brazil	233	12.6	12.3	5.2	0.096	-0.016	-0.020
Canada	1195	12.5	12.1	7.3	0.102	-0.033	-0.018
Israel	72	11.3	10.6	1.7	0.038	-0.010	-0.023
Iceland	8	10.7	10.7	0.0	0.077	-0.001	-0.001
Italy	206	9.8	9.8	2.0	0.049	-0.030	-0.028
Sri Lanka	19	9.5	9.5	0.0	0.014	-0.012	-0.011
Malaysia	818	8.2	8.2	0.0	0.016	-0.013	-0.012
Spain	100	7.1	7.1	0.0	0.021	-0.009	-0.009
Slovakia	11	6.8	6.8	0.0	0.003	-0.003	-0.003
Hong Kong	847	4.8	4.8	0.3	0.044	-0.006	-0.008
Argentina	53	4.5	4.5	0.2	0.006	-0.004	-0.004
Venezuela	16	3.8	3.8	3.8	0.334	-0.239	-0.179
Australia	1,318	3.7	3.7	0.1	0.053	-0.005	-0.010
Morocco	15	3.3	3.3	2.4	0.013	-0.013	-0.018
Turkey	176	3.0	3.0	0.0	0.015	-0.014	-0.013
New Zealand	97	2.7	2.7	0.0	0.082	0.003	-0.011
Qatar	15	1.6	1.6	1.6	0.005	-0.002	-0.007
Singapore	588	1.4	1.4	0.1	0.029	-0.009	-0.015
Peru	50	1.2	1.2	1.0	0.053	-0.020	-0.019
Kuwait	53	1.1	1.1	0.0	0.043	-0.010	-0.011
Hungary	26	1.0	1.0	0.0	0.010	-0.010	-0.006
Thailand	401	0.5	0.5	0.0	0.015	-0.015	-0.015
Poland	240	0.2	0.2	0.0	0.014	-0.005	-0.005
Korea, Republic Of	986	0.1	0.1	0.0	0.014	-0.002	-0.002
China	1,249	0.0	0.0	0.0	0.001	-0.001	-0.001

(continued)

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

Panel B: Results by Industry

		Percentage of Firms					
	Number of Firms	Post-Retirement Benefit Plan	Pension Plan	HealthCare Plan	PBO/Total Assets	Funding Level/ Total Assets	Net Amounts on Balance Sheet/ Total Assets
Aircraft	72	45.2	44.5	19.3	0.226	-0.098	-0.075
Tobacco Products	31	44.3	43.1	22.5	0.181	-0.055	-0.050
Shipping Containers	103	32.6	32.3	13.2	0.164	-0.063	-0.051
Candy & Soda	140	32.2	30.9	9.5	0.135	-0.050	-0.037
Automobiles	567	30.5	30.1	6.9	0.140	-0.075	-0.060
Business Supplies	363	29.9	29.7	8.7	0.142	-0.059	-0.045
Books	232	29.2	28.4	10.1	0.145	-0.047	-0.036
Machinery	975	28.1	27.7	6.7	0.148	-0.071	-0.055
Defense	22	27.6	27.6	11.1	0.343	-0.105	-0.080
Transportation	881	26.7	26.3	5.3	0.119	-0.051	-0.039
Chemicals	931	26.3	26.0	6.2	0.127	-0.054	-0.044
Steel	773	26.3	26.2	5.0	0.120	-0.052	-0.041
Construction	804	25.7	25.4	1.0	0.107	-0.044	-0.035
Rubber	274	25.3	24.3	4.5	0.141	-0.064	-0.049
Beer & Liquor	155	25.2	25.0	4.7	0.104	-0.039	-0.027
Consumer Goods	526	23.9	23.7	4.2	0.158	-0.069	-0.056
Retail	1,230	23.5	22.9	3.4	0.080	-0.028	-0.025
Construction Materials	918	23.3	22.9	4.7	0.117	-0.051	-0.040
Food Products	709	23.2	23.0	4.8	0.117	-0.049	-0.038
Electrical Equipment	428	23.1	22.9	4.0	0.140	-0.065	-0.053
Measuring and Control Equipment	318	22.8	22.5	3.8	0.139	-0.055	-0.045
Telecom	721	22.6	22.1	6.6	0.096	-0.035	-0.028
Electronic Equipment	1,630	21.9	21.8	1.8	0.075	-0.032	-0.027
Fabricated Products	136	21.6	21.6	5.6	0.120	-0.057	-0.046
Ships	73	21.2	21.2	4.6	0.126	-0.063	-0.042
Wholesale	1,709	21.0	20.7	2.5	0.087	-0.031	-0.026
Recreation	226	20.8	20.8	3.0	0.092	-0.045	-0.037
Apparel	257	19.9	19.9	2.1	0.132	-0.044	-0.039
Restaurants	494	19.3	18.9	2.6	0.070	-0.023	-0.022
Textiles	509	18.9	18.8	1.2	0.082	-0.043	-0.036
Coal	97	18.9	18.0	7.7	0.184	-0.110	-0.106
Computers	803	18.8	18.8	1.7	0.087	-0.041	-0.032
Medical Equipment	393	16.7	16.4	4.5	0.094	-0.035	-0.030
Oil	875	15.1	14.9	6.5	0.064	-0.029	-0.026
Personal Services	256	12.9	12.9	0.4	0.094	-0.043	-0.040
Drugs	948	12.7	12.4	3.0	0.101	-0.044	-0.035
Entertainment	460	12.6	12.5	0.9	0.036	-0.010	-0.013
Agriculture	272	12.2	12.0	1.1	0.079	-0.023	-0.024
Miscellaneous	154	11.7	11.2	1.5	0.100	-0.038	-0.037
Business Services	3,318	11.6	11.4	1.5	0.111	-0.044	-0.038
Real Estate	194	10.8	10.8	0.0	0.041	-0.019	-0.020
Healthcare	268	9.2	9.1	0.7	0.061	-0.026	-0.025
Mines	642	7.4	6.9	3.2	0.092	-0.033	-0.028
Trading	197	4.8	4.8	0.5	0.182	-0.027	-0.021
Precious Metals	515	2.5	2.1	1.3	0.025	-0.011	-0.011

(continued)

Table 1: Importance of Post-Retirement Obligations (continued)

Panel C: Results by Year

		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
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) are subtracted from the respective measure of debt, and projected benefit obligations are added. Similarly, prepaid post-retirement costs (and intangible pension asset) 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.

Panel A: Alternative Measures of Leverage

		Consolidated Leverage			Regular Leverage			Difference		*p*-values	
	N	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Means	Medians	*t*-Test	Wilcoxon
Gross Leverage											
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]
Leverage Net of (Cash + Short-Term Investments)											
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

		Consolidated Leverage - Regular Leverage					
Country	N	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: 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) from total debt and adding projected benefit obligations, as well as by subtracting prepaid post-retirement costs (and intangible pension asset) 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 4: 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. 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.

	Post-Retirement Benefit Plans						Pension Plans						Health Care Plans					
Year	N	Interest Expense Ratio	Tax Benefits (5%)/Total Assets	Tax Benefits (Avg)/Total Assets	Tax Benefits (5%)/ Market Cap	Tax Benefits (Avg)/ Market Cap	N	Interest Expense Ratio	Tax Benefits (5%)/Total Assets	Tax Benefits (Avg)/Total Assets	Tax Benefits (5%)/ Market Cap	Tax Benefits (Avg)/ Market Cap	N	Interest Expense Ratio	Tax Benefits (5%)/Total Assets	Tax Benefits (Avg)/Total Assets	Tax Benefits (5%)/ Market Cap	Tax Benefits (Avg)/ Market Cap
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

Table 5: Univariate Analysis of Post-Retirement Plans, Leverage and Real Investment

The table shows characteristics of corporate post-retirement benefit plans, tax benefits of post-retirement benefit plans, regular leverage, consolidated leverage and real investment. 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) are subtracted from the respective measure of debt, and projected benefit obligations are added. Similarly, prepaid post-retirement costs (and intangible pension asset) are subtracted from the measure of firm size, and the fair value of plan assets is added. For real investment, the table reports the ratios of capital expenditures to total assets and research and development expenses to total assets, respectively, where missing values of capital expenditures and research and development expenses are set to zero. 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						
	Low	2	3	4	High	High-Low	*p*-value
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]
Real Investment							
Capital Expenditures/Total Assets	0.064	0.051	0.046	0.044	0.044	-0.020	[0.00]
R&D/Total Assets	0.013	0.015	0.013	0.018	0.022	0.009	[0.00]

(continued)

Table 5: Univariate Analysis of Post-Retirement Plans, Leverage and Real Investment (continued)

Panel B: Sorts by Consolidated Leverage

	Total Debt / Total Assets						
	Low	2	3	4	High	High-Low	*p*-value
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]
Real Investment							
Capital Expenditures/Total Assets	0.044	0.052	0.053	0.052	0.053	0.009	[0.08]
R&D/Total Assets	0.022	0.017	0.013	0.013	0.012	-0.010	[0.00]

Panel C: Sorts by Regular Leverage

	Total Debt / Total Assets						
	Low	2	3	4	High	High-Low	*p*-value
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]
Real Investment							
Capital Expenditures/Total Assets	0.039	0.048	0.051	0.054	0.056	0.017	[0.00]
R&D/Total Assets	0.026	0.019	0.015	0.011	0.009	-0.017	[0.00]

Table 6: Correlation Analysis

The table shows correlations (in percentages) between the main variables used in the empirical analysis. Definitions of all variables are provided in Appendix A. 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) are subtracted from total debt, and projected benefit obligations are added. Similarly, prepaid post-retirement costs (and intangible pension asset) 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.

	PBO/Total Assets	Consolidated Leverage	Regular Leverage	Total Risk (log)	Capital Expenditures/ Total Assets	R&D Expense/ Total Assets	Employees (log)	Market-to-Book	ROA (3-year average)	Volatility of ROA (log)	Age (log)	Tax Rate	Total Assets in USD (log)	Net PPE/Total Assets	Dividend	Tangible Assets/ Total Assets	Net FX-Exposure	Debt Maturity	Gross Profit Margin (3-year average)	Preferred Stock/ Size Market Value	Convertible Debt/ Size Market Value	Negative Book Equity
Consolidated Leverage	35.9 a																					
Regular Leverage	-0.3	90.7 a																				
Total Risk (log)	-21.4 a	0.0	7.6 a																			
Capital Expenditures/Total Assets	-9.9 a	5.7 a	9.6 a	3.6 a																		
R&D Expense/Total Assets	10.6 a	-11.3 a	-15.9 a	3.4 a	-9.3 a																	
Employees (log)	32.0 a	17.4 a	8.4 a	-25.4 a	0.8	-0.4																
Market-to-Book	2.3 a	0.1	-0.6	-4.5 a	5.8 a	10.0 a	5.6 a															
ROA (3-year average)	-5.7 a	-12.6 a	-11.6 a	-10.6 a	17.4 a	-6.8 a	8.8 a	19.4 a														
Volatility of ROA (log)	-9.5 a	-6.8 a	-5.6 a	31.0 a	1.7 a	15.6 a	-23.8 a	9.7 a	-4.3 a													
Age (log)	33.5 a	9.7 a	-1.6 a	-23.9 a	-11.8 a	4.3 a	25.7 a	-7.2 a	-10.7 a	-14.9 a												
Tax Rate	9.2 a	4.8 a	3.0 a	-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)	32.8 a	22.7 a	14.8 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	-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	18.6 a	-1.6 a	-7.7 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	-6.3 a	-11.5 a	-10.1 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	8.9 a	-3.8 a	-7.8 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	10.7 a	28.1 a	26.6 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)	-2.3 a	-6.1 a	-5.6 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	0.2	6.1 a	6.0 a	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	-3.2 a	13.1 a	15.8 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	0.7		
Negative Book Equity	5.2 a	27.9 a	28.0 a	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	26.0 a	3.1 a	
(Cash + Short-Term Investments)/Total Assets (log)	-4.8 a	-30.9 a	-31.7 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	-3.4 a	5.9 a	-1.9 a

Table 7: Multivariate Analysis of Post-Retirement Plans, Leverage and Real Investment

The table reports results from estimations of a simultaneous equations model using the generalized method of moments (GMM) with post-retirement benefits, the ratio of projected benefit obligations to consolidated total assets, leverage measured by the ratio of total debt to consolidated total assets, and real investment measured by the ratio of capital expenditures to total assets (Panel A) and research and development expenses to total assets (Panel B), respectively. 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. The following instruments are used: Post-retirement benefits: Total Assets in USD (log), Natural logarithm of firm age; Projected benefit obligations: Total Assets in USD (log), Negative Book Equity (dummy); Leverage: Market Capitalization in USD (log), ROA (3-year average), Net PPE/Total Assets, Z-Score, Quick Ratio; Capital Expenditures: Negative Book Equity (dummy), Z-Score, Volatility of ROA (log); R&D Expense: Negative Book Equity (dummy), Z-Score, Volatility of ROA (log). All equations include year, country and industry dummies. Definitions of all variables are provided in Appendix A.

Panel A: Results with Capital Expenditures

	Capital Expenditures/ Total Assets		Leverage		PBO/Total Assets		Post-Retirement Benefit Plan	
Variable	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value
PBO/Total Assets *	-0.016	[0.00]	-0.232	[0.00]				
Post-Retirement Benefit Plan *					0.110	[0.00]		
Leverage *	-0.005	[0.00]			-0.049	[0.00]		
Capital Expenditures/Total Assets *			0.232	[0.00]				
Employees (log)					0.006	[0.00]	0.374	[0.00]
Market-to-Book	0.001	[0.00]	0.006	[0.00]	0.001	[0.00]	0.004	[0.08]
ROA (3-year average)					-0.058	[0.00]	-0.629	[0.00]
Volatility of ROA (log)			-0.013	[0.00]	0.005	[0.00]	-0.087	[0.00]
Age (log)	-0.009	[0.00]			0.017	[0.00]		
Total Risk (log)	0.004	[0.00]	0.055	[0.00]	-0.003	[0.01]		
Tax Rate			0.020	[0.00]				
Total Assets in USD (log)	0.000	[0.62]	0.015	[0.00]				
Dividend	0.001	[0.34]	-0.033	[0.00]				
Tangible Assets/Total Assets	0.011	[0.00]	-0.120	[0.00]				
Net FX-Exposure	-0.005	[0.00]	-0.042	[0.00]				
Debt Maturity	0.003	[0.00]	0.111	[0.00]				
Gross Profit Margin (3-year average)	0.014	[0.00]	-0.088	[0.00]				
Preferred Stock/Size Market Value	-0.042	[0.00]	-0.206	[0.00]				
Negative Book Equity			0.453	[0.00]				
Net PPE/Total Assets	0.150	[0.00]						
Convertible Debt/Size Market Value	-0.004	[0.52]						
(Cash + Short-Term Investments)/Total Assets (log)	0.002	[0.00]						
Intercept	0.025	[0.00]	0.008	[0.44]	-0.061	[0.00]	-3.661	[0.00]
Adjusted R^2	0.38		0.28		0.47		0.49	
Observations	32,854							

(continued)

Table 7: Multivariate Analysis of Post-Retirement Plans, Leverage and Real Investment (continued)

Panel B: Results with Research and Development

	R&D Expense/ Total Assets		Leverage		PBO/Total Assets		Post-Retirement Benefit Plan	
Variable	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value
PBO/Total Assets *	0.015	[0.00]	-0.230	[0.00]				
Post-Retirement Benefit Plan *					0.110	[0.00]		
Leverage *	-0.010	[0.00]			-0.049	[0.00]		
R&D Expense/Total Assets *			-0.501	[0.00]				
Employees (log)					0.006	[0.00]	0.374	[0.00]
Market-to-Book	0.000	[0.00]	0.006	[0.00]	0.001	[0.00]	0.004	[0.08]
ROA (3-year average)					-0.058	[0.00]	-0.629	[0.00]
Volatility of ROA (log)			-0.012	[0.00]	0.005	[0.00]	-0.087	[0.00]
Age (log)	0.002	[0.00]			0.017	[0.00]		
Total Risk (log)	0.004	[0.00]	0.056	[0.00]	-0.003	[0.01]		
Tax Rate			0.015	[0.00]				
Total Assets in USD (log)	0.000	[0.87]	0.016	[0.00]				
Dividend	-0.004	[0.00]	-0.034	[0.00]				
Tangible Assets/Total Assets	0.013	[0.00]	-0.094	[0.00]				
Net FX-Exposure	0.017	[0.00]	-0.037	[0.00]				
Debt Maturity	-0.001	[0.25]	0.114	[0.00]				
Gross Profit Margin (3-year average)	0.048	[0.00]	-0.057	[0.00]				
Preferred Stock/Size Market Value	0.056	[0.00]	-0.202	[0.00]				
Negative Book Equity			0.455	[0.00]				
Net PPE/Total Assets	-0.010	[0.00]						
Convertible Debt/Size Market Value	0.021	[0.00]						
(Cash + Short-Term Investments)/Total Assets (log)	0.002	[0.00]						
Intercept	0.003	[0.20]	0.000	[0.96]	-0.061	[0.00]	-3.661	[0.00]
Adjusted R^2	0.35		0.28		0.47		0.49	
Observations	32,854							

Table 8: Multivariate Analysis by Country

The table reports results from estimations of a simultaneous equations model using the generalized method of moments (GMM) with post-retirement benefits, the ratio of projected benefit obligations to consolidated total assets, leverage measured by the ratio of total debt to consolidated total assets, and real investment measured by the ratio of capital expenditures to total assets (Panel A) and research and development expenses to total assets (Panel B), respectively. The estimation framework is the same as in Table 7, but the model is estimated by country and separately for developed and developing countries (defined based on the MSCI classification as of June 2006). All models include year and industry dummies. Models for firms in developed and developing countries also include country dummies. For each country, the table shows the estimated coefficients and associated *p*-values of selected variables in selected equations, as well as the number of observations. Definitions of all variables are provided in Appendix A.

Panel A: Results with Capital Expenditures

	Capital Expenditures Equation		Leverage Equation				
	PBO/Total Assets		PBO/Total Assets		Capital Expenditures/ Total Assets		Observations
	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value	
Australia	-0.109	[0.01]	-0.328	[0.00]	0.037	[0.64]	863
Austria	0.039	[0.73]	-0.624	[0.04]	0.253	[0.35]	120
Canada	-0.063	[0.06]	-0.235	[0.00]	0.239	[0.00]	754
Denmark	-0.102	[0.33]	0.356	[0.21]	0.443	[0.03]	190
Finland	-0.206	[0.01]	-0.682	[0.00]	0.392	[0.02]	218
France	-0.010	[0.69]	-0.569	[0.00]	0.808	[0.00]	645
Germany	-0.029	[0.03]	-0.390	[0.00]	0.065	[0.61]	906
Hong Kong	-0.083	[0.19]	-0.616	[0.00]	0.185	[0.00]	1,433
India	0.001	[0.98]	-0.638	[0.00]	0.625	[0.00]	1,220
Indonesia	0.018	[0.81]	-0.712	[0.00]	0.189	[0.16]	514
Japan	-0.001	[0.93]	-0.173	[0.00]	0.209	[0.00]	5,387
Malaysia	0.002	[0.98]	-0.064	[0.82]	0.269	[0.00]	1,089
Netherlands	-0.025	[0.10]	-0.212	[0.00]	0.750	[0.00]	265
Norway	-0.104	[0.39]	-0.764	[0.00]	0.378	[0.12]	153
South Africa	-0.036	[0.10]	-0.072	[0.19]	0.491	[0.00]	377
Sweden	0.000	[0.99]	-0.294	[0.00]	0.260	[0.17]	426
Switzerland	-0.001	[0.87]	-0.179	[0.00]	-0.041	[0.85]	425
Taiwan, Province Of China	-0.136	[0.02]	-1.097	[0.00]	0.413	[0.00]	1,510
United Kingdom	-0.011	[0.02]	-0.185	[0.00]	0.299	[0.00]	2,880
United States	-0.010	[0.02]	-0.243	[0.00]	0.039	[0.26]	9,217
Developed countries	-0.020	[0.00]	-0.167	[0.00]	0.183	[0.00]	25,501
Developing countries	-0.018	[0.35]	-0.295	[0.00]	0.356	[0.00]	7,353

(continued)

Table 8: Multivariate Analysis by Country (continued)

Panel B: Results with Research and Development

	R&D Expense Equation		Leverage Equation				
	PBO/Total Assets		PBO/Total Assets		R&D Expense/ Total Assets		Observations
	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value	
Australia	0.018	[0.49]	-0.330	[0.00]	-0.235	[0.10]	863
Austria	0.037	[0.36]	-0.630	[0.05]	-0.152	[0.86]	120
Canada	0.022	[0.12]	-0.233	[0.00]	-0.933	[0.00]	754
Denmark	0.212	[0.01]	0.456	[0.12]	-0.372	[0.24]	190
Finland	-0.067	[0.30]	-0.824	[0.00]	-0.940	[0.00]	218
France	-0.006	[0.84]	-0.585	[0.00]	-0.417	[0.00]	645
Germany	0.039	[0.00]	-0.299	[0.00]	-1.355	[0.00]	906
Hong Kong	0.010	[0.48]	-0.632	[0.00]	-0.970	[0.00]	1,433
India	0.005	[0.79]	-0.707	[0.00]	0.337	[0.18]	1,220
Indonesia	0.003	[0.56]	-0.724	[0.00]	1.089	[0.64]	514
Japan	0.038	[0.00]	-0.151	[0.00]	-0.567	[0.00]	5,387
Malaysia	0.052	[0.00]	0.126	[0.67]	-4.104	[0.00]	1,089
Netherlands	0.023	[0.06]	-0.284	[0.00]	0.259	[0.49]	265
Norway	0.055	[0.03]	-0.685	[0.01]	-2.045	[0.09]	153
South Africa	0.019	[0.00]	-0.055	[0.34]	-1.066	[0.03]	377
Sweden	-0.023	[0.33]	-0.283	[0.00]	-0.923	[0.00]	426
Switzerland	-0.030	[0.04]	-0.184	[0.00]	-0.144	[0.34]	425
Taiwan, Province Of China	0.146	[0.00]	-0.954	[0.00]	-1.210	[0.00]	1,510
United Kingdom	0.023	[0.00]	-0.185	[0.00]	-0.250	[0.00]	2,880
United States	-0.001	[0.70]	-0.245	[0.00]	-0.506	[0.00]	9,217
Developed countries	0.011	[0.00]	-0.164	[0.00]	-0.446	[0.00]	25,501
Developing countries	0.021	[0.00]	-0.302	[0.00]	-0.741	[0.00]	7,353

Appendix A: Variable Definitions

The table shows the definitions of the main variables used in the analysis.

Variable	Definition
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
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 exdudes seasonal employees and emergency employees.
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
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
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

(continued)

Appendix A: Variable Definitions (continued)

Variable	Definition
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

Appendix B: Summary Statistics

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

	Observat						Percentiles							
	ions	Mean	Std. Dev.	Skewness	Kurtosis	Minimum	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	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	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
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	0.08	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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
(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
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
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
(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
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
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
(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
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
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
(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
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
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
(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
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
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

(continued)

Appendix B: Summary Statistics (continued)

	Observations	Mean	Std. Dev.	Skewness	Kurtosis	Minimum	Percentiles 1st	5th	25th	Median	75th	95th	99th	Maximum
(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
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
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
(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
Leverage Net of (Cash + Short-Term Investments)														
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
Consolidated Leverage														
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
Consolidated Leverage Net of (Cash + Short-Term Investments)														
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
Post-Retirement Benefits														
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
Pension Benefits														
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
Health Care Benefits														
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

Appendix C: Results for Firms with Consolidated Accounts

The table reports results from estimations of a simultaneous equations model using the generalized method of moments (GMM) with post-retirement benefits, the ratio of projected benefit obligations to consolidated total assets, leverage measured by the ratio of total debt to consolidated total assets, and real investment measured by the ratio of capital expenditures to total assets (Panel A) and research and development expenses to total assets (Panel B), respectively. 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. The following instruments are used: Post-retirement benefits: Total Assets in USD (log), Natural logarithm of firm age; Projected benefit obligations: Total Assets in USD (log), Negative Book Equity (dummy); Leverage: Market Capitalization in USD (log), ROA (3-year average), Net PPE/Total Assets, Z-Score, Quick Ratio; Capital Expenditures: Negative Book Equity (dummy), Z-Score, Volatility of ROA (log); R&D Expense: Negative Book Equity (dummy), Z-Score, Volatility of ROA (log). All equations include year, country and industry dummies. Definitions of all variables are provided in Appendix A.

Panel A: Results with Capital Expenditures

	Capital Expenditures/ Total Assets		Leverage		PBO/Total Assets		Post-Retirement Benefit Plan	
Variable	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value
PBO/Total Assets *	-0.016	[0.00]	-0.225	[0.00]				
Post-Retirement Benefit Plan (dummy) *					0.114	[0.00]		
Leverage *	-0.003	[0.12]			-0.050	[0.00]		
Capital Expenditures/Total Assets *			0.227	[0.00]				
Employees (log)					0.005	[0.00]	0.397	[0.00]
Market-to-Book	0.001	[0.00]	0.006	[0.00]	0.001	[0.00]	0.004	[0.08]
ROA (3-year average)					-0.054	[0.00]	-0.801	[0.00]
Volatility of ROA (log)			-0.013	[0.00]	0.005	[0.00]	-0.090	[0.00]
Age (log)	-0.008	[0.00]			0.016	[0.00]		
Total Risk (log)	0.003	[0.00]	0.052	[0.00]	-0.004	[0.00]		
Tax Rate			0.021	[0.00]				
Total Assets in USD (log)	0.000	[0.15]	0.013	[0.00]				
Dividend (dummy)	0.000	[0.50]	-0.025	[0.00]				
Tangible Assets/Total Assets	0.011	[0.00]	-0.121	[0.00]				
Net FX-Exposure	-0.005	[0.00]	-0.038	[0.00]				
Debt Maturity	0.002	[0.02]	0.110	[0.00]				
Gross Profit Margin (3-year average)	0.012	[0.00]	-0.076	[0.00]				
Preferred Stock/Size Market Value	-0.043	[0.00]	-0.177	[0.00]				
Negative Book Equity			0.452	[0.00]				
Net PPE/Total Assets	0.152	[0.00]						
Convertible Debt/Size Market Value	-0.007	[0.31]						
(Cash + Short-Term Investments)/Total Assets (log)	0.002	[0.00]						
Intercept	0.025	[0.00]	0.020	[0.05]	-0.058	[0.00]	-3.923	[0.00]
Adjusted R^2	0.40		0.29		0.48		0.47	
Observations	27,282							

(continued)

Appendix C: Results for Firms with Consolidated Accounts (continued)

Panel B: Results with Research and Development

	R&D Expense/ Total Assets		Leverage		PBO/Total Assets		Post-Retirement Benefit Plan	
Variable	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value
PBO/Total Assets *	0.015	[0.00]	-0.223	[0.00]				
Post-Retirement Benefit Plan (dummy) *					0.114	[0.00]		
Leverage *	-0.011	[0.00]			-0.050	[0.00]		
R&D Expense/Total Assets *			-0.489	[0.00]				
Employees (log)					0.005	[0.00]	0.397	[0.00]
Market-to-Book	0.000	[0.00]	0.006	[0.00]	0.001	[0.00]	0.004	[0.08]
ROA (3-year average)					-0.054	[0.00]	-0.801	[0.00]
Volatility of ROA (log)			-0.012	[0.00]	0.005	[0.00]	-0.090	[0.00]
Age (log)	0.002	[0.00]			0.016	[0.00]		
Total Risk (log)	0.004	[0.00]	0.053	[0.00]	-0.004	[0.00]		
Tax Rate			0.015	[0.00]				
Total Assets in USD (log)	0.000	[0.08]	0.014	[0.00]				
Dividend (dummy)	-0.004	[0.00]	-0.027	[0.00]				
Tangible Assets/Total Assets	0.013	[0.00]	-0.095	[0.00]				
Net FX-Exposure	0.017	[0.00]	-0.032	[0.00]				
Debt Maturity	-0.001	[0.33]	0.113	[0.00]				
Gross Profit Margin (3-year average)	0.049	[0.00]	-0.046	[0.00]				
Preferred Stock/Size Market Value	0.058	[0.00]	-0.172	[0.00]				
Negative Book Equity			0.454	[0.00]				
Net PPE/Total Assets	-0.011	[0.00]						
Convertible Debt/Size Market Value	0.022	[0.00]						
(Cash + Short-Term Investments)/Total Assets (log)	0.002	[0.00]						
Intercept	0.006	[0.00]	0.014	[0.18]	-0.058	[0.00]	-3.923	[0.00]
Adjusted R^2	0.34		0.29		0.48		0.47	
Observations	27,282							

Appendix D: Results for Alternative Model Specification

The table reports results from estimations of a simultaneous equations model using the generalized method of moments (GMM) with post-retirement benefits, the ratio of projected benefit obligations to consolidated total assets, leverage measured by the ratio of total debt to consolidated total assets, and real investment measured by the ratio of capital expenditures to total assets (Panel A) and research and development expenses to total assets (Panel B), respectively. 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. The following instruments are used: Post-retirement benefits: Total Assets in USD (log), Natural logarithm of firm age; Projected benefit obligations: Total Assets in USD (log), Negative Book Equity (dummy); Leverage: Market Capitalization in USD (log), ROA (3-year average), Net PPE/Total Assets, Z-Score, Quick Ratio; Capital Expenditures: Negative Book Equity (dummy), Z-Score, Volatility of ROA (log); R&D Expense: Negative Book Equity (dummy), Z-Score, Volatility of ROA (log). All equations include year, country and industry dummies. Definitions of all variables are provided in Appendix A.

Panel A: Results with Capital Expenditures

	Capital Expenditures/ Total Assets		Leverage		PBO/Total Assets		Post-Retirement Benefit Plan	
Variable	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value
PBO/Total Assets *	-0.012	[0.00]	-0.313	[0.00]				
Post-Retirement Benefit Plan (dummy) *					0.099	[0.00]		
Leverage *	-0.003	[0.00]			-0.021	[0.00]		
Capital Expenditures/Total Assets *			0.178	[0.00]				
Market-to-Book	0.001	[0.00]	0.006	[0.00]	0.000	[0.79]	0.006	[0.00]
ROA (3-year average)					0.004	[0.01]	1.744	[0.00]
Volatility of ROA (log)			-0.008	[0.00]	0.002	[0.00]	-0.174	[0.00]
Age (log)	-0.012	[0.00]			0.013	[0.00]		
Total Risk (log)	0.001	[0.06]	0.054	[0.00]	-0.002	[0.00]		
Total Assets in USD (log)	0.000	[0.01]	0.017	[0.00]				
Dividend (dummy)	0.009	[0.00]	-0.047	[0.00]				
Tangible Assets/Total Assets	0.008	[0.00]	-0.065	[0.00]				
Debt Maturity	0.004	[0.00]	0.104	[0.00]				
Gross Profit Margin (3-year average)	0.010	[0.00]	-0.052	[0.00]				
Preferred Stock/Size Market Value	-0.025	[0.00]	-0.536	[0.00]				
Negative Book Equity			0.476	[0.00]				
Net PPE/Total Assets	0.127	[0.00]						
(Cash + Short-Term Investments)/Total Assets (log)	0.003	[0.00]						
Intercept	0.031	[0.00]	-0.023	[0.00]	-0.016	[0.00]	-1.155	[0.00]
Adjusted R^2	0.30		0.32		0.45		0.25	
Observations	128,492							

(continued)

Appendix D: Results for Alternative Model Specification (continued)

Panel B: Results with Research and Development

	R&D Expense/ Total Assets		Leverage		PBO/Total Assets		Post-Retirement Benefit Plan	
Variable	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value	Coef	*p*-value
PBO/Total Assets *	0.005	[0.00]	-0.320	[0.00]				
Post-Retirement Benefit Plan (dummy) *					0.099	[0.00]		
Leverage *	0.003	[0.00]			-0.021	[0.00]		
R&D Expense/Total Assets *			-0.327	[0.00]				
Market-to-Book	0.000	[0.00]	0.006	[0.00]	0.000	[0.79]	0.006	[0.00]
ROA (3-year average)					0.004	[0.01]	1.744	[0.00]
Volatility of ROA (log)			-0.006	[0.00]	0.002	[0.00]	-0.174	[0.00]
Age (log)	0.001	[0.00]			0.013	[0.00]		
Total Risk (log)	0.005	[0.00]	0.055	[0.00]	-0.002	[0.00]		
Total Assets in USD (log)	-0.002	[0.00]	0.017	[0.00]				
Dividend (dummy)	-0.007	[0.00]	-0.047	[0.00]				
Tangible Assets/Total Assets	0.017	[0.00]	-0.046	[0.00]				
Debt Maturity	0.000	[0.34]	0.106	[0.00]				
Gross Profit Margin (3-year average)	0.022	[0.00]	-0.042	[0.00]				
Preferred Stock/Size Market Value	0.050	[0.00]	-0.538	[0.00]				
Negative Book Equity			0.480	[0.00]				
Net PPE/Total Assets	-0.010	[0.00]						
(Cash + Short-Term Investments)/Total Assets (log)	0.005	[0.00]						
Intercept	0.060	[0.00]	-0.014	[0.01]	-0.016	[0.00]	-1.155	[0.00]
Adjusted R^2	0.28		0.32		0.45		0.25	
Observations	128,492							