

Is Pension Entirely A Burden to Firms?

Global Evidence on Corporate Pension Funding and Corporate Investments

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Abstract

Financial crises, low interest rate, and extended life expectancy cast doubt on whether corporate defined benefit (DB) pensions are sufficiently funded to cover their liabilities. We study the effect of pension underfunding on corporate investment using international data involving 29 countries at heterogeneous economic development stages and different regulatory environments. We document that corporate pensions are *significantly* underfunded in most countries of our sample in the period of 2001 to 2015. Pension assets are on average less than 50% of pension liabilities among firms that provide DB pension plans. To the extent of pension underfunding effect on corporate investment, we find that the (inverse) relationship is subject to variation in country characteristics. Specifically, firm's investment is more severely constrained by pension underfunding in countries with stronger labor union power and less developed financial market. Finally, while substantial pension underfunding has a negative impact on firm value, our results show that offering more DB pension plans do not reduce firm value. Overall, our findings suggest that DB pension plans could still play a useful role in creating firm value.

JEL Classification: G30, G31, G32, J26

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1. Introduction

Defined benefit (DB) pensions are an important source of private saving and retirement income for employees around the world. Despite the popularity (and flexibility) of defined contribution (DC) retirement plans, many firms around the world continue to sponsor DB pension plans. Companies with DB pension plans promise their employees certain monthly benefit payment at retirement, which is calculated based on employee salary before retirement and number of service years. DC plans work differently from DB plans, and they resemble ordinary saving accounts. The firm deposits a share of wages (or profits) into the accounts each year; after a short vesting period (usually one to three years), the account then belongs to the worker. DB pension involves no deposits or accounts as such. Still, government rules state that companies must make contributions to their pension funds to meet their future pension liabilities according to legally specified formulas.

With a DB pension plan, the firm pledges retirement benefits to employees determined by each employee's age, tenure, and salary at retirement. Sponsored pension plans are therefore considered an important component of firm's liabilities. In the U.S., firms hold the responsibility to assure their pension plans to be fully or nearly fully funded (see section 2.2 for the details). Several recent studies (e.g., Rauh, 2006) present empirical evidence on the economic costs of pension underfunding in the U.S. From this perspective, DB plans become a burden to sponsoring firms.¹

There is nevertheless a potential positive role of defined benefit pensions as employees defer a significant portion of their compensation upon their retirement. Treynor (1976) and Ippolito (1985a,b) bring up the implicit contract theory of pension that workers anticipating long careers with a firm will consider the package of wage and pension benefits they expect to collect over their life cycle. Under this framework, workers in pension plans have incentives to remain with the firm because workers expect to "get more" from their pension plan. This helps bond employees with the firm – offering strong incentives for workers to complete the normal tenure in the firm, not to quit early. For example, a recent study by Chang, Kang,

¹ It should be noted corporate liabilities are estimated based on actuarial assumptions and pension information is often opaque to investors (see e.g., Coronado and Sharpe, 2003; Bergstresser, Desai, and Rauh, 2006), which to some extent alleviates corporate from the pension burden.

and Zhang (2017) shows that pension underfunding plays a positive role in firm's acquisitions. They find that acquirers with larger pension underfunding experience higher announcement returns, and they are more likely to experience an improvement in labor productivity and less likely to become a target post acquisition. A more interesting point on pension underfunding is brought up by Ippolito (1985 a,b) that part of such costs to make pensions fully funded are the unionized employees' hold-up problem – corporates use pension underfunding as a device to bargain against unionized workers. Some recent studies offer support for this argument.² Using a unique dataset of airlines, Benmelech, Bergman, and Enriquez (2012) show that firms in their sample obtain wage concessions from their employees whose pension plans are underfunded. In other words, management can employ the threat of “pension dumping” to gain extra power in negotiations with employees.

As countries differ in their legal and economic status, a study examining pension funding around the world helps to understand and differentiate the alternative drivers for corporate pension funding. For instance, according to Ippolito's implicit contract theory, we expect to observe higher levels of pension underfunding in countries with stronger employee protections such as union power, and this can provide employees with stronger incentives to work hard and create value for the firm. Nonetheless, there is a tradeoff: severe underfunding can also cause financial constraint on firm's investment since firms may not find it easy to access external financing. Therefore, it is interesting to examine empirically how firms choose to fund their pensions, and the effect of pension underfunding on firm investment and valuation across countries.

In this study, we examine the use of corporate pension in an international setting. With a sample of 29 countries, we are able to take advantage of the substantial heterogeneity across countries in terms of corporate legal environment, regulations, and economic conditions. We expect that factors like a country's financial development, its labor law, and the presence of influence of labor unions have an impact on the funding status of corporate pension and the economic consequence of pension underfunding. We

² In the US, voluntary underfunding is easy to implement. Specifically, the ERISA allows the unfunded liability to be amortized over a long period, typically 5–30 years.

particularly focus on three questions regarding corporate pensions. The first is on funding status around the world. In other words, are they in general underfunded? And if yes, by how much? Second, we investigate the effect of pension underfunding on corporate investment in the international market. Specifically, we are interested in the cross-country heterogeneity of the impact of pension underfunding on firm (under)investment, and the determinants of such heterogeneity. Potential candidates of the source of such determinants include labor laws and policies and financial market and economic conditions. Last but not least, we examine the value implication of both DB pension adoption and pension underfunding, and their variations among countries. In the United States and many other countries, there are so-called “three pillars” in the retirement system, the first pillar being a country’s public social security, the second being retirement income provided by employers and employees’ own contributions during their career, and the third being private pensions carried out by the retirees at individual level. Therefore, in order to avoid potential bias caused by heterogeneity in countries’ public social protection programs, we also take into account the first pillar system and control for the percentage of a country’s social-security-like income in retiree’s total income in our cross-country analyses.³

This paper makes important contributions to the existing literature ~~in the following aspects~~. First, pension underfunding has been a trending topic in recent years because it has been reportedly severe in both public and private sector in the US as well as other countries. Since the 2008 global financial crisis, most countries have lowered interest rates in order to ease corporate financing and boost investing. However, one of the by-products of low interest rate in the pension context is that it mechanically increases the present value of projected benefits obligations for DB pension plans. Even worse, if pension plans’ investments experience weak performance due to the condition of the equity market, the assets of firms’ pension plans would not be able to keep up with the increase in the liabilities, and underfunding will become more severe. In the privates sector, it is reported that the pension deficit for S&P 1500 companies has exceeded \$500 billion in 2016. In the public sector, an extreme case is that Puerto Rico’s pension plans reportedly have \$45

³ We also divide our full sample into two subsamples based on whether a country has relatively high level of public social protection system. In untabulated results, we find that our results in table 5 through 8 are similar across both subsamples, indicating that our results are not driven by heterogeneity in countrie’s public social protection.

billion in liabilities but only \$2 billion in assets⁴. Although anecdotal evidence shows that pension underfunding is a global issue, empirical evidence in the global market is scarce. We attempt to fill this gap and contribute to the pension literature by studying international pension underfunding in a systematic way. To our knowledge, this is the first paper to connect corporate pension with economic status and legal systems of various countries.

Furthermore, we attempt to be the first to show the relationship between country characteristics and investment-pension-underfunding sensitivity as well as firm valuation across countries. Labor laws, which typically have influence on country's retirement systems, differ among countries. In the international finance literature, it is also shown that access to external finance, among others, varies significantly across countries. In particular, through the channel of pension underfunding, we add evidence to the effect of various country characteristics on corporate investment, such as financial markets development and labor-related legislations and regulations.

Our study is related to three strands of literature. First, the impact of financial constraint on corporate investment is one of the central topics in corporate finance. Starting from Fazzari et al. (1988), many papers have documented that various firm characteristics (e.g. Almeida and Campello, 2007 and Hadlock and Pierce, 2010) and exogenous shocks (e.g. Lamont, 1997 and Duchin, Ozbas, and Sensoy, 2010) can lead to higher financial constraint and thus lower investment.

Specifically related to the pension literature, the concern about the significant pension underfunding in recent years and the effect of pension underfunding on corporate investment take the central stage. To be specific, Rauh (2006) documents that firms' mandatory contributions to the pension plans they sponsor have negative impact on their capital expenditures and the effect is stronger among firms with otherwise more severe financial constraints. Two follow-up papers, Franzoni and Marin (2006) and Franzoni (2009) further study the negative effect of pension underfunding on firm's stock performance. The papers argue that the market does not take into account the information on pension funding status and significantly overvalues firms with severely underfunded pension plans. These companies earn lower stock returns than

⁴ See Wall Street Journal, 8/25/2016, "Puerto Rico's Pensions: \$2 Billion in Assets, \$45 Billion in Liabilities"

firms with healthier pension plans for several years following the first occurrence of the underfunding. Furthermore, according to Martin and Henderson (1983), the ERISA regulates minimum pension contributions as liabilities that is more senior to debentures, bank loans, and corporate bonds, etc. This is similar to the “debt overhang” situation argued by Myers (1977), where managers may choose to forgo positive NPV projects if they foresee a value transfer from the shareholders to the creditors. In sum, pension underfunding potentially has both direct and indirect negative impact on firm’s investment, and thus its growth.

Finally, the vast heterogeneity in the international capital market makes our study appealing. One important source of such variation is the regulation of labor markets. For example, Botero et al. (2004) find significant variation in labor laws including employment laws and social security laws among countries with different ideologies and legal systems. Such heterogeneity in labor law can drive cross-country variations in pension design, causing differential pension funding status and relationships between pension funding status and firm investment. More recently, Banker, Byzalov, and Chen (2013) and Simintzi, Vig, and Volpin (2015) document that employment protection legislations have important influence on firm’s labor adjustment costs and capital structure, respectively. In the global context, Aggarwal and Goodell (2013) study how public pension progressivity is related to country characteristics, especially culture, but their study is focused on only one respect of public pension system and says nothing about the private pension system. Glaum (2009) provides a survey of pension-related accounting rule progress in Europe, but offers no specific cross-country analysis using empirical data. In broader international finance literature, it is shown that investor rights and protection and access to external finance, among others, vary significantly across countries. They are also shown to have influence on firm’s investment. For instance, various country characteristics are shown to have significant effect on corporate investment, such as financial market development (e.g. Rajan and Zingales, 1998 and Wurgler, 2000) and legal environment (Julio and Yook, 2012).

The remainder of the paper is organized as follows. The next section introduces defined benefit pensions and (under)funding. Section 3 develops the main hypotheses in this study. Section 4 describes the

data and the construction of our sample. In section 5, we provide empirical evidence on corporate pension funding in international markets, and test our hypotheses in detail by analyzing the relation between the effect of pension underfunding on firm's investment and various country characteristics. Section 6 concludes the paper.

2. Background on Pension and Pension Underfunding

Pension funding status is a key concept in pension studies, and is defined as the difference between pension assets and pension liabilities. Pension assets are mainly shifted by market values of the equity and fixed income assets that firms select to invest in order to fund pension liabilities, as well as potential variation in the amount of cash that firms contribute. Pension liabilities move closely with interest rate and the relationship is inverse. When the market value of pension assets is greater than the present value of projected pension liabilities, the pension plan is overfunded and firms do not have to make contributions to their pension funds. Actually, if the pension plan is overfunded and the firm still makes contributions to its pension plans, it may receive some unfavorable tax treatment. When the value of pension assets is below the value of projected future pension obligations, the pension plan is underfunded. When the underfunding severity reaches a certain point, firms in the US are required by Employee Retirement Income Security Act of 1974 (ERISA) to make mandatory contributions to the pension plan.

Therefore, pension funding status can be affected by many factors that are out of the control of the firm, such as financial market performance and interest rate level, as well as factors that can be controlled to some extent by the firm, such as pension assets' expected rate of return, and firms' contributions. When a country's equity and bond markets perform well, and/or its interest rate level is high, pension plans in this country are more likely to be well funded. When managers assume higher expected rate of return on pension assets and make abundant contributions to firm's pension plans, they also tend to be better funded.

Additionally, in his seminal paper, Ippolito (1985a) brings up the Implicit Contract Theory of Pension Underfunding: workers anticipating careers with a firm will consider the package of wage and pension benefits they expect to collect over their life cycle. Following the notation in Ippolito (1985 a,b),

we consider a simple case where a worker starts with the firm at age zero. For an employee with A years of service to date, the firm could project the employee's pension benefit P_A as

$$P_A = gAW(R)e^{-i(R-A)}, \quad (1)$$

where A is the employee's years of service; R is the retirement age; i is the discount rate; $W(R)$ is the final wage; g is generosity parameter, determining the percentage of salary the employee can get upon retirement. However, if an employee terminates the employment at age A , the termination pension benefit is⁵

$$P_T = gAW(A)e^{-i(R-A)}. \quad (2)$$

It is clear that $P_A > P_T$. As a result, a unique feature of pension is its ability to retain employees.

Since DB pension benefit is significantly greater for an employee working with a firm for a longer time, employees with defined benefit pension have stronger incentives to stay with a firm. In contrast, as defined contribution retirement plans do not specify the amount of benefit accrued to employees, defined contribution retirement plans would not have the retention benefit as defined benefit pensions do.

In addition, pension may act as a costly bonding device to align the interests of firms and employees. This offers a vital role of pension plans in a modern society where a significant portion of employers has switched their retirement plans to defined contribution plans. Suppose the formula for pension benefit (PB) is:

$$PB = baW_j \quad (3)$$

where b is generosity parameter, a is employee age, and W_j is wage at age j . As a result, accumulated pension benefit is:

$$PV_a = \int_{j=a}^R baW_j f_{ja} e^{-i(R-a)} dj \quad (4)$$

where f_{ja} is the conditional probability density of pension accruals stopping either because the individual leaves the firm or the firm terminates the pension at age j , given that the individual is currently age a .⁶

⁵ In fact, firms simultaneously report these two numbers in their financial statements. The former is known as the projected benefit obligations (PBOs), equal to the present value of liabilities earned and the present value of liability from future compensation increases. The latter is the accumulated benefit obligations (ABOs), estimated based on the assumption that the pension plan is to be terminated immediately; it does not consider any future salary increases.

Suppose that pension contract is not a complete contract which cannot effectively control employees' effort level. This potentially increases the default probability of the firm, hence increasing the probability of pension termination at early year.

An effective way to reduce the low effort level problem is to underfund the pension project. Assume the above pension plan is partially funded with a funding ratio δ (<1),

$$F_A = \delta P_A$$

If the employee fails to work diligently, and thus the firm goes bankrupt, the employee can only receive δP_A for her retirement benefit at retirement. As a result of this threat, the employee is motivated to work with the employer to avoid bankruptcy. This is the so called bonding mechanism of underfunded pension.⁷ When there is a labor hold up problem given the presence of labor union, it is ideal for the firm to underfund the pension. This imposes a potential cost on employee when they force the firm into bankruptcy.

3. Hypotheses Development

In this section, we describe our main hypotheses on how corporate pension funding status and the effect of pension underfunding on firm's investment activities and firm values can be different across countries. This cross-country analysis is one of the main novelties in our study since earlier research on the financial constraint effect of pension underfunding on firm investment is within a single country (e.g. Rauh, 2006). Our country characteristics belong to two main groups – laws and policies, and the financial market development. In addition, the economy in general and industry effect are also part of our consideration. One thing worth mentioning is that in the law and finance literature, most studies investigate how different countries' laws and institutions vary in protecting investors' rights, especially for the minority stakeholders, and such protection can in turn influence firms' investing and financing activities. A vast majority of the research in this area points out that English common law system dominates civil law systems in terms of protecting small investors, allocating resources efficiently, and enhancing financial market development. (e.g., La Porta et al., 1998, Brockman and Unlu, 2009, and Djankov et al., 2008, etc.) In this study, however,

⁶ Note Equations (1) and (2) are the result of equation (4) assumes the employment is terminated at age a or at retirement.

⁷ The benefit from pension insurance typically has an upper limit in terms of employee benefit. Therefore, the bonding mechanism of underfunded pension still holds.

we investigate laws and institutions that protect employees instead of investors. We follow the spirit of the studies mentioned above, and posit that country characteristics such as laws and policies and financial market development can affect firms' decisions in pension and investment dimensions. We next outline testable hypotheses, which we formally examine in section 4.

3.1. Pension funding

Since the 2008 global financial crisis, most countries have lowered interest rates in order to ease corporate financing and boost investing. However, one of the by-products of low interest rate in the pension context is that it mechanically increases the present value of projected benefits obligations for DB pension plans. Even worse, if pension plans' investments experience weak performance due to the condition of the equity market, the assets of firms' pension plans would not be able to keep up with the increase in the liabilities, and underfunding will become more severe. This could in turn limit investment and thus to some degree act against stimulations.

In the United States, for example, DB pension funds in general have been underfunded for years since the financial crisis. According to the Federal Reserve (2016), in year 2015, private pension funds in the US in total are underfunded by almost \$500 billion, more than 15% of pension plan assets. Anecdotal evidence also points to the same direction. According to a recent Wall Street Journal article (Monga, 2016), "The combined pension deficit for S&P 1500 companies ballooned to \$568 billion at the end of June, a \$164 billion increase from the end of 2015." Following the unfavorable situation and uncertainty involved in DB pension plans that companies need to bear, many firms offering DB pension plans chose to freeze their DB plans for their new employees and instead offer defined contribution (DC) plans. UPS and L.L. Bean are the two most recent examples in the US. The situation in the public sector is even worse, both at the Federal level and the State and Local level. Given that private DB pension plans are adopted globally and that the economic conditions (e.g. the 2008 financial crisis) are intertwined across countries thanks to globalization, it is natural to ask whether private pension funds experience similarly severe underfunding in other countries. Since we observe globally a low level of interest rate and financial market performance in general, we expect to see a similar picture of funding status in the global context as in the US.

H1 (Global underfunding hypothesis): *Pension underfunding is a global phenomenon.*

Furthermore, we expect that heterogeneity in country characteristics leads to variation in pension underfunding status across countries. In particular, labor-related laws and policies, financial market development, as well as stock market performances can have effect on pension underfunding. Specifically, one can argue that in a country with stronger employee protection and more generous retirement system in general, DB pension plans should be funded better because retirement funds is considered one of the most important rights of employees and therefore properly funding their pension funds is treated with higher priority in firms' business. For example, Laboul and Yermo (2006) argue that "Anglo-Saxon countries have generally allowed a much greater degree of involvement of employers in the administration of pension funds than have Continental European countries. Funding rules, which set minimum ratios of pension assets to liabilities, have also been generally laxer in the former countries while investment regulations have largely relied on the 'prudent person' standard."

Alternatively, one could argue that we may observe the opposite. This is because in countries with stronger employee protection and more generous retirement system, it may be harder for firms that do provide their employees with DB pension plans to cut their benefits or manipulate parameters used to calculate pension assets or liabilities such as expected rate of return on pension investment. Under unfavorable economic situations at the macro level such as lower interest rate and weaker stock market performance, DB pension-providing firms in these countries are more likely to experience relatively bad funding status in their pension funds. In addition, with respect to union power, Ipolito's implicit contract theory suggests that in countries with stronger union power, firms tend to purposefully underfund their pension plans to maintain stronger negotiation power against their employees. One piece of evidence consistent with this point is that according to Ghilarducci (2006), "the average ratio of assets to liabilities is smaller in defined benefit plans in unionized companies than in non-union companies" in the US.

Similar to our argument in H1, cross-country variation in funding status should be more straightforward in terms of financial market development. Underfunding arises when pension discount rates are low and when investment returns of pension assets are low. In addition, as Cooper and Ross (2002)

point out, pensions are more likely to be underfunded when corporate face tight borrowing constraints. If it is easier for firms to access external finance, we expect that firms will have better funding status, because they could more easily raise external capital with less cost to fund their pension plans. In fact, it is not uncommon for firms to issue debt or equity to fund their pension funds. For example, a recent Wall Street Journal article reports that some US firms would borrow money to fund their DB pension plans in order to boost their EPS numbers⁸.

Empirically, we test how firm's funding status is related to the country-level employee protection variables and financial market development:

H2-A (funding level requirements): *Firms in countries with stricter employee protection, on average, are more likely to maintain their corporate pension plan funding at a level closer to full funding and therefore are less likely to have underfunded pension plans.*

H2-B (legal constraints and union holdup): *Firms in countries with stricter employee protection, on average, are less likely to maintain their corporate pension plan funding at a level closer to full funding and therefore are more likely to have underfunded pension plans.*

H2-C (market imperfection): *Firms in countries with more developed financial markets are more likely to maintain their pension plan funding at a level closer to full funding.*

3.2. The effect of pension underfunding on corporate investment

More importantly, our study is motivated by Rauh (2006) and Franzoni (2009), who investigate the negative effect of financing constraints, caused by pension underfunding, on firm's investment activities. Rauh (2006) takes advantage of the policy by Employee Retirement Income Security Act (ERISA) that mandates firms to make contributions to their defined benefit pension plans if assets backing these plans fall below certain level. He argues that although the contributions are endogenously determined with other real and financial firm decisions, the mandatory contributions required by ERISA act as an exogenous shock and therefore provide a good opportunity to study the effect of financial constraints on firm's investment. One can exploit

⁸ Wall Street Journal, 1/13/2017, "Pension Contributions Could be Bigger Boost to EPS than Buybacks: GSAM"

this discontinuity to deal with the endogeneity problem. In so doing, he finds that the need to make large pension contributions leads to a reduction in corporate investment. More specifically, firms cut their capital expenditures almost 70 cents for every dollar of mandatory pension contributions. Furthermore, this reduction is most significant for firms that are more likely to face constraints on external borrowing such as those with a lower credit rating. In our study, we would ideally like to investigate a similar impact of mandatory pension contributions on firm's investment in the global context and study the variation of this pattern across countries. Unfortunately, due to data limitations, we are not able to extract mandatory contributions from pension expense data. Instead, we take an alternative approach and focus on firm's pension funding status, and the idea of studying the impact of financial constraint on firm investment is consistent with that in Rauh (2006). We specify our approach in more detail in section 4.

Rather than investigating the relationship between corporate investment and mandatory contributions to pension funds, we examine how firm's investment is affected by adverse pension funding status in our sample, and then study such sensitivity across countries. Regarding labor laws and policies, we expect to see a positive relationship between labor protection laws and the sensitivity of corporate investment to firm's pension funding status. We argue that under stronger labor protection and more generous retirement benefits, firms are more obliged to shore up their pension shortfalls when underfunding occurs and thus channel their funds from real operations to pension funds. However, if one takes into account firms' selection, it is also possible that in countries with stricter labor protection and more generous retirement system, firms that choose to offer DB pension plans are precisely those whose investments are more rigid and less affected by their financial constraints, or those who have less financial constraints to begin with. Therefore, the actual relationship between laws and policies and firm's investment-to-funding-status sensitivity is an empirical question.

We expect to see a negative relationship between financial market development and the sensitivity of corporate investment to firm's pension funding status. This is because easier access to external capital allows firms to more easily maintain their level of investment even when their pension funds are underfunded. Consistent with this notion, Whited (2010), for example, argues that when firms face financial

shocks, they typically seek to adjust their margins rather than real operations because adjustment costs are lower for financial activities. Therefore, we have our last hypothesis:

H3-A (legal constraints): *In the international market, the relationship between firms' pension funding and investment is stronger in countries with stricter labor-related laws and regulations.*

H3-B (selection): *In the international market, the relationship between firms' pension funding and investment is weaker in countries with stricter labor-related laws and regulations.*

H3-C (financial market): *The relationship between firms' pension funding and investment is weaker in countries with more developed financial markets because it is easier for firms to raise external capital to fund their pension plans.*

3.3 Valuation Effect of Pension Underfunding

Although we state that pension underfunding could act as a mechanism employed by firm voluntarily to increase management's bargaining power against the union and may even increase firm value, the cost is obvious: underfunding the pension plans could very well reduce firm value. For example, according to Rauh (2006), "US firms that are sufficiently overfunded are exempt from variable Pension Benefit Guaranty Corporation (PBGC) insurance premiums.⁹ In other words, more severely underfunded pension plans may incur heavier insurance premiums. Furthermore, credit rating agencies may take unfunded pension liabilities into account, and unfunded liabilities may raise a company's cost of capital through that channel (Clifton et al., 2003). It is possible that by contributing a dollar to the pension fund, a firm may reduce its PBGC insurance premiums and its probability of a rating downgrade in such a way that the value of the firm is increased." Additionally, if a pension plan is underfunded to certain extent, it will be required to make mandatory contributions to the plan per ERISA policies, and if the firm cannot fulfill such mandatory contribution requirement, it may incur excise taxes. Finally, contributions to pension plans are tax-deductible. Therefore, profitable firms may forfeit tax shield coming from pension contributions if they choose not to make contributions to pension plans.

⁹ As of 2003 these premiums were \$19 per employee per year, plus \$9 per \$1,000 of shortfall.

As the final hypothesis in the paper, we empirically test how pension underfunding affects firm value. As is mentioned above, pension underfunding could have a negative effect on firm value due to reasons such as reduced investments, higher pension insurance premiums, higher cost of capital, etc. Alternatively, under the union hold-up hypothesis, pension underfunding may actually have a positive effect on firm value. Furthermore, across countries with different levels of union powers, the value of underfunded pension users may be higher than overfunded pension users in countries with stronger union power.

With regard to financial market development, we expect to observe stronger link between pension funding and firm value in countries with more developed financial market. This is because in countries with more developed financial market, pensions are less likely to suffer involuntary underfunding. In other words, firms are more likely to intentionally underfund their pensions in order to use it as bonding device with their employees. Therefore, in these countries, we expect to see a stronger negative effect between funding and firm value. To sum up, we have:

H4-A (Constraint effect): *Pension funding in general has more positive effect on firm value.*

H4-B (Bonding effect): *Pension funding has less positive effect on firm value in countries with stronger labor union power.*

H4-C (Financial market development and pension underfunding): *In more financially developed countries, DB pension funding has less positive effect on firm value.*

4. Data and Summary Statistics

4.1. Data

Our primary data source for firm-level data on pension funding status, corporate investment, and firms' other characteristics is Thomson Reuter DataStream/WorldScope. To compute pension funding status, we require a country to have at least one firm with non-missing defined benefit pension items (described below) to be included in the sample. We follow Picconi (2006) and obtain Pension Assets and Projected Benefits Obligations and take the difference of the two variables. We also collect other important pension-related

variables such as discount rate and contribution-related variables such as service cost and interest cost. Following Rauh (2006), we collect data on firm's investment, components used to construct Tobin's q , as well as cash flow, leverage, and main industry segment. Specifically, we collect capital expenditures (hereafter CapEx, WC04601), research and development spending (WC01201) and total assets (WC02999) to compute investment. As in Chen and Chen (2012), Cash flows are measured as Net Income (WC01651) plus Depreciation & Amortization (WC04049). Following the literature, we measure beginning-of-year Tobin's q at firm-level as the ratio of the sum of book value of debt and market value of equity over book value of total assets. Leverage is firm's total debt. Return-to-assets (ROA) is net income over total assets. Unless otherwise specified, all variables are then normalized by firm's total assets at the beginning of fiscal year except for pension funding status, which is scaled by pension fund assets. We exclude companies from financial services (4900-4949), utilities (6000-6999), and public administration (≥ 9000). We also collect firm's SIC code, and construct a dummy variable for high-labor-depreciation industries. We classify industries with SIC code smaller than 4999 as high-labor-depreciation and others as not high-labor-depreciation. Finally, we convert foreign currencies into US Dollars and then normalize Dollar-value variables to beginning of year 2000 Dollars.

Next, we drop firm-year observations with (i) missing or extreme values on important variables¹⁰, (ii) firm data for fewer than three years, and (iii) countries that have fewer than 25 firms in our sample. We winsorize all key variables at the top and bottom one percentiles of their distributions within each country in each year. And finally, following the literature (e.g. Duchin, Ozbas, and Sensoy (2010)), we bound beginning-of-year Tobin's q at 10 because winsorized q may still exceed 10 in our sample. Finally, we drop observations in country-year where pension variables are available for less than 25 firms.

We collect country-level variables through various sources. The details of these variables are provided in Appendix A. We use the three labor law variables from Botero et al. (2004) as our labor law variables that potentially have effects on countries' private pension characteristics. These variables include

¹⁰ We consider the following situations extreme or erroneous: no pension data, pension fund assets or pension fund liabilities > 200% of total assets, CapEx > 500% of total assets or < total assets, cash flow > 500% or < -200% of total assets, leverage > 200% of total assets or < 0, fund status > 200% of total assets or < -200% of total assets, fund status > 10 times fund liabilities or < -10 times fund liabilities.

Employment Laws, Collective Relations Laws, and Social Security Laws, each of which is the average of a number of indices that belong to the corresponding category. Employment Laws measures the incremental cost to the employer of deviating from a labor contract such as firing employees, thus the protection of employees. Collective Relations Laws reflect how well employees are protected from employers through collective actions and unions. Social Security Laws capture the generosity of the social security system in each country. In addition to the three indices mentioned above, we also collect data on the two subindices – “Labor union power” and “Old age, disability, and death benefits” index, from Collective Relations Laws and Social Security Laws, respectively. This is because these two variables are more specifically relevant in our study, as Collective Relations Laws and Social Security Laws include items that are essentially irrelevant to pensions such as how well strikings are protected and how generous healthcare and unemployment benefits are. The indicator of pension insurance presence in a country is a dummy variable that indicates whether a country is mentioned to have a pension insurance program such as PBGC in the US, and is obtained from Stewart (2007). The widespread underfunding of private defined benefit pensions has generated concern over the viability of employers' promises of retirement benefits. These concerns led to the creation of pension benefit insurance plans by governments in the United States and a number of other countries. We include this variable in our analysis because we expect it to have effect on firm's pension-related behaviors. Our last law-related variable is the legal origin variable from La Porta et al. (1998), a variable widely used in the Law and Finance literature. Although this variable is not directly related to the pension system in a country, we include legal origin in our analysis because it reflects a country's fundamental legal structure and it is considered exogenous to a country's economy because most countries adopt their legal origins involuntarily. This variable, together with the five variables from Botero et al. (2004), are downloaded from Professor La Porta's website¹¹.

To measure countries' financial market development, we collect data from World Bank's World Development Indicators (WDI), including the ratio of stock market capitalization over GDP (EQUITY), the ratio of domestic credit to private sector over GDP (CREDIT), and the combination of the two as a general

¹¹ <http://faculty.tuck.dartmouth.edu/rafael-laporta/research-publications/>

measure of financial market development (FD). Finally, we acquire GDP per capita from World Bank's World Development Indicators (WDI), and US Consumer Price Index for All Urban Consumers at Bureau of Labor Statistics. We take natural logarithm of GDP per capita to mitigate the high level of skewness of this variable. Next, we obtain data on income from countries' social protection programs, such as social security in the US, as percentage of total retiree income from OECD website. In addition, we collect DB/GDP, average percent of DB pension plan assets over GDP over our sample period. Higher level of DB/GDP indicates more prevalent use of DB pension plans in the country. This item is obtained from the OECD website. All country-level variables are described in more detail in Appendix A. We also collect stock market performance from Thomson's DataStream/WorldScope in each country in our sample because we expect it to have some effect on firm's pension funding. Due to possible accounting reporting delay, we use data through fiscal year 2015, and our sample begins from fiscal year 2002 because that is when corporate DB pension data is available for most countries in our sample.

4.2. Summary Statistics

4.2.1. Firm variables

After the data cleaning process, we end up with an unbalanced panel of roughly 82,000 firm-year observations that contain about 9,900 firms during our 15-year sample period across 29 countries. Table 1 provides summary statistics on various firm variables. We scale CapEx by total assets at the beginning of year, and then multiply the ratio by 100 to create the percentage versions so that we can observe and interpret the results more easily, and we do the same for cash flow and funding status. Panel A provides statistics for our full sample, while Panel B shows information for the subsample where firms have DB pension plans. The average (median) annual capital expenditures in the full sample is 5.46% (2.51%) of firm assets. For firms that maintain DB pension plans, firms' pension assets has a mean (median) of 10% (3%) of total assets. On average, firms' pension underfunding is 2.89% of firm's total assets, and a whopping 115% of pension assets, which means that pension assets are not even half the size of pension liabilities. In addition, from Panel B we could see that most firms' pension plans are underfunded, because the 75th percentile of pension funding status is still negative.

Insert Table 1 here

Table 2 provides descriptive statistics on various firm variables by country. Beginning and ending dates during which each country is included in our sample, each country's total number of firm-year observations and the number of firms are provided in Panel A. Most countries have data that begin in year 2002 or 2003, and end in 2015. In addition, the values of these statistics represented as percentages of the corresponding total across countries are given in Columns 5 and 7, respectively. Japan and the United States represent the two largest markets in the sample, accounting for approximately 40% of the total observations, while Russia represents the least.

In Panel B, we provide summary statistics for firms' pension-related variables for the 29 markets from the Worldscope database. These variables are reported in firms' annual financial statements and collected by Thomson Reuters. The columns show means and medians of Pension fund assets and Pension fund liabilities over total assets, Pension fund assets in USD (millions), Pension funding status (assets minus liabilities) over total assets and pension assets. The third and fourth to last rows show the countries with the minimum and maximum values for each country-level variable, respectively, and the two rows below show the means and standard deviations of each variable. From the table, we can see that the DB pension plans are most prevalent in the United Kingdom by pension assets and liabilities relative to firms' total assets. Russia and India are two countries where DB pensions are least popular. In addition, South Africa is the only country where firms' pension plans are on average overfunded, although Brazil also has a positive median funding status.

Insert Table 2 here

4.2.2. Country variables

To demonstrate cross-country variations in the country-level variables, we report the country characteristics by individual countries for the 29 markets in our sample in Table 3. Corresponding with our hypotheses in section 2, our country characteristics are five labor law-related variables from Botero et al. (2004), two other law/policy variables, namely the Legal origin and Pension insurance presense, as well as financial

market development. Due to data availability, not all countries/economic entities have all the variables. The labor law proxies from Botero et al. (2004) include employment laws, collective relations laws, “Labor union power”, social security laws, and “Old age, disability, and death benefits” index. Columns 7 and 8 are Common law dummy and pension insurance availability. The next four columns are indicators of financial market development and GDP. Furthermore, we include DB/GDP, average percent of DB pension plan assets over GDP over our sample period. Labor industry is constructed as proportion of observations that are in high-labor-depreciation industries in a certain country. And finally, we include OECD dummy to indicate whether a country is in OECD. The detailed introductions and sources of these variables are provided in Appendix A.

The third and fourth to last rows show the countries with the minimum and maximum values for each country-level variable, respectively. The last two rows report the means and standard deviations of these characteristics across all countries. One important observation from the table is that countries that have stricter employee protection laws and more generous retirement systems are, in general, Civil Law countries, while there are more Common Law countries that have laxer employee protection legislations and less generous retirement systems. This is consistent with the findings in Botero et al. (2004). Seven countries in our sample offer PBGC-like explicit pension insolvency insurance: Canada, Switzerland, Germany, United Kingdom, Japan, Sweden, and United States. Not surprisingly, these are also typically early adopters of DB pension plans. Hong Kong is one of the economies with the most developed financial market while Pakistan is one of the worst. Finally, in our sample, Belgium has the most generous public social protection system and Korea’s appears to be the least generous.

Insert Table 3 here

Pairwise Pearson correlations among these country variables are presented in Table 4. In the parentheses below the correlation coefficients are p-values, and those with p-values below 0.05 are in boldface. Ideally, we would like to have high pairwise correlations among the variables within each category and low correlations between variables from different categories. Although the former seems to be the case, the latter is not entirely true. For example, employment law (Emp_Laws) is not only significantly

correlated with collective relations laws in the labor law category, but also highly correlated with all the variables from the financial market development category. Still, the absence of widespread correlations makes us more confident in our cross-country analyses that our results are not severely contaminated by correlations between country variables.

Insert Table 4 here

5. Empirical Specification and Results

5.1. Are DB pensions underfunded globally?

Before we examine how DB pension funding status varies across countries, we first study how many firms worldwide have been experiencing underfunding during our sample period. In the last two columns in Table 2 Panel B, we can see that firms in most countries on average experience underfunding during the period between 2002 and 2015. In fact, all countries except Brazil and South Africa have experienced underfunding during our sample period. If we scale funding status by firm's total assets, UK and Germany are the most severely underfunded by looking at the average and median of firms' funding status, respectively. British firms in our sample on average (at the median) have an underfunding of roughly 6.23% (3.08%) of their total assets, while South African firms on average (at the median) have an overfunding of 3.65% (0.24%) of their total assets. The results verify our expectation that corporate pensions are widespreadly underfunded worldwide due to the unfavorable stock market performance and low interest rate. To show the time trend of pension underfunding in each country more closely, Figure 1 consists of time-series of pension funding status for each country over our sample period. Funding status is defined as $(\text{pension assets} - \text{pension liabilities}) / \text{pension liabilities} * 100\%$. One interesting observation from this figure is that firms' pensions are more underfunded during the 2008 financial crisis period, which is to be expected.

Insert Figure 1 here

5.2. DB pension funding status across countries

We next examine how DB pension funding status varies across countries. Table 5 reports the results when firm's pension funding status relative to pension fund assets are used as dependent variable, where funding

status is defined as the difference between fund assets and liabilities. As with pension fund size relative to firm's total assets, our funding status variable has similar relationship with country variables.

Results in columns 1 to 5 show that employers in countries with stricter employee protections have worse funding situations, or experience more underfunding. This is consistent with the notion that employers in countries with stricter employee protections face stricter constraints that prevent them from reducing pension liabilities through, for example, freezing/terminating pension plans or manipulating pension-related parameters such as interest rates. The results in column 2 and 3, specifically, are also consistent with the union holdup problem mentioned in Ippolito (1985). In addition, firms in countries with Common Law legal origin and pension insurance programs tend to have more favorable funding status. Regarding pension insurance, its positive relationship with funding status is likely due to the fact that firms that provide DB pension plans typically need to pay a premium to the pension insurance program so that they can be insured against severely adverse funding situations, and the premium is typically proportional to the level of underfunding. In order to incur less insurance premiums, firms in these countries are naturally incentivized to maintain a relatively healthy funding status.

In the last five columns in Table 5, consistent with our expectations, we do observe better funding status in countries with generally more developed financial markets, since raising external fund to maintain a healthy DB pension funding status ought to be less costly in these countries.

Also, at the firm level, we can see that, as we expect, firm's pension fund size is positively correlated with profitability (ROA) and each firm's pension discount rate, and negatively related with the "high-labor-depreciation" industry dummy. The effect of a country's public social protection program on the funding status of their private pensions is mixed, which is not surprising, because we do not expect any particular relationship between the two. The last finding indicates that in the high-labor-depreciation industries, underfunding tends to be more severe, because firms in such industries (for example, transportation) are more likely to offer DB pension plans to their employees and thus have larger pension liabilities to fulfill because they offered higher benefits in order to provide safeguards for their employees after retirement.

Insert Table 5 here

5.3. The impact of pension underfunding on corporate investment across countries

In section 2, we mention that the ideal specification to investigate how pension funding affects firm's investment is to use mandatory contribution data. Unfortunately, due to data limitations we have to take an alternative approach and focus on firm's pension funding status instead. Specifically, we construct a dummy variable that indicates whether a firm's pension plans are underfunded and a dummy variable that indicates whether the pension plans are overfunded. We then interact these two variables with firm's funding status and construct two interaction variables FundStatus^- and FundStatus^+ . This approach allows us to distinguish the effect of funding on firm's investment between firms whose pensions are underfunded and those whose pensions are overfunded. This is roughly consistent with the notion of nonlinear rules regarding mandatory pension contributions used in Rauh (2006) for identification because only underfunded firms are subject to possible required contributions to their pension funds. In other words, we expect to see effect of pension funding status on firm's investment only for the interaction between underfunding dummy and pension funding status.

Before investigating cross-country analysis, we first examine the investment-to-funding status in the pooled sample. Table 6 Panel A shows the regression results, where firm-level CapEx relative to total assets is used as dependent variable, and both the interaction terms between underfunding dummy and overfunding dummy with funding status are included. The regression includes firm fixed effects and industry times year fixed effects to control for time-invariant firm-level investment and time-varying investment opportunities in different industries. The results show that in the pooled sample, firm's capital expenditures are positively affected by pension funding status, or negatively affected by pension underfunding, and this effect is only significant for firms with underfunded pension plans, which is consistent with our expectation and earlier studies in the literature. In addition, coefficients on other control variables such as cash flow, Tobin's q are also consistent with those in the corporate investment literature.

In Panel B of Table 6, we report the results of regressions similar with that in Panel A, but

separately run in each country in our sample. The dependent variable is again firm-level CapEx relative to total assets. We only show the coefficients on the interaction term between underfunding dummy and funding status since the interaction between overfunding dummy and funding status is in general insignificant in terms of affecting firm's investment. From Panel B, we can see that in roughly two thirds of the countries, we do observe a positive (negative) impact of pension funding status (underfunding) on firm's investment. In order to more clearly examine the relationship between this sensitivity and country characteristics, we run more regressions and show the results in Panel C of Table 6.

In Panel C, we use panel regression analysis to explore the relationship between firms' investment-to-pension funding status sensitivity, and variables measuring country characteristics. We then address possible concerns with our analysis. Using firm-level data, we establish the following specification:

$$y_{i,t} = \lambda_i + \beta_1 \cdot X_{i,t-1} + \beta_2 \cdot X_{i,t-1} \cdot \phi_k + \beta_3 \cdot \chi_{i,t} + \alpha_j \cdot \gamma_t + \varepsilon_{i,t} \quad (5)$$

where i denotes a firm, t denotes a fiscal year, j an industry, and k a country. The dependent variable $y_{i,t}$ is our measure of investment CapEx; $X_{i,t-1}$ is a lagged firm-level pension funding status, FundStatus^- , and $\phi_{k,t}$ is a country characteristic. λ_i represents including firm fixed effect; $\chi_{i,t}$ includes firm-level controls such as cash flow, q , and leverage, and $\alpha_j \cdot \gamma_t$ is Fama-French-48 industry (Fama and French, 1997) times year fixed effects to control for time-varying investment opportunities. We also include natural logarithm of GDP per capita in our regressions as well as interaction between public social protection and firm's funding status as controls. Standard errors are clustered at the country level.

Columns 1 to 5 in Panel C show somewhat mixed results regarding the effect of employee protection and retirement system generosity. Employers in countries with stricter employee protection laws do not appear to restrain their investment more significantly when they experience pension underfunding. However, in countries with stronger collective relations laws and union power, employers face more financial constraints when their pension plans are more severely underfunded. In other words, in these countries, firms seem to be more constrained by their pension fund shortfalls. This is consistent with our hypothesis. On the other hand, the generosity of the social security and retirement system does not have significant effect on the investment-to-funding-status sensitivity. This indicates that firms in countries that

offer more security to the employees do not necessarily face more constraints when their pension is underfunded. One possible explanation is that in these countries, only firms whose investments are more rigid choose to adopt DB pension plans for their employees. In other words, there may be selection bias in our analysis. The other law- and policy-related variables, Common Law dummy and pension insurance dummy variables do not seem to affect the sensitivity between corporate investment and pension funding status. In the last five columns in Table 6 Panel C, we do see some evidence on the relationship between the investment-to-funding sensitivity and financial market development and general economic conditions. This is consistent with our hypothesis that firms in more financially and economically developed countries are subject to less financial constraints when their pensions are underfunded because they have easier access to external financial markets to raise money to buffer their pension funds. We also observe significantly stronger sensitivity in countries where there are more firms in the high-labor-depreciation industries. The signs of the coefficients on the firm-level variables are consistent with those in the literature.

Insert Table 6 here

In summary, the results above show that firms' external business environment, specifically labor laws and policies and financial and economic development, indeed matter for firms' investment activities when they face financial constraints originated from pension underfunding. Firms in countries with stronger labor union power and less developed financial and economic markets appear to be more constrained, demonstrating some potential side-effects of stricter employee protection laws and benefits of developed financial markets.

5.4. The valuation implications of DB pension prevalence and underfunding across countries

Table 7 reports the results on valuation implications, where firm-level market-to-book (MtoB) value is used as dependent variable in all three panels. We include firm's investment, ROA, and leverage in our regressions. Following La Porta et al. (2002), we also include sales growth from the previous year and control for country fixed effect. Finally, we include interaction between pension assets over total assets and country's public social protection as percentage of retiree income, as well as interaction between funding

status and public social protection as percentage of retiree income to control for the effect of social protection across countries.

Regarding the effect of pension underfunding on firm value, we can see from Panel A that the financial constraint effect dominates the bonding effect argued by Ippolito. Firms with DB pensions with better funding status also have higher valuations. This is consistent with Franzoni and Marin (2006). In addition, the interaction terms between funding status and labor union power and collective relations laws are both insignificant in affecting firm value, although the employment laws do show effect consistent with the bonding device theory. In other words, for those firms in countries with stricter employee protections, firms with more severe underfunding appear to have higher values. This is to some extent consistent with Ippolito's implicit contract theory but not direct evidence.

According to hypothesis H4-C, for firms in countries with more developed financial markets, having a more underfunded pension is more likely to be voluntary, or to be driven by bonding effort, and thus leads to higher valuation. In other words, we expect to see negative coefficients on the interaction terms. However, the results seem inconsistent with this prediction. One more thing worth mentioning, though, is that the coefficient on the interaction term between pension insurance and funding status is positive and significant. This is consistent with bonding theory because it means that in countries with pension insurance, the effect of underfunding on firm value becomes weaker, indicating that underfunding is less effective in these countries because pension insurance act against the bonding effort.

6. Conclusions

We investigate corporate pension funding status and its impact on investment in a sample of 29 countries. Our research resonates with anecdotal evidence that firms in and outside the U.S. have experienced significant pension underfunding for roughly the past decade. This is also in the spirit of earlier studies on the effect of pension underfunding on corporate investment and valuation such as Rauh (2006) and Franzoni (2009).

More importantly, taking advantage of cross-country variation in labor laws and policies and financial market development, this study sheds further light on the importance of business environment in

which the firms operate. We show that firms from countries with weaker employee protection, less generous retirement system, and more developed financial markets tend to show better funding status in DB pension plans. In terms of impact of pension underfunding on firm's capital expenditures, our results indicate that investment-to-pension-funding-status sensitivity is stronger in countries with stronger employee protection in terms of labor union power and collective relations, and weaker in countries with more developed financial markets. This suggests the side-effects of some labor laws and the benefits of deeper financial markets in mitigating firms' financial constraints. Last but not least, pension underfunding has negative impact on firm value, and inconsistent with Ippolito's bonding theory, a firm with more severe pension underfunding in a country with stronger union power does not seem to have higher value than its counterpart in a country with weaker union power. Our results are robust to controlling for countries' public social protection programs.

To our knowledge, this is the first study on corporate DB pension plan funding status around the world. We are the first to connect corporate pension funding status with legal and economic status of individual countries. Furthermore, we are the first to document the effect of heterogeneity in country characteristics on firm's financial constraint in terms of investment as well as value implications.

Finally, our study suggests that although employee protection legislations and generous retirement systems are meant to better protect employee rights and benefits, they may have unintended consequences that can impede firm's investment and growth that could in turn harm retirees' benefits ultimately.

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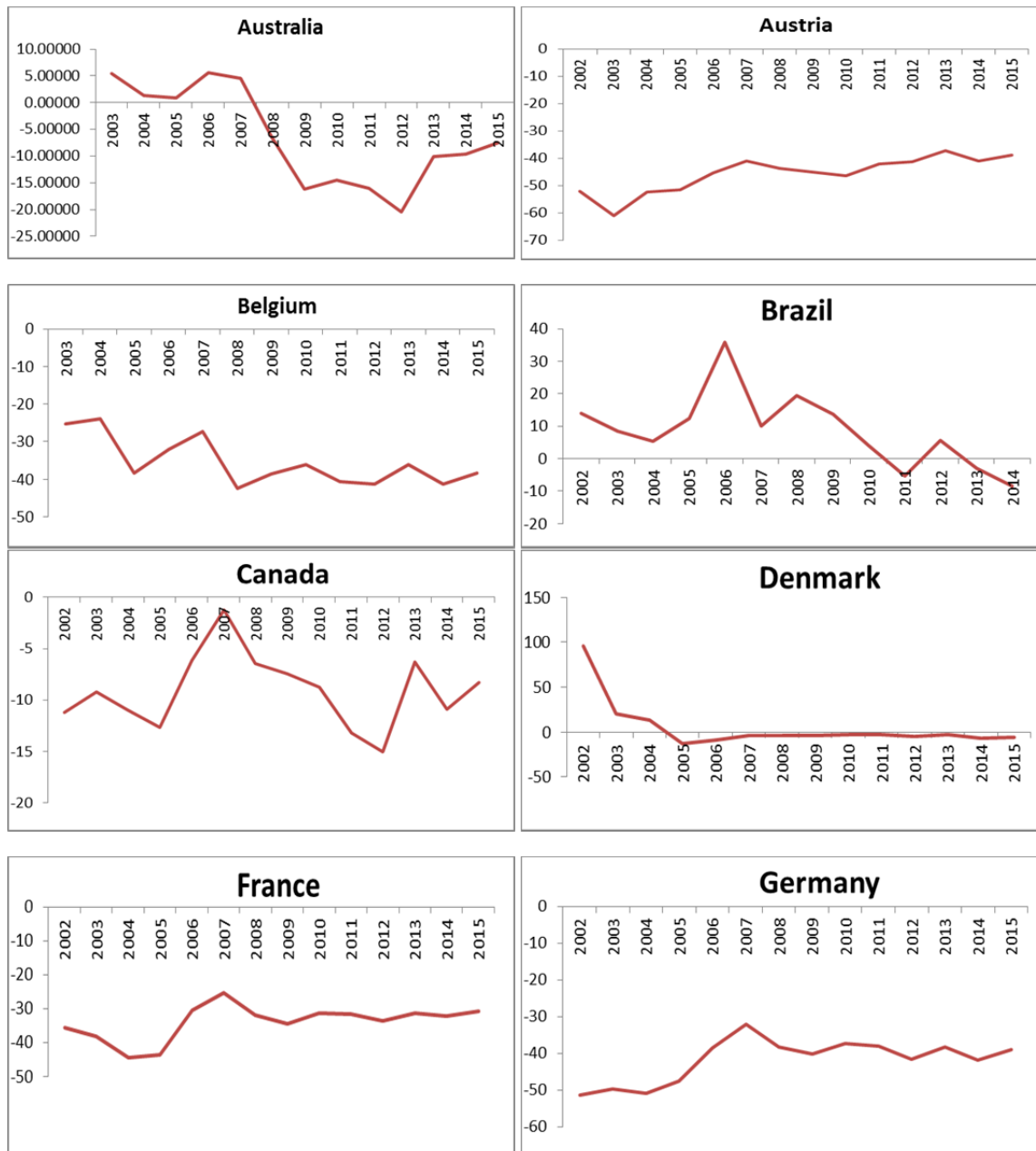
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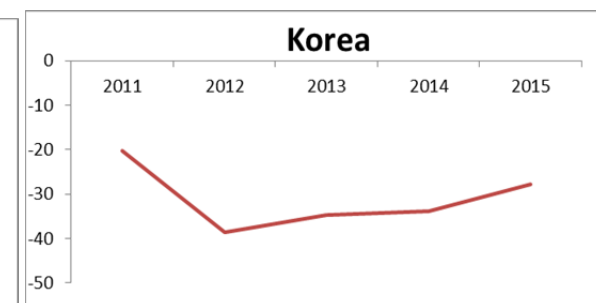
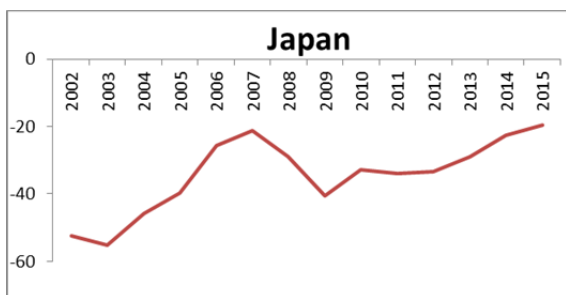
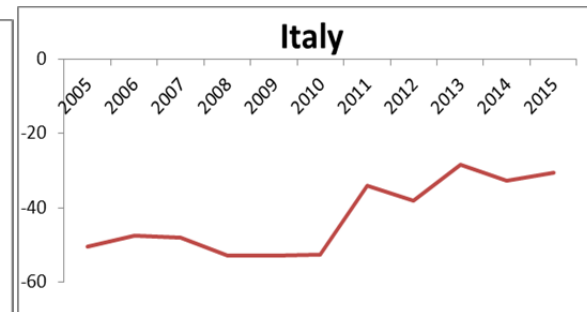
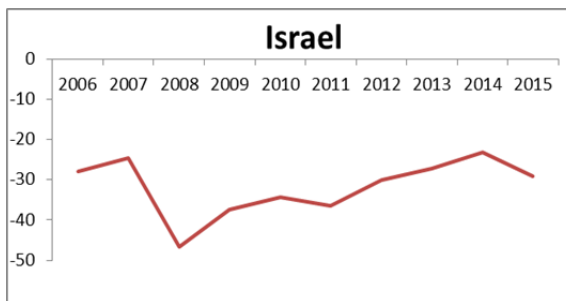
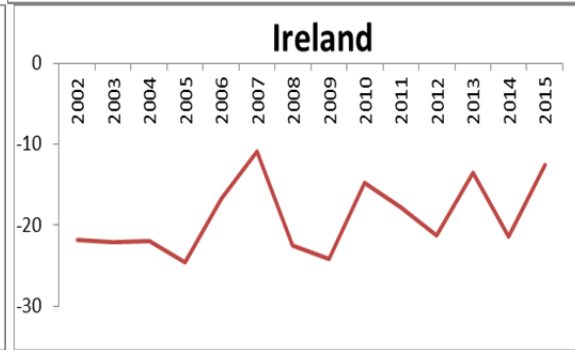
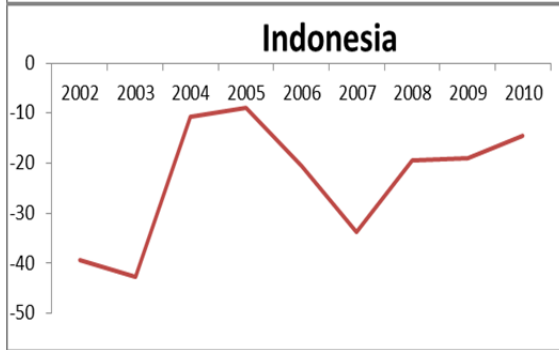
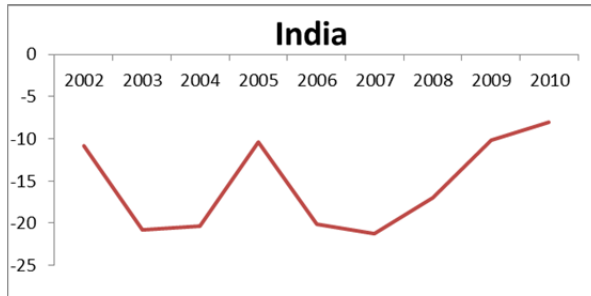
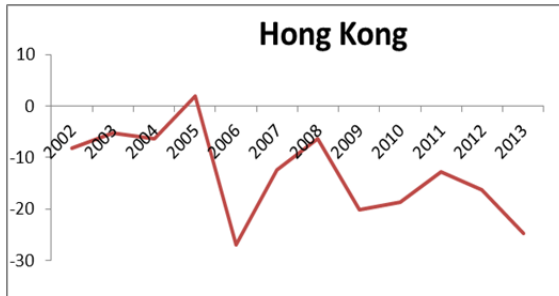
Appendix A – Country Characteristic Variable Details

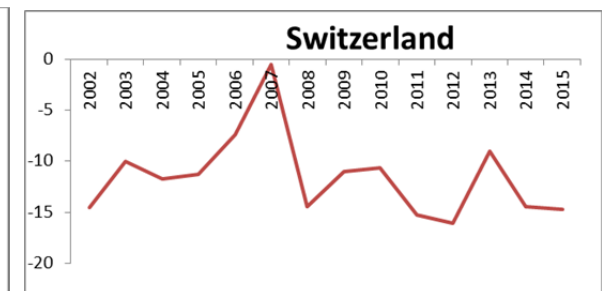
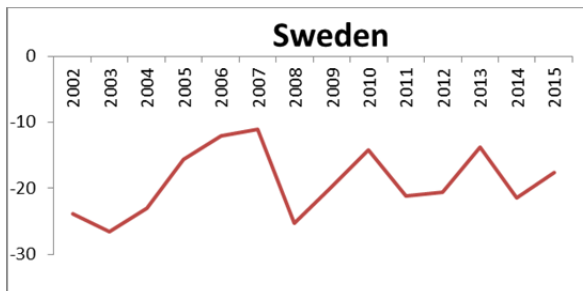
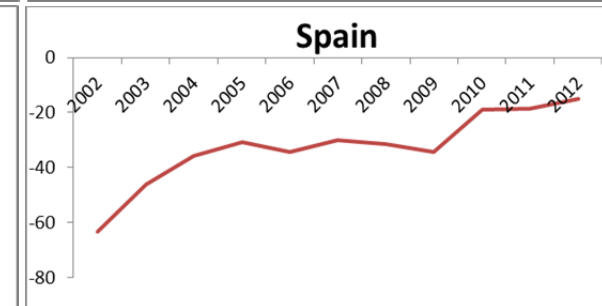
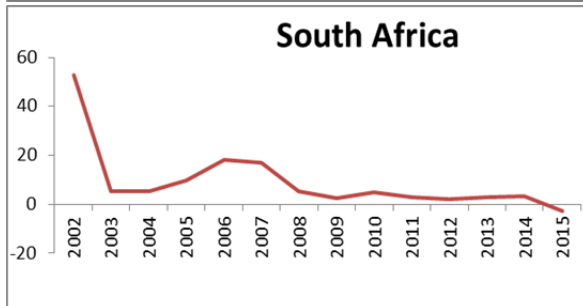
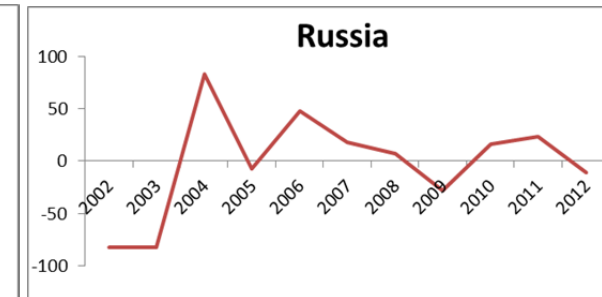
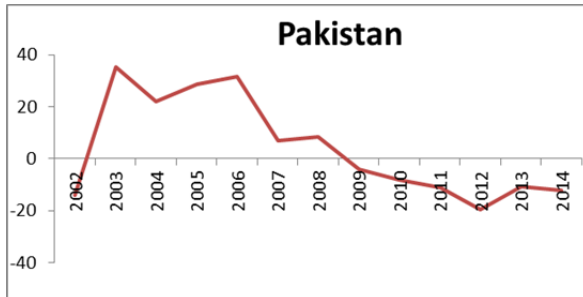
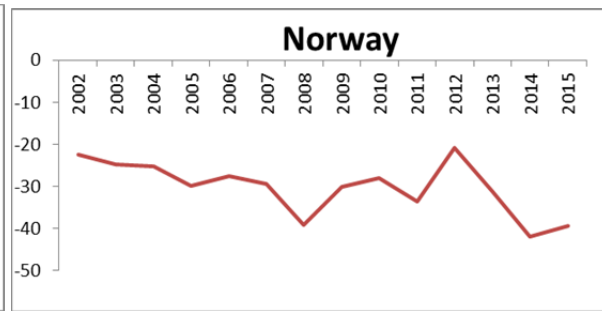
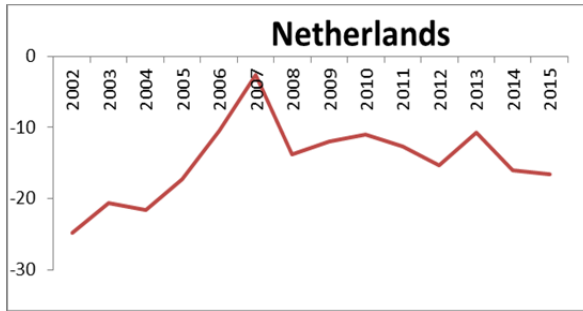
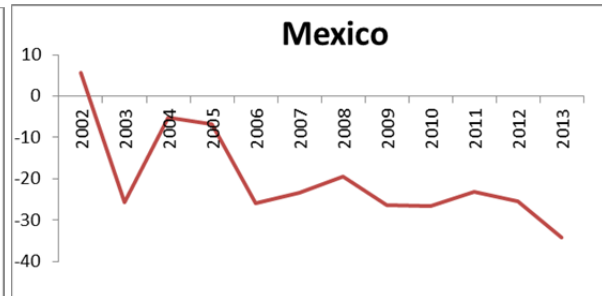
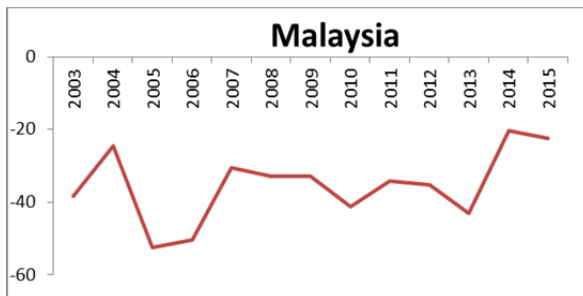
Emp_Laws	Employment Laws. Measures the protection of labor and employment laws as the average of: (1) alternative employment contracts, (2) cost of increasing hours worked, (3) cost of firing workers, and (4) dismissal procedures. The index is obtained from Botero et al. (2004). The index ranges from 0 to 1.
Coll_relatio n_laws	Collective Relations Laws. Measures the protection of collective relations laws as the average of: (1) labor union power and (2) collective disputes. The index is obtained from Botero et al. (2004). The index ranges from 0 to 1.
Union power	Measures the statutory protection of unions as the average of the following seven dummy variables which equal one: (1) if employees have the right to unionize, (2) if employees have the right to collective bargaining, (3) if employees have the legal duty to bargain with unions, (4) if collective contracts are extended to third parties by law, (5) if the law allows closed shops, (6) if workers, or unions, or both have a right to appoint members to the Boards of Directors, and (7) if workers' councils are mandated by law.
Soc_Sec_La ws	Social Security Laws. Measures social security benefits as the average of: (1) old-age, disability, and death benefits, (2) sickness and health benefits, and (3) unemployment benefits. The index is obtained from Botero et al. (2004). The index ranges from 0 to 1.
Oldage benefit	Measures the level of old-age, disability, and death benefits as the average of the following four normalized variables: (1) the difference between retirement age and life expectancy at birth, (2) the number of months of contributions or employment required for normal retirement by law, (3) the percentage of the workers' monthly salary deducted by law to cover old-age, disability, and death benefits, and (4) the percentage of the net preretirement salary covered by the net old-age cash-benefit pension.
Common Law Dummy	This variable is the dummy variable that indicates whether a country's legal origin is English Common Law or Civil Law. Source: Professor La Porta's website http://faculty.tuck.dartmouth.edu/rafael-laporta/research-publications/ .
Pension Insurance	This variable is a 1/0 indicator of whether the country has a pension insurance program set up. The indicator is obtained from Stewart (2007).
EQUITY	Equity market development, defined as a country's stock market capitalization divided by its GDP. This item is from the World Bank's World Development Indicators database.
CREDIT	Credit market development, defined as a country's ratio of domestic credit to private sector over GDP. This item is from the World Bank's World Development Indicators database.
FD	Financial market development, which is the combination of EQUITY and CREDIT.
GDP	GDP per capita in constant 2010 US Dollars. Source: World Bank.
DB/GDP	Defined benefit pension plan assets as percent of the country's GDP. Source: OECD website: http://stats.OECD.org/Index.aspx?DatasetCode=PNNI_NEW#
High-labor- depreciatio n Industry	This variable is calculated based on industries of firms in each country. We classify industries with SIC code smaller than 4999 as high-labor-depreciation and others as not high-labor-depreciation. Then we calculate country average and divide countries in our sample into more high-labor-depreciation and less high-labor-depreciation based on that country average.

Figure 1 Time-series Pension Funding status in each country

This graph shows the pension funding status in each country over our sample period. Funding status is defined as (pension assets – pension liabilities)/pension liabilities*100%.







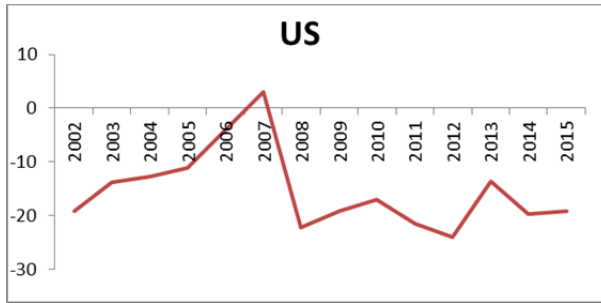
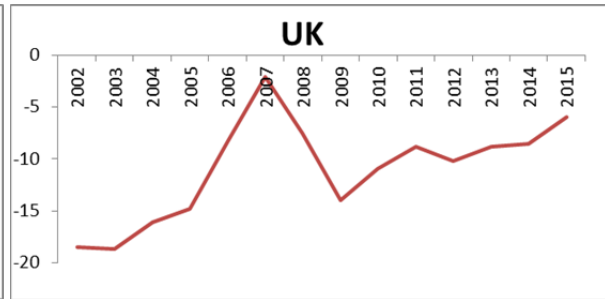
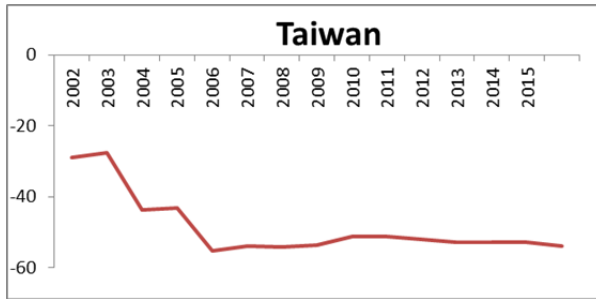


Table 1 – Summary statistics for firm-level variables

Panel A provides summary statistics for firm variables at firm-year level in our full sample. CapEx is defined as annual capital expenditures over total assets. Cash Flow is constructed as annual income before extraordinary items plus depreciation over total assets at the beginning of the year. Tobin's q is measured as the ratio of market value of assets over book value of assets at the beginning of each year, and is bounded above at 10. Leverage is total debt over total assets. ROA is return on assets, or net income over total assets. Pension Assets is pension assets over total assets. Pension Liabilities is pension liabilities over total assets. Finally, FundStatus_TA and FundStatus_PA are pension funding status over total assets and pension assets, respectively. Panel B provides summary statistics for the same variables as in Panel A, but in the subsample where firms maintain some DB pension plans.

Panel A: Firm variable in Full Sample summary statistics						
VARIABLES	(1) N	(2) Mean	(3) Std. Dev.	(4) 25 th Percentile	(5) Median	(6) 75 th Percentile
CapEx (%)	282,859	5.46	9.68	0.69	2.51	6.17
Cash Flow (%)	289,900	4.43	17.42	0.92	5.86	11.41
Tobin's q	310,132	1.52	3.98	0.88	1.08	1.55
leverage	309,783	0.53	0.29	0.32	0.53	0.72
ROA (%)	309,732	-0.94	18.80	-1.06	2.16	6.07
PenAssets	308,829	0.02	0.10	0.00	0.00	0.00
PenLiab	310,184	0.03	0.12	0.00	0.00	0.01
FundStatus_TA (%)	309,642	-0.73	2.66	0.00	0.00	0.00
FundStatus_PA (%)	310,184	-30.10	124.85	0.00	0.00	0.00

Panel B: Firm variable in Pension Subsample summary statistics						
VARIABLES	(1) N	(2) Mean	(3) Std. Dev.	(4) 25 th Percentile	(5) Median	(6) 75 th Percentile
CapEx (%)	76,804	4.68	6.10	1.14	3.06	6.03
Cash Flow (%)	77,037	8.08	8.96	3.33	7.46	11.93
Tobin's q	78,300	1.37	1.05	0.95	1.10	1.48
leverage	78,294	0.58	0.24	0.42	0.58	0.74
ROA (%)	78,293	3.21	8.40	0.75	3.03	6.32
PenAssets	77,037	0.10	0.19	0.01	0.03	0.10
PenLiab	76,579	0.13	0.22	0.01	0.05	0.14
FundStatus_TA (%)	77,831	-2.89	5.95	-3.86	-1.10	-0.16
FundStatus_PA (%)	77,842	-114.93	221.71	-99.73	-36.82	-11.43

Table 2 – Summary statistics for firm-level variables by country**Panel A**

This table provides summary statistics for the 29 markets from the Worldscope database. Column 2 and 3 report the beginning and ending dates during which each country is included in our sample. Each country's total number of firm-year observations and the number of firms are provided in columns 4 and 6, respectively. The values of these statistics represented as percentages of the corresponding total across countries are given in Columns 5 and 7, respectively. The rest of the columns show average Total Assets in USD (millions), means and medians of CapEx as a percentage of Total Assets, Cash Flow as percentage of Total Assets, Tobin's Q, and leverage, respectively.

Country	Start year	End year	No. of Firm-yr Obs	% of Total obs	No. of firms	% of Total firm	Total Assets in USD	CapEx_Mean (%)	CapEx_Median (%)	Cash Flow Mean (%)	Cash Flow Median (%)	Tobin's Q_Mean	Tobin's Q_Median	Leverage_Mean	Leverage_Median
Austria	2002	2015	283	0.34%	34	0.34%	15501.24	6.36	5.33	8.69	8.82	1.20	1.12	0.65	0.62
Australia	2003	2015	825	1.00%	100	1.01%	41131.46	7.33	4.26	8.29	7.84	1.51	1.23	0.59	0.55
Belgium	2003	2015	512	0.62%	56	0.57%	36383.85	4.67	3.21	8.12	7.37	1.17	1.05	0.61	0.62
Brazil	2003	2015	920	1.11%	116	1.17%	25873.53	6.26	5.05	10.68	9.48	1.35	1.12	0.61	0.59
Canada	2002	2015	2034	2.46%	200	2.02%	29266.89	5.88	4.22	8.54	8.42	1.33	1.19	0.59	0.58
Switzerland	2002	2015	1829	2.21%	187	1.89%	34552.94	3.31	2.70	7.53	8.45	1.66	1.27	0.55	0.56
Germany	2002	2015	2470	2.98%	294	2.98%	45356.09	4.46	3.60	8.33	8.69	1.39	1.18	0.62	0.63
Denmark	2002	2015	369	0.45%	37	0.37%	25904.70	4.36	3.23	10.14	8.81	1.99	1.25	0.59	0.58
Spain	2005	2015	276	0.33%	41	0.42%	143395.39	3.75	2.24	5.97	4.93	1.40	1.04	0.77	0.82
France	2002	2015	2071	2.50%	223	2.26%	60902.84	3.83	3.29	7.22	6.75	1.33	1.12	0.66	0.65
UK	2002	2015	6044	7.30%	636	6.44%	30258.26	4.30	2.93	8.89	9.04	1.48	1.26	0.62	0.61
Hong Kong	2004	2015	245	0.30%	28	0.28%	17089.84	3.77	2.82	9.06	8.73	1.30	1.05	0.42	0.37
Indonesia	2007	2015	349	0.42%	61	0.62%	5595.00	6.90	5.01	14.75	12.55	2.17	1.35	0.52	0.50
Ireland	2002	2015	375	0.45%	35	0.35%	19349.70	3.30	2.44	6.41	7.16	1.70	1.25	0.67	0.67
Israel	2006	2015	456	0.55%	87	0.88%	4757.49	3.83	2.55	7.00	5.79	1.26	1.05	0.70	0.73
India	2007	2015	6922	8.37%	1112	11.26%	2372.56	7.93	4.79	9.68	8.38	1.58	1.06	0.58	0.59
Italy	2006	2015	275	0.33%	32	0.32%	126610.10	3.79	3.21	5.78	5.93	1.17	1.03	0.70	0.72
Japan	2002	2015	20884	25.24%	2319	23.48%	9956.88	3.68	2.65	6.65	6.58	1.07	0.99	0.53	0.53
Korea	2011	2015	4382	5.30%	1049	10.62%	2206.36	5.38	3.20	6.61	6.33	1.20	0.97	0.48	0.48
Mexico	2004	2015	567	0.69%	70	0.71%	7395.30	5.50	4.39	10.02	9.31	1.53	1.31	0.53	0.51
Malaysia	2003	2015	281	0.34%	36	0.36%	8723.42	4.01	3.27	9.70	7.17	1.79	1.04	0.54	0.54
Netherlands	2002	2015	946	1.14%	109	1.10%	68896.33	4.16	3.23	8.74	8.89	1.43	1.29	0.64	0.63
Norway	2002	2015	1035	1.25%	129	1.31%	8183.75	7.97	3.50	7.05	6.48	1.30	1.03	0.64	0.64
Pakistan	2003	2015	764	0.92%	84	0.85%	1503.52	6.48	3.13	13.03	10.84	1.75	1.17	0.62	0.62
Russian	2005	2015	133	0.16%	26	0.26%	38551.45	13.56	12.33	14.95	14.50	1.15	1.00	0.42	0.38
Sweden	2002	2015	978	1.18%	105	1.06%	24866.21	3.73	2.76	10.59	9.98	1.62	1.42	0.60	0.60
Taiwan	2001	2015	8760	10.59%	853	8.64%	2590.07	4.87	2.61	8.73	7.54	1.31	1.09	0.46	0.46
United States	2002	2015	17135	20.71%	1750	17.72%	22870.50	4.28	2.96	7.80	7.43	1.53	1.23	0.67	0.66
South Africa	2002	2015	629	0.76%	69	0.70%	13712.48	5.85	4.88	11.77	11.07	1.54	1.26	0.60	0.57
All			82749	100.00%	9878	100.00%	873758.12								

Panel B Sample pension-related descriptive statistics

This table provides summary statistics for firms' pension-related variables for the 29 markets from the Worldscope database. The columns show equal-weighted means and medians of Pension fund assets as percentage of Total Assets, Pension fund liabilities as percentage of Total Assets, Pension fund assets in USD (millions), Pension fund liabilities in USD (millions), and Pension funding status (assets minus liabilities) as percentage of total assets, respectively.

Country	Pension Assets Mean	Pension Assets Median	Pension Liabilities Mean	Pension Liabilities Median	Pension Fund Assets Mean (\$million)	Pension Fund Assets Median (\$million)	FundStatus over Total Assets Mean	FundStatus over Total Assets Median	FundStatus over Pension Assets Mean (%)	FundStatus over Pension Assets Median (%)
Austria	0.0356	0.0244	0.0826	0.0642	451.56	77.20	-0.0442	-0.0325	-262.3460	-164.2490
Australia	0.0524	0.0215	0.0585	0.0244	609.54	105.37	-0.0049	-0.0009	-14.8340	-6.4490
Belgium	0.0600	0.0208	0.0907	0.0341	472.12	22.87	-0.0345	-0.0080	-124.8010	-56.0220
Brazil	0.1548	0.0820	0.1587	0.0853	1970.24	299.37	0.0033	0.0002	-31.9080	0.8400
Canada	0.1199	0.0526	0.1347	0.0637	989.11	106.09	-0.0144	-0.0064	-33.0010	-15.8120
Switzerland	0.2236	0.1442	0.2349	0.1619	1352.13	163.67	-0.0140	-0.0102	-24.0260	-12.2160
Germany	0.0514	0.0157	0.1114	0.0704	1498.79	29.23	-0.0572	-0.0329	-339.5270	-142.1690
Denmark	0.0437	0.0194	0.0543	0.0306	399.02	31.44	-0.0099	-0.0079	-90.1220	-41.5570
Spain	0.0464	0.0097	0.0531	0.0150	2276.50	215.15	-0.0073	-0.0038	-137.2840	-44.9040
France	0.0471	0.0142	0.0711	0.0334	1111.97	60.98	-0.0239	-0.0141	-217.5150	-92.7730
UK	0.3710	0.2336	0.4311	0.2761	1795.65	144.29	-0.0623	-0.0308	-23.3720	-18.3170
Hong Kong	0.0369	0.0115	0.0385	0.0151	260.58	26.22	-0.0013	-0.0011	-48.1500	-13.1110
Indonesia	0.0288	0.0150	0.0462	0.0284	94.71	10.16	-0.0155	-0.0088	-161.7580	-53.5840
Ireland	0.1619	0.0846	0.1939	0.1016	732.91	151.63	-0.0332	-0.0111	-22.5060	-20.4190
Israel	0.0229	0.0112	0.0310	0.0170	54.23	9.27	-0.0071	-0.0035	-83.2400	-43.6200
India	0.0136	0.0066	0.0172	0.0092	32.94	0.72	-0.0031	-0.0009	-98.7780	-19.1230
Italy	0.0437	0.0176	0.0644	0.0341	1771.59	250.80	-0.0211	-0.0113	-135.4200	-66.7090
Japan	0.0601	0.0428	0.1009	0.0787	319.10	38.21	-0.0404	-0.0249	-142.7670	-68.9170
Korea	0.0255	0.0187	0.0420	0.0328	51.41	4.91	-0.0156	-0.0092	-64.3080	-38.4620
Mexico	0.0361	0.0091	0.0536	0.0187	478.05	14.07	-0.0154	-0.0066	-217.9760	-83.8510
Malaysia	0.0189	0.0045	0.0309	0.0117	73.18	4.10	-0.0137	-0.0028	-220.0490	-59.3270
Netherlands	0.2122	0.1222	0.2427	0.1486	3425.38	417.48	-0.0293	-0.0137	-58.5340	-17.6430
Norway	0.0446	0.0177	0.0621	0.0259	221.75	16.48	-0.0176	-0.0062	-75.6870	-43.1190
Pakistan	0.0399	0.0181	0.0427	0.0185	34.96	4.16	-0.0025	-0.0005	-38.8320	-9.9820
Russia	0.0068	0.0022	0.0249	0.0137	961.16	7.92	-0.0154	-0.0089	-526.9020	-423.1180
Sweden	0.0682	0.0280	0.1026	0.0702	667.11	57.59	-0.0311	-0.0194	-160.3500	-46.9650
Taiwan	0.0094	0.0053	0.0223	0.0136	13.96	1.68	-0.0127	-0.0057	-241.5500	-107.0190
United States	0.1281	0.0628	0.1605	0.0837	1380.29	131.27	-0.0308	-0.0129	-40.1870	-26.9220
South Africa	0.1429	0.0418	0.1234	0.0340	378.03	95.52	0.0365	0.0024	8.9320	10.7200
Minimum	Russia	Russia	India	India	Taiwan	India	UK	Germany	Russia	Russia
Maximum	UK	UK	UK	UK	Netherlands	Netherlands	South Africa	South Africa	South Africa	South Africa
Mean	0.07953	0.03991	0.09934	0.05567	823.378	86.1324	-0.0186	-0.0101	-125.0620	-59.4758
Std. Dev.	0.08155	0.0512	0.08854	0.058	827.448	102.74	0.0193	0.00965	116.8557	80.9822

Table 3 - Country Characteristics

This table reports the country characteristics used in the cross-country analysis of pension funding status and its effect of on firm's investment. The country characteristics are five labor law-related variables from Botero et al. (2004) in columns 2 to 6, two other labor-related policies – Common Law dummy and pension insurance dummy in column 7 and 8, three financial market development variables in columns 9 to 11. The last five columns are indicators average GDP per capita over our sample period, public social protection as percentage of retiree income, average percent of DB pension plan assets of GDP over the sample period, proportion of observations that are in high-labor-depreciation industries, and OECD dummy. The details of these variables are provided in Appendix A.

Country	Emp_La ws	Coll_relatio ns_laws	Soc_sec_ laws	Union power	Oldage benefit	Commo n Law	Pension Insurance	EQUITY	CREDIT	FD	Average_G DP	Public social protectio n	DB/GD P	Labor Industry	OECD
Austria	0.50	0.36	0.71	0.43	0.58	0	0	28.34	92.74	121.08	41093.29	82%		0.87	1
Australia	0.35	0.37	0.78	0.29	0.79	1	0	107.62	113.90	221.52	41989.02	59%	11%	0.60	1
Belgium	0.51	0.42	0.62	0.43	0.52	0	0	66.00	60.89	126.89	38794.78	84%		0.67	1
Brazil	0.57	0.38	0.55	0.38	0.50	0	0	49.01	44.90	93.92	7443.07	47%	10%	0.70	0
Canada	0.26	0.20	0.79	0.14	0.77	1	1	112.80	152.36	265.15	39700.44	39%	55%	0.67	1
Switzerland	0.45	0.42	0.82	0.33	0.67	0	1	216.01	155.65	371.66	63465.62	74%	0%	0.64	1
Germany	0.70	0.61	0.67	0.71	0.69	0	1	45.40	95.42	140.82	37641.51	73%		0.63	1
Denmark	0.57	0.42	0.87	0.71	0.85	0	0	55.75	167.83	223.57	51027.51	65%	3%	0.74	1
Spain	0.74	0.59	0.77	0.71	0.73	0	0	81.35	140.51	221.86	26599.47	68%	0%	0.56	1
France	0.74	0.67	0.78	0.67	0.82	0	0	77.96	87.96	165.92	36244.57	75%		0.60	1
UK	0.28	0.19	0.69	0.00	0.63	1	1	120.84	153.32	274.16	39254.88	50%		0.54	1
Hong Kong	0.17	0.46	0.80	0.29	0.81	1	0	795.92	168.40	964.32	30347.14		5%	0.62	0
Indonesia	0.68	0.39	0.18	0.29	0.53	0	0	33.56	27.74	61.30	2092.93		1%	0.65	0
Ireland	0.34	0.46	0.71	0.43	0.74	1	0	51.42	113.29	164.71	47562.54	79%	32%	0.62	1
Israel	0.29	0.31	0.81	0.29	0.72	1	0	71.89	71.30	143.19	26297.87	57%	29%	0.56	1
India	0.44	0.38	0.40	0.14	0.43	1	0	76.12	43.31	119.43	967.56			0.73	0
Italy	0.65	0.63	0.76	0.43	0.64	0	0	36.90	80.54	117.44	32108.63	74%	0%	0.62	1
Japan	0.16	0.63	0.64	0.71	0.64	0	1	74.63	181.30	255.94	39014.98	40%	12%	0.68	1
Korea	0.45	0.54	0.68	0.71	0.60	0	0	73.17	125.91	199.08	19491.41	16%	2%	0.64	1
Mexico	0.59	0.58	0.51	0.57	0.72	0	0	30.49	21.39	51.88	8420.10	30%	2%	0.68	1
Malaysia	0.19	0.19	0.20	0.00	0.59	1	0	136.87	114.52	251.39	7251.91	30%		0.83	0
Netherlands	0.73	0.46	0.63	0.43	0.52	0	0	90.49	114.38	204.87	43980.61	83%		0.58	1
Norway	0.69	0.65	0.83	0.71	0.74	0	0	52.16	112.86	165.02	74670.50	73%	7%	0.72	1
Pakistan	0.34	0.31	0.47	0.29	0.55	1	0	25.15	22.38	47.53	899.82	25%			0
Russia	0.83	0.58	0.85	0.57	0.59	0	0	40.47	35.16	75.63	8305.24	26%		1.00	0
Sweden	0.74	0.54	0.84	0.62	0.83	0	1	95.09	108.59	203.68	46541.02	74%	0%	0.61	1
Taiwan	0.45	0.32	0.75	0.38	0.67	0	0				18112.67			0.96	0
US	0.22	0.26	0.65	0.14	0.58	1	1	124.65	184.18	308.82	45638.44	52%	44%	0.66	1
South Africa	0.32	0.54	0.58	0.71	0.34	1	0	211.39	140.48	351.87	5471.16	39%		0.55	0
Minimum	Japan	Malaysia & UK	Indonesia	UK	South Africa	n/a	n/a	Pakistan	Mexico	Pakistan	Pakistan	Korea	n/a	UK	n/a
Maximum	Russia	France	Denmark	Multiple	Denmark	n/a	n/a	Hong Kong	US	Hong Kong	Norway	Belgium	Canada	Russia	n/a
Mean	0.48	0.44	0.67	0.43	0.65	0.38	0.24138	106.480	104.686	203.885	34212.84	58%	13%	0.68	0.69
Std. Dev.	0.20	0.14	0.18	0.23	0.12	0.49	0.43549	143.519	49.7574	172.331	22126.60	21%	17%	0.12	0.47

Table 4 - Correlations of country characteristics

This table reports the correlations among the country-characteristic variables. The country characteristics are five labor law-related variables from Botero et al. (2004) in columns 2 to 6, two other labor-related policies – Common Law dummy and pension insurance dummy in column 7 and 8, three financial market development variables in columns 9 to 11. The last four columns are indicators average GDP per capita over our sample period, public social protection as percentage of retiree income, average percent of DB pension plan assets of GDP over the sample period, and proportion of observations that in high-labor-depreciation industries. The details of these variables are provided in Appendix A. The p-values for the pairwise correlations are reported in parentheses, and those with p-values below 0.05 are in boldface.

	Emp_Laws	Coll_Relations_Laws	Union	Soc_Sec_Laws	OldAge	Common	PensionInsurance	EQUITY	CREDIT	FD	GDP	Public social protection	DB/GDP	Industry_manu
Emp_Laws	1.00													
Coll_Relations_Laws	0.59 (0.00)	1.00												
Union	0.54 (0.00)	0.86 (<.0001)	1.00											
Soc_Sec_Laws	0.17 (0.38)	0.30 (0.12)	0.39 (0.04)	1.00										
OldAge	0.09 (0.63)	0.16 (0.41)	0.19 (0.32)	0.62 (0.00)	1.00									
Common	-0.75 (<.0001)	-0.61 (0.00)	-0.65 (0.00)	-0.18 (0.34)	-0.11 (0.59)	1.00								
Pension Insurance	-0.23 (0.24)	-0.15 (0.43)	-0.13 (0.50)	0.20 (0.30)	0.18 (0.36)	0.06 (0.77)	1.00							
EQUITY	-0.42 (0.03)	-0.08 (0.70)	-0.19 (0.33)	0.16 (0.41)	0.19 (0.34)	0.34 (0.07)	0.03 (0.90)	1.00						
CREDIT	-0.45 (0.02)	-0.09 (0.64)	0.04 (0.84)	0.42 (0.03)	0.31 (0.11)	0.19 (0.34)	0.50 (0.01)	0.43 (0.02)	1.00					
FD	-0.48 (0.01)	-0.09 (0.65)	-0.15 (0.45)	0.26 (0.18)	0.25 (0.20)	0.34 (0.07)	0.17 (0.39)	0.96 (<.0001)	0.65 (0.00)	1.00				
GDP	0.07 (0.71)	0.14 (0.46)	0.20 (0.30)	0.67 (0.00)	0.55 (0.00)	-0.23 (0.25)	0.39 (0.04)	0.02 (0.92)	0.57 (0.00)	0.18 (0.35)	1.00			
Public social protection	0.42 (0.03)	0.24 (0.22)	0.15 (0.43)	0.45 (0.02)	0.26 (0.17)	-0.34 (0.08)	-0.01 (0.96)	-0.09 (0.65)	0.14 (0.47)	0.02 (0.89)	0.62 (0.00)	1.00		
DB/GDP	-0.62 (0.01)	-0.70 (0.00)	-0.60 (0.01)	0.10 (0.71)	0.00 (0.99)	0.76 (0.00)	0.37 (0.14)	-0.06 (0.82)	0.27 (0.30)	0.02 (0.95)	0.14 (0.60)	-0.13 (0.61)	1.00	
Industry_manu	0.12 (0.56)	-0.12 (0.54)	-0.03 (0.88)	-0.06 (0.77)	-0.12 (0.56)	-0.27 (0.18)	-0.23 (0.26)	-0.20 (0.33)	-0.31 (0.13)	-0.26 (0.21)	-0.17 (0.40)	-0.25 (0.20)	-0.02 (0.96)	1.00

Table 5 Cross-country analysis: Pension Funding status and Country Characteristics

Table 5 reports the results when firm-level funding status is used as dependent variable, respectively, where funding status is defined as the difference between fund assets and liabilities, over fund assets. If this variable is positive, it means firm's pension fund is overfunded; otherwise, it means the firm's pension fund is underfunded. The country characteristics are five labor law-related variables from Botero et al. (2004), two other labor-related policies – Common Law dummy and pension insurance dummy, and three financial market development variables, logarithm of GDP per capita, and OECD dummy. The details of these variables are provided in Appendix A. The t-statistics reported in parentheses are computed using robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Country Characteristics	(1) Emp_Laws	(2) Coll_Relations_Laws	(3) Union	(4) Soc_Sec_Laws	(5) OldAge	(6) Common	(7) PensionInsurance	(8) GDP	(9) EQUITY	(10) CREDIT	(11) FD	(12) OECD
Leverage	-51.39*** (10.64)	-85.18*** (10.55)	-85.85*** (10.52)	-42.89*** (10.88)	-51.25*** (10.59)	-89.63*** (10.63)	-44.02*** (10.87)	-43.15*** (10.86)	-71.78*** (10.77)	-57.59*** (10.74)	-60.41*** (10.40)	-46.54*** (10.91)
ROA	1.000*** (0.171)	0.502*** (0.159)	0.507*** (0.159)	1.169*** (0.178)	1.077*** (0.172)	0.471*** (0.162)	1.141*** (0.178)	1.167*** (0.178)	0.657*** (0.165)	0.951*** (0.173)	0.772*** (0.161)	0.992*** (0.176)
Disc_rate	1.75e-05*** (8.21e-07)	1.22e-05*** (7.38e-07)	1.20e-05*** (7.35e-07)	2.14e-05*** (8.77e-07)	1.64e-05*** (8.16e-07)	1.08e-05*** (7.43e-07)	2.08e-05*** (8.79e-07)	2.12e-05*** (8.73e-07)	1.29e-05*** (8.85e-07)	1.69e-05*** (8.77e-07)	1.46e-05*** (8.29e-07)	2.26e-05*** (8.88e-07)
Index_rate	-55.13*** (10.85)	30.50*** (10.94)	30.99*** (11.06)	-9.757 (10.39)	-14.73 (10.58)	-3.821 (10.57)	-19.62** (9.908)	-12.55 (11.03)	-14.48 (11.24)	-18.12 (11.63)	-2.194 (10.83)	-13.98 (10.83)
Industry_manu	-3.006 (5.911)	-4.836 (5.677)	-3.240 (5.690)	-5.463 (6.021)	-7.379 (5.870)	-4.452 (5.695)	-4.656 (6.063)	-5.494 (6.024)	-3.696 (6.010)	-3.857 (5.930)	-1.624 (5.772)	-4.204 (6.008)
Public social protection	210.8*** (24.11)	-95.78*** (23.90)	-129.6*** (24.28)	-56.80** (24.31)	0.411 (22.80)	-80.22*** (23.63)	-33.02 (26.61)	-50.68** (24.32)	17.21 (22.87)	212.0*** (24.45)	148.8*** (21.14)	16.42 (19.39)
Country Characteristics	-256.7*** (19.20)	-344.3*** (12.79)	-225.7*** (8.139)	43.51 (41.15)	-465.0*** (37.22)	127.0*** (4.505)	17.27** (7.630)	58.00*** (10.51)	158.4*** (6.964)	176.2*** (11.65)	230.7*** (10.81)	-98.94*** (8.607)
GDP	-21.52** (9.274)	48.99*** (10.44)	43.60*** (10.74)	56.15*** (10.73)	74.68*** (9.427)	55.81*** (9.165)	44.05*** (12.56)		26.01*** (8.251)	-73.21*** (7.832)	-65.40*** (8.066)	
Observations	49,509	49,509	49,509	49,509	49,509	49,509	49,509	49,509	46,164	48,666	49,509	49,509
R-squared	0.039	0.097	0.099	0.016	0.038	0.096	0.016	0.015	0.088	0.045	0.076	0.012

Table 6 Corporate investment-to-funding status sensitivity and its relationship with Country Characteristics

Panel A reports the results when firm-level CapEx relative to total assets is used as dependent variable, and both the interaction terms between underfunding dummy and overfunding dummy with funding status are included. The regression includes firm fixed effects and industry times year fixed effects to control for time-invariant firm-level investment and time-varying investment opportunities in different industries.

Panel B reports the results when firm-level CapEx relative to total assets is used as dependent variable, and the interaction term between underfunding dummy and funding status is included. The regression includes firm fixed effects to control for time-invariant investment opportunities in each firm. The t-statistics reported in parentheses are computed using robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Panel A: Full sample regression of CapEx on Funding Status	
VARIABLES	full
Tobin's q	0.701*** (0.0884)
Leverage	1.321*** (0.328)
Cash Flow	0.0836*** (0.00901)
Funding Status ⁻	0.0171** (0.00709)
Funding Status ⁺	0.00742 (0.0159)
GDP	3.670** (1.811)
Observations	42,252
R-squared	0.662

Panel B: Regressions of CapEx on Funding Status by country		
Country	Coefficients on Funding Status	
	Slope	t-stat
Austria	0.0705	(0.62)
Australia	0.3479	(1.27)
Belgium	0.0106	(0.67)
Brazil	-0.0614***	(-2.71)
Canada	0.0290	(0.64)
Switzerland	0.0194	(1.46)
Germany	-0.0428*	(-1.75)
Denmark	-0.0005	(0.00)
Spain	0.3195*	(1.88)
France	-0.0133	(-0.36)
UK	-0.0144*	(-1.74)
Hong Kong	-0.0955	(-0.39)
Indonesia	0.0388	(0.17)
Ireland	-0.0344	(-0.68)
Israel	-0.1913	(-1.11)
India	0.1408	(0.58)
Italy	0.0467	(0.56)
Japan	0.0394***	(5.32)
Korea	-0.0025	(-0.02)
Mexico	0.0552**	(2.22)
Malaysia	0.1184	(0.54)
Netherlands	0.0413	(1.61)
Norway	-0.1411	(-0.48)
Pakistan	0.0051	(0.14)
Russian	0.0140	(0.02)
Sweden	-0.0933*	(-1.81)
Taiwan	0.0059	(0.29)
US	0.0294***	(3.71)
South Africa	0.0432	(0.92)

Table 6 Corporate investment-to-funding status sensitivity and its relationship with Country Characteristics

Panel C reports the results when firm-level CapEx relative to total assets is used as dependent variable, and funding status is interacted with various country characteristics on the right hand side of the regression equations. The country characteristics are five labor law-related variables from Botero et al. (2004), two other labor-related policies – Common Law dummy and pension insurance dummy, and three financial market development variables, logarithm of GDP per capita, high-labor-depreciation dummy, DB dummy, and OECD dummy. High-labor-depreciation dummy indicates whether firms in a country are more high-labor-depreciation or less high-labor-depreciation. DB_dummy indicates whether a country's DB pension assets over GDP is above the median value among all countries in our sample, The details of these variables are provided in Appendix A. The t-statistics reported in parentheses are computed using robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Panel C: Corporate investment as dependent variable in the full sample

VARIABLES	(1) Emp_Laws	(2) Coll_Relatio ns_Laws	(3) Union	(4) Soc_Sec_La ws	(5) OldAge	(6) Common	(7) PensionInsur ance	(8) GDP	(9) EQUITY	(10) CREDIT	(11) FD	(12) DB/GDP dummy	(13) Industry_ma nu	(14) OECD
Tobin's q	0.693*** (0.0850)	0.693*** (0.0850)	0.693*** (0.0850)	0.694*** (0.0850)	0.693*** (0.0850)	0.692*** (0.0850)	0.693*** (0.0850)	0.692*** (0.0850)	0.717*** (0.0942)	0.653*** (0.0846)	0.671*** (0.0939)	0.696*** (0.0850)	0.695*** (0.0850)	0.693*** (0.0850)
Leverage	1.631*** (0.313)	1.595*** (0.313)	1.596*** (0.313)	1.605*** (0.312)	1.600*** (0.312)	1.589*** (0.313)	1.600*** (0.313)	1.599*** (0.313)	1.607*** (0.337)	1.568*** (0.312)	1.559*** (0.336)	1.627*** (0.312)	1.611*** (0.312)	1.602*** (0.313)
Cash Flow	0.0859*** (0.00847)	0.0854*** (0.00846)	0.0854*** (0.00846)	0.0855*** (0.00844)	0.0855*** (0.00844)	0.0854*** (0.00847)	0.0856*** (0.00847)	0.0856*** (0.00845)	0.0875*** (0.00918)	0.0867*** (0.00870)	0.0887*** (0.00947)	0.0857*** (0.00845)	0.0855*** (0.00845)	0.0856*** (0.00845)
Funding Status	0.0500*** (0.0178)	0.000194 (0.0176)	0.0127 (0.0124)	0.230*** (0.0877)	0.122 (0.0770)	0.0369*** (0.00903)	0.0326** (0.0148)	0.198 (0.138)	0.103*** (0.0346)	-0.0205 (0.0553)	0.0472 (0.0384)	0.00832 (0.0132)	-0.114* (0.0689)	0.0390 (0.0709)
Public social protection×Fun ding Status	-0.0106 (0.0335)	-0.0195 (0.0194)	-0.0216 (0.0190)	-0.0255 (0.0283)	-0.0378 (0.0270)	-0.0240 (0.0177)	-0.0264 (0.0200)	-0.0133 (0.0229)	-0.0230 (0.0229)	-0.0250 (0.0276)	-0.0248 (0.0228)	-0.0308 (0.0205)	-0.0256 (0.0181)	-0.0230 (0.0212)
Country Characteristics × Funding Status	-0.0928** (0.0468)	0.0673** (0.0327)	0.0438** (0.0205)	-0.305** (0.131)	-0.144 (0.111)	-0.0179* (0.0106)	-0.00557 (0.0139)	-0.0166 (0.0133)	-0.0172** (0.00808)	0.00974 (0.0108)	-0.01213* (0.00777)	0.0369*** (0.0120)	0.227** (0.106)	-0.0126 (0.0715)
GDP	2.648* (1.576)	2.449 (1.571)	2.457 (1.570)	2.426 (1.568)	2.416 (1.570)	2.430 (1.572)	2.445 (1.570)	2.379 (1.567)	1.889 (1.716)	2.154 (1.562)	1.694 (1.708)	2.590* (1.569)	2.488 (1.569)	2.446 (1.569)
Observations	46,112	46,112	46,112	46,112	46,112	46,112	46,112	46,112	42,813	45,282	41,983	46,112	46,112	46,112
R-squared	0.664	0.664	0.664	0.665	0.664	0.664	0.664	0.664	0.668	0.668	0.672	0.665	0.664	0.664

Table 7 Characteristics

Panel A reports the results when firm-level market-to-book (MtoB) value is used as dependent variable, and both pension assets to total assets and funding status to total assets are included as independent variables. In Column 1, all the variables are without industry adjustment whereas in Column 2, all variables are industry-adjusted by subtracting industry median from the variable value. The industries are classified into 48 industries according to Fama and French (1997). The regressions include country fixed effects to control for time-invariant country-level valuations. The standard errors are clustered by year. The t-statistics reported in parentheses are computed using robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Panel A: Corporate investment as dependent variable in the full sample		
VARIABLES	(1) w/o industry adjustment	(2) w/ industry adjustment
Lag CapEx	0.00597 (0.00487)	0.0125 (0.00756)
Sales_growth	-1.06e-05 (1.38e-05)	-6.62e-06 (1.75e-05)
ROA	-0.0107*** (0.00255)	-0.00278*** (0.000822)
Leverage	0.0237 (0.0787)	0.102 (0.0686)
Funding Status	0.0152*** (0.00153)	0.0102*** (0.00153)
Observations	208,339	153,906
R-squared	0.010	0.008

Panel B and C report the results when firm-level market-to-book (MtoB) value is used as dependent variable, and pension assets over total assets and funding status over total assets are interacted with various country characteristics on the right hand side of the regression equations. The country characteristics are five labor law-related variables from Botero et al. (2004), two other labor-related policies – Common Law dummy and pension insurance dummy, and three financial market development variables, logarithm of GDP per capita, and OECD dummy. The details of these variables are provided in Appendix A. In Panel B, all variables are without industry adjustment whereas in Panel C all variables are with industry adjustment. The regressions include country fixed effects to control for time-invariant country-level valuations. The standard errors are clustered by year. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Panel B: Firm valuation – without industry adjustment

Country characteristics	(1) Emp_law	(2) Coll_relations	(3) Soc_sec_laws	(4) Union	(5) OldAge	(6) PensionInsuran ce	(7) GDP	(8) EQUITY	(9) CREDIT	(10) FD	(11) Common	(12) OECD
CapEx	0.00706 (0.00623)	0.00708 (0.00623)	0.00708 (0.00623)	0.00707 (0.00623)	0.00708 (0.00623)	0.00707 (0.00623)	0.00703 (0.00623)	0.00726 (0.00646)	0.00761 (0.00656)	0.00706 (0.00623)	0.00708 (0.00622)	0.00707 (0.00623)
Sales Growth	-1.06e-05 (1.39e-05)	-1.05e-05 (1.39e-05)	-1.07e-05 (1.40e-05)	-1.05e-05 (1.38e-05)	-1.07e-05 (1.40e-05)	-1.05e-05 (1.38e-05)	-1.04e-05 (1.38e-05)	-1.88e-05* (1.00e-05)	-8.68e-06 (1.49e-05)	-1.06e-05 (1.39e-05)	-1.05e-05 (1.39e-05)	-1.05e-05 (1.38e-05)
ROA	-0.00908*** (0.00280)	-0.00911*** (0.00279)	-0.00907*** (0.00279)	-0.00911*** (0.00279)	-0.00907*** (0.00279)	-0.00903*** (0.00281)	-0.00905*** (0.00280)	-0.00864** (0.00300)	-0.00910*** (0.00286)	-0.00904*** (0.00280)	-0.00912*** (0.00280)	-0.00907*** (0.00280)
Leverage	0.0247 (0.0849)	0.0207 (0.0857)	0.0230 (0.0852)	0.0209 (0.0856)	0.0234 (0.0852)	0.0252 (0.0852)	0.0257 (0.0848)	0.0423 (0.0878)	0.0260 (0.0862)	0.0239 (0.0851)	0.0197 (0.0860)	0.0239 (0.0851)
Pension Assets	-0.0860 (0.268)	-0.224 (0.264)	-1.212** (0.554)	-0.333 (0.288)	-1.095** (0.440)	0.259 (0.374)	3.863 (2.205)	-2.861*** (0.673)	1.552 (1.543)	0.642 (1.326)	-0.931 (0.538)	-0.262 (0.488)
Funding Status	0.00327 (0.00353)	0.00345 (0.00544)	0.0117 (0.00794)	0.00520 (0.00504)	0.00711 (0.00409)	-0.00369 (0.00315)	-0.0856*** (0.0265)	0.0456*** (0.0139)	-0.0402*** (0.0120)	-0.0221** (0.00843)	0.00482 (0.00490)	0.00573 (0.00486)
Funding Status×Public social protection	0.0296*** (0.00657)	0.00534 (0.00850)	0.00295 (0.00839)	0.00440 (0.00888)	-0.000437 (0.00872)	0.00730 (0.00628)	-0.00521 (0.00889)	-0.00779 (0.00984)	0.0158** (0.00528)	0.00995 (0.00602)	0.00784 (0.00835)	-0.00219 (0.00891)
Funding Status× Country	-0.0283*** (0.00774)	0.00631 (0.00787)	-0.00667 (0.0117)	0.00372 (0.00469)	0.00427 (0.00850)	0.0118*** (0.00253)	0.00922*** (0.00287)	-0.00735** (0.00245)	0.00833*** (0.00240)	0.00473** (0.00169)	0.000450 (0.00202)	0.00588 (0.00572)
Observations	169,579	169,579	169,579	169,579	169,579	169,579	169,579	158,016	166,224	169,579	169,579	169,579
R-squared	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09

Panel C: Firm valuation – with industry adjustment

Country characteristics	(1) Emp_law	(2) Coll_relations	(3) Soc_sec_laws	(4) Union	(5) OldAge	(6) PensionInsur ance	(7) GDP	(8) EQUITY	(9) CREDIT	(10) FD	(11) Common	(12) OECD
CapEx	0.0111 (0.00658)	0.0111 (0.00658)	0.0111 (0.00658)	0.0111 (0.00658)	0.0111 (0.00658)	0.0111 (0.00658)	0.0111 (0.00658)	0.0110 (0.00684)	0.0115 (0.00694)	0.0111 (0.00658)	0.0111 (0.00658)	0.0111 (0.00658)
Sales Growth	-8.62e-06 (1.16e-05)	-8.90e-06 (1.16e-05)	-8.78e-06 (1.17e-05)	-8.81e-06 (1.16e-05)	-8.85e-06 (1.17e-05)	-8.61e-06 (1.17e-05)	-8.56e-06 (1.17e-05)	-1.80e-05* (1.00e-05)	-8.24e-06 (1.29e-05)	-8.64e-06 (1.17e-05)	-8.90e-06 (1.16e-05)	-8.66e-06 (1.16e-05)
ROA	-0.00505*** (0.000781)	-0.00505*** (0.000782)	-0.00503*** (0.000782)	-0.00505*** (0.000782)	-0.00503*** (0.000782)	-0.00504*** (0.000781)	-0.00504*** (0.000781)	-0.00565*** (0.000847)	-0.00501*** (0.000800)	-0.00504*** (0.000780)	-0.00506*** (0.000782)	-0.00505*** (0.000782)
Leverage	0.170** (0.0754)	0.169** (0.0757)	0.169** (0.0757)	0.169** (0.0756)	0.170** (0.0756)	0.171** (0.0756)	0.171** (0.0753)	0.194** (0.0775)	0.174** (0.0758)	0.169** (0.0755)	0.168** (0.0756)	0.170** (0.0754)
Pension Assets	0.0336 (0.229)	-0.0453 (0.217)	-0.740 (0.462)	-0.140 (0.220)	-0.853** (0.363)	0.194 (0.349)	2.653 (2.134)	-0.522 (0.591)	1.170 (1.519)	0.907 (1.381)	-0.651 (0.390)	-0.249 (0.460)
Funding Status	0.00234 (0.00283)	-0.00481 (0.00474)	0.0138 (0.00883)	-0.00131 (0.00435)	0.00443 (0.00351)	-0.00198 (0.00304)	-0.0499** (0.0216)	0.0197** (0.00781)	-0.0204* (0.00984)	-0.00327 (0.0103)	0.00626 (0.00402)	0.00572 (0.00465)
Funding Status×Public social protection	0.0109 (0.00649)	0.00438 (0.00803)	0.00394 (0.00832)	0.00388 (0.00828)	-0.00297 (0.00756)	0.00236 (0.00570)	-0.00448 (0.00785)	-0.00218 (0.00815)	0.00773 (0.00492)	0.00446 (0.00599)	0.00114 (0.00830)	-0.00190 (0.00788)
Funding Status×Country	-0.0122* (0.00699)	0.0063 (0.00593)	-0.0182 (0.0149)	0.00432 (0.00336)	0.00277 (0.00707)	0.00678** (0.00231)	0.00534** (0.00229)	-0.00310** (0.00105)	0.00413* (0.00195)	0.000865 (0.00181)	-0.00481** (0.00172)	0.000261 (0.00486)
Observations	169,579	169,579	169,579	169,579	169,579	169,579	169,579	158,016	166,224	169,579	169,579	169,579
R-squared	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08