

*Pension fund finance and sponsoring companies**

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Abstract

We present empirical evidence on the funding and portfolio allocation of around 200 Dutch corporate pension funds over the period 1996–2005, with a special focus on the influence of the sponsoring firm. We find that unprofitable and small firms contribute less to their pension funds than profitable and large firms, consistent with theories of capital market imperfections. Sponsor contributions are found to be positively correlated with leverage, suggesting that tax effects play a role. Defined benefit funds invest relatively more in equity and less in bonds than their defined contribution counterparts, which is in accordance with the risk shifting theory.

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1 Introduction

Ongoing rises in life expectancy, volatility in stock markets, and historically low capital market interest rates have caused funding problems over the past decade for defined benefit pension plans in many countries. In the Netherlands, with the world's largest defined benefit pension funding system, the funding and portfolio allocation of pension funds are a constant concern. When a defined pension fund faces a funding shortage, it has only three possibilities. It can raise the level of contributions, limit the adjustment of benefits to the rate of wage inflation or, as a last resort, cut benefits.

Most pension funds in the Netherlands are corporate pension funds, the contributions to which are paid partly by the company's employees and partly by

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the employer, the so-called 'sponsoring company'. Employees and the employer are represented in the pension fund's board and share responsibility for pension fund management. The prudential supervisor sets minimum required funding levels for the pension fund and checks whether it meets these requirements.

In this paper, the funding and portfolio allocation of corporate pension funds are investigated, with special focus on the relation with the sponsoring firm. We test several hypotheses on the influence of the sponsoring company on funding and portfolio allocation of its defined benefit pension fund. We specifically test whether pension funding is affected by the profitability, leverage or size of the sponsoring company, and whether the pension fund's asset allocation toward more risky securities such as equity is related to the sponsoring company's leverage.

The existing empirical studies in this area are mostly for the US and often cover a relatively short time span. Although all of these studies address the asset allocation of pension plans, only a few cover pension funding as well. The results are also quite mixed. For example, Friedman (1983), using a broad sample of US firms for 1977, documents that the level of pension funding is negatively related to sponsor profitability, whereas Bodie *et al.* (1987), using data on around 500 US firms for 1980, find that the level of pension funding is positively related to companies' long-run profitability. With respect to pension asset allocation, Bodie *et al.* (1987) report that pension assets of more risky firms are more heavily invested in equity, while Friedman (1983) finds the opposite. Petersen (1996), using US data for 1988–1990, concludes that defined benefit pension funds invest more in safe assets if the sponsoring firms are less profitable and more in risky assets if the firms have high earnings. Gallo and Lockwood (1995) and Rauh (2009), using US data over longer periods (1981–1987 and 1990–2003, respectively), confirm Friedman's finding. Gallo and Lockwood find that risky firms tend to offset firm risk by investing more in fixed income securities and Rauh reports that firms with low credit ratings and underfunded funds allocate a greater share of pension fund assets to safer securities, whereas firms with high credit ratings and well-funded pension plans invest more heavily in equity. Contrary to these findings, Cocco and Volpin (2007), using cross-section data on 90 UK pension funds for 2002, report that pension plans of leveraged firms invest a higher proportion in equities and receive smaller contributions from the firm. As suggested by Rauh, these conflicting results for the US and the UK probably reflect different institutional settings in both countries, particularly the absence in the UK of mandatory supplementary firm contributions if the pension fund gets underfunded.

In the Netherlands, mandatory supplementary firm contributions are absent as well, making it interesting to look into the Dutch case. The dominance of defined benefit pension schemes, the absence of public pension benefit insurance and of restrictive regulation concerning sponsoring companies' contributions, and a fixed 50/50 representation of the pension fund's board by employer and employee, make the Dutch system particularly interesting for the research problem at hand. The absence of mandatory supplementary firm contributions in the Netherlands means there is scope for the full range of contribution rates and hence allows an unrestricted test

of economic hypotheses with respect to funding by the sponsor. The 50/50 representation of the pension fund's board by employer and employee offers the possibility to test whether employees on balance are able to counteract the influence of corporate incentives.

We contribute to the literature by investigating the effects of sponsor characteristics on both pension asset allocation and pension funding, using a combined dataset on around 200 Dutch corporate pension funds and their sponsoring firms over the years 1996–2005. Hence, the difficult years 2000–2002 of low stock market sentiment (the dotcom crash) and low interest rates are included in the sample. The availability of supervisory data on required assets of individual pension funds allows a more accurate measurement of the funding status of pension funds than is usual in previous studies.¹ Our study is the first to address the issue of the relationship between sponsor and pension finance – sponsor contributions and asset allocation – for the Netherlands. The existing empirical literature on Dutch pension funds until now has focused on asset allocation (e.g. de Dreu and Bikker, 2009; Bikker *et al.* 2011; De Haan and Kakes, 2011), leaving aside the impact of the financial position of the sponsoring firm, and without much concern for pension funding as such. For a country with a huge and still largely defined benefit pension sector like the Netherlands, this left an important gap in the literature that our current work fills.

The results for pension funding suggest that unprofitable and small firms contribute less to their pension funds than profitable and large firms, consistent with theories of capital market imperfections. Sponsor contributions are found to be positively correlated with leverage, suggesting that tax effects play a role. The results for pension asset allocation indicate that defined benefit funds invest relatively more in equity and less in bonds than their defined contribution counterparts, which is in accordance with the risk shifting theory. We do not find any significant effects of leverage on pension asset allocation decisions.

The outline of the paper is as follows. First, we give a brief review of the existing theoretical literature on the relationship between pension finance and sponsoring firms and formulate our hypotheses, which are drawn directly from the theories. Then we sketch the institutional setting, including features of the Dutch pension system and some regulatory aspects, and discuss its implications for the hypotheses. Next, we outline the methodology and data used and present our empirical results for pension funding and portfolio allocation, respectively.

2 Theory and hypotheses

In this section, we discuss the theory of defined benefit plan governance and propose hypotheses regarding the influence of sponsoring companies on the funding and portfolio allocation of pension funds (for clarity, the hypotheses are italicized). In general, we distinguish four perspectives in the literature, namely risk shifting, risk management, tax incentives and capital market imperfections.

¹ Due to the introduction of the Financial Assessment Framework, 2005 is the last year for which comparable data is available.

2.1 Risk shifting

A key feature determining behaviour of the sponsors of a defined benefit pension fund is that the pension plan contains embedded options that lead to an incentive for risk shifting, suggesting that moral hazard in many cases will induce risk taking in the pension fund (Rauh, 2009).

For example, Sharpe (1976) and Treynor (1977) highlight that the shareholders of a company sponsoring a defined benefit pension plan own a put option. If the assets of the company and the fund fall short of the pension fund liabilities, the sponsoring company has a put option to give these assets to the pension beneficiaries as payment and liquidate the pension fund. Since the value of each option increases with the risk of the underlying assets, the sponsoring company has an incentive to increase the risk of the assets (of the company and the fund) beyond what is optimal for the pension plan participants, as well as to underfund the pension fund by contributing less to the fund. Hence *defined benefit plans will invest more in equity than a corresponding defined contribution plan*.

Cocco and Volpin (2007) show that the financial structure of the firm should also affect the asset mix of the pension fund. According to the agency theory, equity holders of highly leveraged firms prefer risky projects, as this entails a wealth transfer from debt to equity holders. Such projects would evidently also include the asset mix of the pension fund, since with more leverage the put option is closer to being ‘in the money’. As a result, *leveraged firms will invest more pension assets in equity*.

Meanwhile, Webb (2007) notes that pension plan liabilities are similar to long-term debt. Accordingly, pension plan deficits that must be funded are a debt burden to the sponsoring firm (whereas surpluses and unfunded deficits are sources of equity – in effect a call option). The sponsoring company may thus have an incentive to favour shareholders by reducing contributions to the fund, thus minimizing funds payable to such ‘debt’ holders. The outcome is underfunding. This is true for all pension funds, but the incentive is stronger for a highly leveraged firm, given the high obligations the firm already has, implying *a negative relation of sponsor contributions to leverage*. A corollary of lower sponsor contributions will be a larger dividend payout. Whereas a minimum funding requirement may reduce the danger of underfunding, it may lead instead to greater risk in the pension fund’s investment policy.

Looking more closely at embedded options in defined benefit pension plans, Kocken (2006) points out that defined benefit pension plans involve two more embedded options besides the default option described by Treynor (1977). First, if the defined benefit pension plan contract includes a guarantee from the sponsor to make supplementary payments in case the fund’s funding ratio drops below some pre-specified level, there is a guarantee option. Second, there is the conditional indexation option, which can be exercised if the funding ratio drops below some pre-specified level. The exercise of all three types of options is triggered by various values of the fund’s funding ratio, making the volatility of this ratio a key variable to the option values. The volatility of the funding ratio in turn will be determined by the fund’s asset mix to a considerable extent.

However, Kocken's guarantee option is not 'hard' and cannot be exercised by Dutch pension funds because mandatory supplementary contributions are absent in the Netherlands, as will be explained in Section 3. Supplementary contributions by the sponsor are voluntary. Broeders (2010) assumes supplementary sponsor contributions to be conditional on the financial position of the sponsor and corrects the market value of the guarantee option for the financial ability of the sponsor to pay these. In that case he shows that the pension fund should reduce risk taking, by investing in less risky assets, if the sponsor has a high risk profile, which may be proxied by high leverage or low credit rating. Accordingly, *pension funds' bond holdings will be positively related to sponsoring firms' leverage.*

2.2 Risk management

Against the risk-shifting view highlighted above, Rauh (2009) opposes the 'risk management' view, according to which incentives for risk shifting are limited by costs of financial distress for the sponsoring firm. He argues that when pension funds are underfunded, mandatory supplementary sponsor contributions may drive the sponsor into financial distress. This is because the firm must continue to finance the fund with liquid resources, thus increasing the risk of defaulting on non-pension debts. Cash drains from mandatory supplementary contributions will also depress capital investment of the firm (Rauh, 2006). Hence, according to the risk management view, *highly leveraged firms with poorly funded pension plans should invest more in bonds.* Rauh (2009) finds evidence for the risk management view as US firms with poorly funded pension plans, high firm leverage and weak credit ratings tend to invest more pension assets in bonds.

2.3 Tax incentives

The option-based incentive to invest in equity highlighted in the risk-shifting perspective may also be partly offset by the tax advantages of holding debt securities in the (tax-exempt) pension fund, which provide an *incentive for a defined benefit plan to invest in bonds* (Black, 1980; Tepper, 1981). Indeed, a firm might optimally lever up and invest the proceeds in the pension fund in the form of bonds, thereby funding pension liabilities to the maximum extent possible and implying that a *positive relationship of sponsor contributions to leverage* may arise from tax effects.² Such incentives do not apply to the same extent in defined contribution funds where returns all belong to the participants.³

² We note an alternative argument that the relationship could be negative (all else being equal) if, when firms are highly leveraged, the marginal tax rates are low and therefore there is no (tax) benefit from increasing pension contributions.

³ However, as shown by Harrison and Sharpe (1983), the incentive to invest in debt is mitigated where there is a possibility of default on pension obligations and pension benefit insurance, as benefit insurance in effect subsidises the risk of an equity-based investment approach.

2.4 Capital market imperfections

An alternative view to those discussed above for pension incentives is based on capital market imperfections, which draws in turn on optimal contract theory. Cooper and Ross (2002) regard a firm as rationally desiring to provide its risk-averse workers with a substitute for insurance and borrowing opportunities that are missing or costly due to capital market imperfections. To this end, the risk-neutral firm provides a labour contract facilitating employees' consumption smoothing over time and over states of nature, in retirement as well as during working life. The firm sets up a pension fund to do this because it cannot credibly commit to providing funds itself to employees in retirement; the fund is a commitment device as the firm cannot use the pension funds' assets for other purposes.

From the perspective of optimal contracts, the firm would have no incentive to underfund pensions with perfect capital markets. Following the literature that shows that real decisions of the firm are dependent on financial conditions when capital markets are imperfect (e.g. Bernanke *et al.* 1999), Cooper and Ross (2002) argue that funding is an investment made on behalf of employees and hence will depend on financial conditions the firm faces. In effect, the firm may have incentives to borrow from the pension fund by not funding it sufficiently. Accordingly, corporate pension funds may be underfunded in circumstances when the sponsoring company makes little or no profits, and is not able to borrow (e.g. due to high leverage). So *sponsor contributions will be positively related to sponsoring firms' profitability and negatively related to sponsoring companies' leverage.*

Cooper and Ross (2002) also argue that if the likelihood of borrowing constraints depends in turn on firm size (as in Gertler and Gilchrist, 1994), *larger firms are more likely to fully fund their pension scheme. Furthermore, firms may underfund the pension plan if the profitability of the pension fund is relatively low.*^{4,5}

Another relevant aspect of optimal contracting is in terms of risk sharing between employers and workers. Relaxing Cooper and Ross's assumption of a risk neutral employer, Arnott and Gersovitz (1980) suggest that a risk-averse firm may have underfunded pension funds as a way to share risk with risk-averse workers. Such risk aversion is most likely for smaller firms (e.g., Kihlstrom and Laffont, 1979) so *sponsor contributions will be positively related to firm size.* Arnott and Gersovitz also suggest that firms with underfunded pension funds have an incentive to shift even more risk to workers by taking on more

⁴ If the investment yield on the pension fund's portfolio is lower than the yield on the financial market, there would be an opportunity cost to the sponsor's funding of the pension plan. The above analysis applies in the absence of public pension insurance. Cooper and Ross (2003) show that in the presence of benefit insurance, the incentive to underfund is increased, owing to moral hazard. Without insurance it is only firms that have insufficient capital that underfund, but with benefit guarantees all firms have an incentive to reduce their contributions.

⁵ Bergstresser *et al.* (2006) show that US sponsoring firms manipulate earnings forecasts by assuming relatively high long-term rates of return on pension assets, and that higher assumed rates of return, in turn, drive pension asset allocation towards more equity. In the Netherlands, the main parameters for the pension fund (such as the discount rate and the maximum expected rate of return on investments) are dictated by the supervisor. The sponsor has no say on these parameters.

Table 1. *Hypotheses*

H#	Formulation	Theoretical references
<i>Hypotheses concerning funding</i>		
H1	Sponsor contributions are positively related to sponsoring companies' profitability	Capital market imperfections (Cooper and Ross, 2002)
H2	Sponsor contributions are negatively related to sponsoring companies' leverage	Capital market imperfections (Cooper and Ross, 2002, Arnott and Gersovitz, 1980) and risk shifting (Webb, 2007)
H3	Sponsor contributions are positively related to sponsoring companies' leverage	Tax effects (Black, 1980, Tepper, 1981)
H4	Sponsor contributions are positively related to pension funds' return on assets	Capital market imperfections (Cooper and Ross, 2002)
H5	Sponsor contributions are positively related to sponsoring firms' company size	Capital market imperfections (Cooper and Ross, 2002, Arnott and Gersovitz, 1980)
<i>Hypotheses concerning portfolio allocation</i>		
H6	Defined benefit pension funds invest more in equity than defined contribution pension funds	Risk shifting (Treyner, 1977)
H7	Defined benefit funds invest more in bonds than defined contribution funds	Tax effects (Black, 1980, Tepper, 1981)
H8	Defined benefit pension funds' equity holdings are positively related to sponsoring firms' leverage	Risk shifting (Cocco and Volpin, 2007)
H9	Defined benefit pension funds' bond holdings are positively related to sponsoring firms' leverage	Risk management (Rauh, 2009), Risk shifting (Broeders, 2010)

debt⁶, implying again that *sponsor contributions will be negatively related to sponsoring firms' leverage*.

2.5 Hypotheses

From the theoretical discussion above several hypotheses emerge concerning the impact of sponsor characteristics on the funding and portfolio allocation of pension funds. We formulate our hypotheses on the funding side in terms of sponsor contributions, as the most direct measure of the sponsor's funding policy.⁷ Table 1 presents nine hypotheses, together with their theoretical references.

In Table 1, we classify the hypotheses into two groups, according to whether they address sponsor contributions or pension asset allocation. Thereby, we obviously do

⁶ Complementing Cooper and Ross (2002), Ippolito (1985) sees underfunding as a way to improve a firm's bargaining position with labour unions. A prediction from this model is that most underfunding should be found in the funds of unionised workers. This hypothesis cannot readily be tested for the Netherlands since most firms are unionised.

⁷ The funding ratio – defined as the pension fund's available assets over liabilities – is a poor proxy of the sponsor's funding policy because it is dominated by the investment performance of the fund. Analyses we undertook, not reported here, confirmed this.

not specify both the null hypothesis and the alternative hypothesis in case there is only one hypothesis to test, as for example H1, H4 and H5. However, we specify both hypotheses when different theories have diametrically opposed implications, as for example H2 versus H3, H6 versus H7 and H8 versus H9.

The capital market imperfections and the offsetting risk shifting effects have not been explicitly addressed in studies on pension funding and asset allocation that have been reviewed in Section 1. However, several of the relationships predicted by these theories have been examined in a different context. Friedman (1983) and Bodie *et al.* (1987) test relationship H1 for the funding ratio of US pension plans, with opposite conclusions (see Section 1). Cocco and Volpin (2007) test H1–H3 for UK firms and find that firm profitability and leverage correlate positively and negatively with sponsor contributions, respectively. To the best of our knowledge, H4 and H5 have not been tested before.

As for pension asset allocation, H6 and H7 have implicitly been examined by Petersen (1996), who finds that defined benefit plans invest marginally higher proportions in equity and bonds compared to defined contribution plans. H8 and H9 have been examined before, with mixed results. Friedman (1983) finds that higher leverage for US firms tends to be offset by more conservative investments of pension assets, while Cocco and Volpin (2007) find that UK firms with higher leverage have more equity investments in their pension plans, particularly when more of the firms' executive directors are trustees in the fund. Gallo and Lockwood (1995) find that more risky US firms invest greater amounts of pension assets in bonds. Rauh (2009) includes pension funding status in his pension asset allocation regressions and finds that underfunded pension plans invest more in safe securities, in line with the risk management hypothesis.

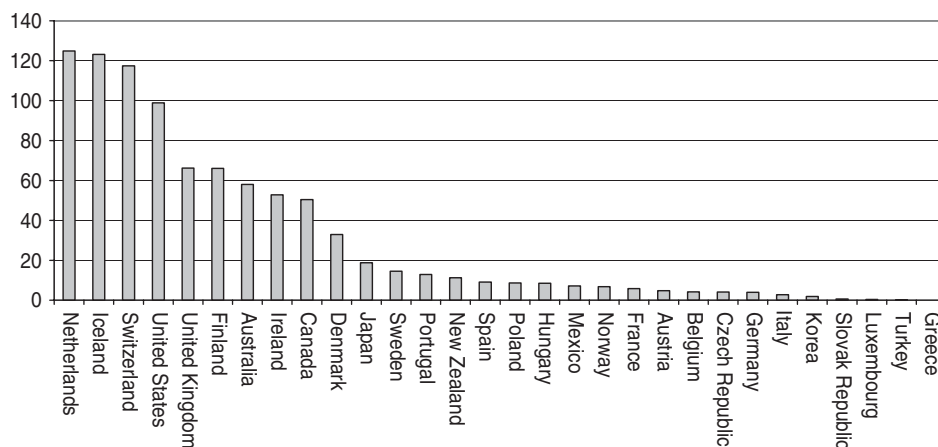
3 Institutional setting

In this section, we first give a general picture of the Dutch pension system, followed by Dutch regulatory and tax issues, after which we discuss how the Dutch institutional setting may affect the predictions of the hypotheses given in the previous section.

3.1 The Dutch pension system

The Dutch pension system is remarkable for its high dependence on fully funded, defined benefit occupational pensions. The Dutch pension system has two main tiers, consisting of a flat-rate public pay-as-you-go scheme and earnings-related, fully funded private schemes, mostly organized in pension funds. Most companies offer a pension scheme to their employees, either through a corporate pension fund or by participating in an industry-wide pension fund.⁸ If a pension scheme is offered, participation is mandatory for the employee. The result is a coverage ratio of over 90% for all workers (OPF&VB, 2010).

⁸ If there is an industry-wide pension scheme, employers are obliged to participate.



Source: OECD (2006).

Figure 1. Assets of pension funds in OECD countries, 2005 (% GDP).

As a result of this high coverage, the Dutch pension fund industry is well developed. In 2005, Dutch pension funds' total assets amounted to \$780 billion, which accounts for more than half of all euro area pension assets (OECD, 2006). In relative terms, the Netherlands has the world's largest pension fund industry (Figure 1).

During the period under investigation, the Dutch pension fund industry included more than 800 pension funds, of which some 700 are corporate pension funds (the subject of this study) and about 100 are industry-wide funds or funds for independent professionals. Defined benefit schemes are still dominant in the Netherlands: 9 out of 10 workers have one. In recent years, many pension funds switched from final earnings-based to career average-based pension schemes. The typical Dutch pension scheme currently aims at building up a pension entitlement within 40 years, yielding a benefit ranging from 70 to 80% of the career average wage (including the first pillar flat rate benefit). Most career average-based schemes apply wage inflation indexation, conditional on the fund's financial health.

3.2 Regulation

Each Dutch corporate pension fund has to be organized in a legal entity, which is separate and independent from the sponsoring company. Most pension funds are foundations. Policy is determined by the fund's board of trustees, with an equal number of employer and employee representatives. Nevertheless, the trustees are required to act independently and only in the fund's interest. In principle, a pension fund must be able to continue functioning for the benefit of all existing participants even if the sponsoring company ceases to exist. In general, the sponsoring firm is not liable to the pension fund when the former goes bankrupt. However, the pension fund's board may be found liable for mismanagement.

Some pension funds reinsure, fully or partly, their pension obligations via a re-insurance company. In that case a premium is paid to the reinsurer who guarantees

the payment of pension benefits. In contrast to the US, there is no public pension benefit insurance of any sort in the Netherlands.

The supervisory authority gives directions to individual funds concerning the minimum capital requirements. The most important of these directions during the period under investigation were the following:⁹

- Liabilities of the fund (accumulated benefit obligations) are valued using a fixed discount rate with a maximum of 4%.
- Assets are valued at market prices, although in the earlier years of our sample period pension funds were also allowed to value bonds by their redemption value.
- Basically, there are no investment restrictions, only a directive that investments have to be ‘solid’. This precludes, for instance, large financial interests of the pension fund in the sponsoring company.
- The reserves have to be sufficient to ensure solvency in the case of a 40% equity price decline and a 10% bond price decline. For the average pension fund, this implies a minimum funding ratio of 130% (PVK, 2002).¹⁰
- There are no formal restrictions to premium holidays or even refunds of employer contributions, as long as the pension fund is in a healthy financial position according to the supervisor. However, the firm cannot force the pension fund’s board to grant premium holidays or refunds; the employer has only 50% of the votes.
- If the funding ratio is insufficient, the pension fund’s board has the following options: a rise of contributions, limited or no indexation of pensions to the rate of wage increases and, in the last resort, a reduction of pension rights. Another possibility is that the sponsor incidentally pays a supplementary contribution over the employer’s regular contributions already paid. However, there are no legal obligations for the sponsor to do this, like in the US, in case of underfunding.
- In most cases, the sponsor agrees by contract to pay some regular contribution, often some fixed percentage of the contributions paid by employees.¹¹ Not paying therefore may have legal consequences. Supplementary contributions by the sponsor, paid when the funding ratio is too low, are discretionary.

3.3 Taxes

In the Netherlands, pension accumulation is stimulated through taxation measures. Pension benefits are only taxed when they are received. No personal income tax is levied on pension contributions. However, the growth of pension rights in the pension fund is limited by the accrual rate, i.e. the percentage of pension entitlements to be built by a participant for each year of service. For career average-based pension

⁹ Our data sample period covers 1996–2005, and hence falls before 2007 when a new, risk-based regulatory regime came into force.

¹⁰ Although this benchmark was made explicit only in 2002, it also provides a reasonable approximation for the period before as it reflects the Dutch pension funds’ common practice to provide for a pension benefit in real terms. With an annual inflation rate of 2% (the inflation target of the ECB) a nominal funding ratio of approximately 130% would translate into a real funding ratio of 100%.

¹¹ Some of the corporate pension plans are collectively bargained. Unfortunately, we do not have information on this.

schemes, the accrual rate is set to 2.25%. The growth of pension rights via the pension fund's investment performance remains untaxed.

For the sponsor, pension contributions are deductible for the corporate income tax.¹² However, regulations prevent a company paying additional contributions to shield high profits from corporate income taxes. First, the growth of pension rights is limited by the accrual rate, as mentioned above. Second, companies are not allowed to pay contributions in advance. These stipulations make it very hard for a company to pay more contributions than necessary if the pension fund's financial position is healthy. Moreover, it is impossible for the company to withdraw money from the pension fund, as explained in Section 3.2. Hence, these limitations should diminish any incentive for the sponsor to overfund the pension plan in profitable times and take advantage of the tax shield, and then refund contributions to the sponsor in bad times.

3.4 Implications for hypotheses

Some of the institutional characteristics described above are specific to the Dutch pension system and, in several respects, differ from the situation in the US. Therefore, the question arises how these characteristics may affect the validity of the nine hypotheses, since most of these have been formulated with the US pension system in mind.

H1 (sponsor contributions are positively related to sponsoring companies' profitability) seems to be relevant for the Netherlands. When the firm is profitable, it is likely that the employer's representatives in the pension fund's board agree to pay more contributions (as suggested by Cooper and Ross, 2002).

H2 (sponsor contributions are negatively related to sponsoring companies' leverage) seems to be less likely as, in the Netherlands, sponsor and pension fund are two separate legal entities and mandatory supplementary sponsor contributions in case of pension deficits are absent. Hence, pension deficits are not to be considered as a debt burden to the sponsoring firm (as suggested by Webb, 2007). On the other hand, if the sponsor is financially constrained, its representatives in the pension fund's board may renegotiate lower contributions (as suggested by Cooper and Ross, 2002).

H3 (sponsor contributions are positively related to the sponsor's leverage) seems to be relevant for the Netherlands. This is because Black's (1980) arbitrage story is applicable to the Netherlands, as sponsor contributions and interest payments are tax deductible, while interest income in the pension fund is tax exempt.

H4 (sponsor contributions are positively related to pension funds' return on assets) seems to be less likely as, in the Netherlands, the sponsor's representatives in the pension fund's board are more likely to renegotiate lower rather than higher contributions when the pension fund's investment income is sufficiently high to sustain its funding ratio at the required level.

H5 (sponsor contributions are positively related to sponsoring firms' company size) seems relevant for the Netherlands. If smaller firms are more likely to be

¹² The corporate tax rate during the sample period was 35.0% in 1996–2000, 34.5% in 2002–2004 and 31.5% in 2005.

financially constrained than larger firms, the representatives of a smaller company in the pension fund's board may more often renegotiate lower contributions than the representatives of a larger company (as suggested by Cooper and Ross, 2002).

H6 (defined benefit pension funds invest more in equity than defined contribution pension funds) follows from the risk shifting theory, according to which Treynor's (1977) default option increases in value with more equity investments. This theory seems to be less valid for the Netherlands, where sponsor and fund are two separate legal entities, implying that the value of the default option is relatively low. However, when bond yields are relatively low, as they were during the sample period, the employees' representatives in the defined benefit pension fund's board may wish to invest more, not less, in equity, thereby hoping to generate a higher level of investment return and avoid missing indexation.

Tax incentives leading to the opposite H7 (defined benefit funds invest more in bonds than defined contribution funds) seem to be relevant because the tax arbitrage story of Black (1980) is applicable to the Netherlands. However, for reasons mentioned with respect to H6, the employees' representatives in the defined benefit pension fund's board may wish to invest more, not less, in equity.

H8 (pension funds' equity holdings are positively related to the sponsor's leverage) seems to be less likely. If the default option has low value anyhow because of the strict separation of sponsor and pension fund into two legal entities, more risky investments with higher leverage would have little effect of bringing the default option closer into the money (as suggested by Cocco and Volpin, 2007).

The contrasting H9 (pension funds' bond holdings are positively related to the sponsor's leverage) also seems to be less likely as, in the Netherlands, mandatory supplementary sponsor contributions are absent, implying that pension deficits are not likely to drive sponsors into financial distress (as suggested by Rauh, 2009). Hence, there is less need to compensate financial risk in the firm by safer investments in the pension fund.

4 Methodology

The hypotheses formulated above are tested using empirical data for around 200 Dutch pension funds between 1996 and 2005. In the model that is estimated, the dependent variable y is a function of a set of hypothesized explanatory variables x and a set of control variables z :

$$y_{it} = x_{i,t-1}\alpha + x_i\beta + z_{i,t-1}\delta + u_i + \varepsilon_{it}, \quad (1)$$

where i denotes either the firm or the pension fund and t is the time operator. $x_{i,t-1}$ and $z_{i,t-1}$ are vectors of variables that vary over pension funds (or firms) and time, x_i is a vector of time-invariant variables ('dummy' variables), which vary only over pension funds (or firms). u_i are the individual effects, ε_{it} is the disturbance term assumed to follow a first-order autoregressive process $\varepsilon_{it} = \varepsilon_{it-1}\rho + \mu_{it}$. All (time-varying) independent variables have been lagged one year, to reduce simultaneity bias.

From the hypotheses formulated above, four models are estimated with as dependent variable, respectively:

1. The sponsoring firm's contributions to the pension fund, scaled by the fund's total assets (hypotheses H1–H5).
2. The ratio of equity holdings to total assets for the pension fund (H6 and H8).
3. The ratio of bond holdings (including mortgages and other loans) to total assets for the pension fund (H7 and H9).¹³

Five explanatory variables, as hypothesized above, are tested:

1. The sponsoring firm's leverage, measured by total debt over total assets (H2, H3, H8 and H9).
2. The sponsoring firm's profitability, measured by return on total assets (H1).
3. The sponsoring firm's size, measured by the logarithm of total assets (H5).
4. The pension fund's profitability, measured by return on total assets (H4).
5. A 'defined benefit dummy' variable, which is 1 for a defined benefit fund and 0 for a defined contribution fund (H6 and H7).

The following set of control variables is added to account for other factors determining sponsor contributions and portfolio allocation:

- The pension fund's size, measured by the natural logarithm of total assets. Larger funds are more sophisticated investors than smaller funds (De Dreu and Bikker, 2009), which impacts asset allocation. We expect that fund size increases the proportion of equity investments in total assets and decreases the proportion of bonds.
- The pension fund's maturity, defined as the proportion of inactive participants. A less mature fund has fewer immediate obligations and therefore may be less risk averse than a mature fund that has a large proportion of pensioners. We expect that pension funds with a large proportion of retired participants invest less in equity.¹⁴
- The pension fund's use of reinsurance, defined as the proportion of pension liabilities that has been reinsured. The use of reinsurance is a way to decrease insurance risk and may also be used as a signalling device to signal financial soundness. This would mean that more reinsurance allows for more risky investment. On the other hand, reinsurers may put restrictions on the portfolio allocation toward risky assets. Hence, the effect of reinsurance on asset allocation is ambiguous.
- Indexation of obligations demands additional funding efforts. We expect pension funds with conditional indexation or no indexation to receive lower sponsor contributions than fully indexed funds. Two dummy variables are therefore introduced as control variables. A 'conditional indexation dummy', taking a value of 1 if

¹³ Dutch pension funds invest in bonds, mortgages, and other loans. We take these investment categories together to represent the 'less risky' investments that theory often opposes to the more risky investments in equity. In the remainder of this paper, we will shortly refer to 'bonds' and 'equity'.

¹⁴ The age distribution of active participants may affect asset allocation as well, since it determines the duration of liabilities and hence the shortfall risk, with older workers typically entailing less equity and more bonds. See e.g. Alestalo and Puttonen (2006) for evidence for Finland and Bikker *et al.* (2011) for the Netherlands. Our dataset lacks information on participants' age.

indexation in year t is conditional on the financial position of the pension fund and 0 otherwise, and a ‘no-indexation dummy’, with value 1 if there is no indexation at all and 0 otherwise.

- Year dummies. These should capture effects of macro-economic trends, common to all funds.¹⁵
- The pension fund’s funding ratio, defined as the fund’s available assets over liabilities.¹⁶ As a result of supervisory requirements (Section 3.2), we expect a positive relationship between the funding ratio and the proportion of equity investments. For sponsor contributions, we expect a negative relationship with the funding ratio, as the sponsor will have to contribute less when the funding ratio is already high.
- The pension fund’s equity holdings. When modelling sponsor contributions, the fund’s equity holdings are included as a control variable. We have no prior as to the relationship between equity holdings and sponsor contributions.

We regress each of the three dependent variables under consideration on the sets of explanatory and control variables introduced above. Pension funds’ funding ratio, use of reinsurance, and equity and bond holdings are instrumented by their lagged values when included as controls.¹⁷ We use generalized least squares (GLS), allowing for the presence of autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels.¹⁸

5 Data

Individual corporate pension fund data were obtained from the supervisory authority, De Nederlandsche Bank (DNB). These data include sponsoring firms’ contributions as received by the pension funds.¹⁹ The data for the sponsoring companies have been taken from Bureau van Dijk’s *Reach*. We connect fund and sponsor data into one dataset, dropping pension funds—observations for which data for sponsoring firms are not available. Whereas for large, listed firms sponsor data were fully available, it was hard to find sponsor data notably for small, unlisted firms. Combining fund to firm data restricts our sample to around 240 pension funds. We also delete outliers with a funding ratio higher than 300% and drop funds that were almost fully

¹⁵ Time dummies may also capture any structural breaks. To our knowledge, there have been no disruptive structural breaks in the supervisory framework during the sample period.

¹⁶ The funding ratio is only calculated for the defined benefit pension funds in the sample (92% of the sample). Obviously, it is by definition 100% for the defined contribution pension plans (8% of the sample).

¹⁷ Simultaneity is highly improbable for the hypothesized explanatory variables that reflect sponsoring firm’s characteristics.

¹⁸ We also experimented with less sophisticated estimators such as OLS. Reported GLS results are in most cases similar to those obtained with the between-effects estimator. Within-estimation did not produce a good fit. As the time variation in the data is much lower than the cross-sectional variation, within-estimation loses too much information. We verified the appropriateness of random effects using the Hausman specification test.

¹⁹ As we do not have data on ‘pension expense’ from the sponsors’ income statements, we cannot examine whether smoothing mechanisms as identified by Shivdasani and Stefanescu (2010) are relevant for the Netherlands.

Table 2. Summary statistics 1996–2005

	Mean	Median	Standard deviation	Number of observations
Panel A. Population of pension funds				
<i>Pension Funds</i>				
Contributions from sponsor	0.412	0.035	11.438	6144
Equity holdings	0.237	0.237	0.205	6823
Bond holdings	0.516	0.579	0.297	6831
Funding ratio	1.309	1.239	0.284	5016
Fund size	9.802	10.063	2.372	6873
Maturity	0.342	0.286	0.264	5991
Profitability	0.180	0.012	11.645	6112
Use of reinsurance	0.026	0.000	0.087	5383
Panel B. Sample of pension funds and sponsoring firms				
<i>Pension Funds</i>				
Contributions from sponsor	0.041	0.028	0.059	1696
Equity holdings	0.315	0.318	0.157	1761
Bond holdings	0.545	0.562	0.202	1756
Funding ratio	1.289	1.234	0.242	1612
Fund size	11.419	11.520	1.626	1720
Maturity	0.341	0.306	0.225	1736
Profitability	0.008	0.017	0.069	1672
Use of reinsurance	0.024	0.000	0.079	1669
<i>Sponsoring firms</i>				
Leverage	0.667	0.679	0.218	1685
Profitability	0.068	0.064	0.086	1649
Firm size	12.470	12.462	2.111	1738
<i>Of which: Listed firms</i>				
Leverage	0.648	0.662	0.142	573
Profitability	0.073	0.081	0.071	569
Firm size	13.947	13.833	1.739	559
<i>Non-listed firms</i>				
Leverage	0.676	0.688	0.248	1112
Profitability	0.064	0.051	0.093	1080
Firm size	11.770	11.807	1.900	1179
<i>Difference between listed and non-listed firms</i>				
Leverage	−0.028***	−0.026***		
Profitability	0.009**	0.030***		
Firm size	2.177***	2.026***		

Explanatory note: Differences in means and medians between listed and non-listed firms have been tested using *t* and Pearson's χ^2 -test, respectively; ** and *** denote significance at the 5 and 1% level, respectively.

reinsured. This leaves us with a dataset containing around 200 pension funds and firms.

Panel B of Table 2 presents summary statistics for the sample of pension funds and sponsoring firms. Because of the restriction of the sample size as a consequence of

combining pension fund data with relatively scarce sponsoring firm data, the representativeness of the sample may be an issue. To assess this, in panel A, we also give summary statistics for the population of pension funds, which can be compared to the sample. Table 2 shows that means and medians for funding ratio, bond holdings, maturity, and reinsurance are quite similar for sample and population. The means for profitability and sponsor contributions differ, but taking account of the standard deviations these differences are not statistically significant. In general, the population has higher standard deviations than the sample indicating that the sample selection resulted in less heterogeneity. Funds in the sample have higher equity holdings and are considerably larger compared to the population, though. This is due to the fact that it was hard to find sponsor data for small pension funds of unlisted firms. As a result, there is a selection bias towards larger pension funds that invest more into equity (see Section 6). Nevertheless, for most pension variables, the distributional characteristics between sample and population do not differ substantially, which makes the sample sufficiently representative of the population.

The firm data are also given for listed and non-listed companies, separately, as this distinction will turn out to be important in the empirical part. Listed firms are larger than non-listed firms, have lower leverage, and are more profitable. The distinction between listed and non-listed firms in the empirical part of the paper is principally motivated by statistical considerations. First, the standard deviations indicate that heterogeneity among non-listed firms is greater than among listed firms. Second, listed firms represent the population, whereas the non-listed firms included are only a part of the full sample. Therefore, the results for the listed firms are expected to be more representative and statistically stronger than the results for the non-listed firms. Of course, there are also economic differences between listed and unlisted firms that are worth mentioning. Unlisted firms disclose less information and are more opaque than listed firms (e.g. Buzby, 1975). Loderer and Waelchli (2010) find that controlling shareholders have a tighter grip on unlisted firms. These authors further assess that both listed and unlisted firms face similar potential conflicts of interest (i.e. between existing shareholders and new shareholders, between management and shareholders). As the potential implications of these differences between listed and unlisted firms for the funding and asset allocation of pension funds are not evident, they will not be explored further in this paper.

Figure 2 shows the distribution of the funding ratio over the sample period. A funding ratio of 1 (i.e. 100%) means that the available assets are exactly equal to the minimum required assets set by the supervisor. There are funds in the sample that occasionally had funding ratios below this level (see the 'minimum' observations). The fifth percentile of the distribution was slightly above 1 during most of the sample period. The median fund's funding ratio deteriorated from 1.35 in 2000 to 1.08 in 2002, largely due to the sharp fall in stock prices during the dotcom crash. For the 99th percentile, the fall of the funding ratio was even more dramatic, as pension funds with such high levels of funding typically hold more equity. The dotcom crash in the stock market manifested itself globally. The development of the funding ratio of

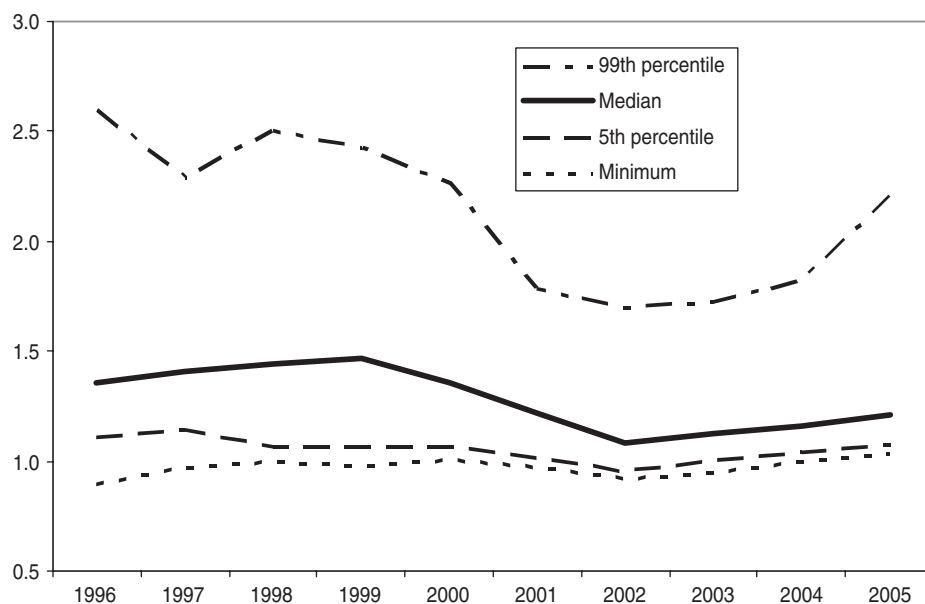


Figure 2. Distribution of funding ratio (ratio of assets to liabilities).

Dutch pension funds is therefore representative of other countries' defined benefit pension fund sectors.²⁰

6 Estimation results

The first columns of Tables 3–5 show the regression results for all (around 200) firms. The second and third columns present results for the listed and non-listed firms, respectively.²¹ This enables us to detect any differences between these two types of firms.

6.1 Sponsor contributions

Table 3 presents results for the sponsor contributions. All sponsor variables (leverage, profitability and size) are statistically significant for the full sample; the Wald test rejects the hypothesis that the coefficients of these variables are all zero.

Profitable and large firms are found to contribute more to their pension funds, which supports the capital market imperfections hypotheses H1 and H5. When the firm is profitable and less often financially constrained thanks to its size, the employer's representatives in the pension fund's board are more likely to agree with paying higher contributions (as suggested by Cooper and Ross, 2002).

We find a positive relation of firm leverage to sponsor contributions. This finding supports tax effects hypothesis H3 according to which the sponsor may benefit from

²⁰ See, for example, Davis (2004) on UK developments which parallel those in the Netherlands.

²¹ One company is counted both listed and unlisted, because it got a listing during the sample period and is consequently counted unlisted in the years before going public and counted listed thereafter.

Table 3. Estimation results for sponsor contributions

		All firms	Listed firms	Non-listed firms
<i>Hypothesized variables</i>	Predicted sign from hypotheses			
Sponsoring firm's profitability _{<i>t</i>-1}	H1: +	0.003* (0.002)	0.014 (0.009)	0.003* (0.002)
Sponsoring firm's leverage _{<i>t</i>-1}	H2: - H3: +	0.004** (0.001)	0.026*** (0.005)	0.002 (0.001)
Pension fund's profitability _{<i>t</i>-1}	H4: +	-0.018** (0.007)	0.002 (0.002)	-0.035*** (0.011)
Sponsoring firm's size _{<i>t</i>-1}	H5: +	0.003*** (0.0004)	0.005*** (0.0005)	0.001** (0.0004)
<i>Control variables</i>				
Pension fund's funding ratio _{<i>t</i>-1}		-0.039*** (0.004)	-0.044*** (0.006)	-0.041*** (0.006)
Pension fund's size _{<i>t</i>-1}		-0.003*** (0.0005)	-0.005*** (0.0006)	-0.003*** (0.0007)
Pension fund's maturity _{<i>t</i>-1}		-0.055*** (0.002)	-0.064*** (0.004)	-0.048*** (0.003)
Pension fund's equity holdings _{<i>t</i>-1}		-0.025** (0.009)	-0.054*** (0.012)	0.010 (0.012)
Pension fund's use of reinsurance _{<i>t</i>-1}		0.077*** (0.018)	0.159** (0.067)	0.061*** (0.021)
Conditional indexation dummy		-0.000 (0.003)	0.001 (0.004)	-0.001 (0.003)
No indexation dummy		-0.003 (0.004)	-0.006 (0.010)	-0.003 (0.004)
Wald test for sponsor variables		52.36***	132.93***	7.08*
Pseudo <i>R</i> ²		0.271	0.511	0.250
Number of observations		1098	381	717
Number of funds		207	59	149

Explanatory note: The feasible GLS estimator has been used, allowing for the presence of first-order autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels. Funding ratio, equity holdings and use of reinsurance have been instrumented by lagged values. Standard errors are given within parentheses; *, ** and *** indicate statistical significance at 10, 5 and 1 % levels, respectively. Year dummies and an intercept have been included (not reported). Wald test gives the χ^2 statistic for the overall statistical significance of the sponsoring firm's variables.

Table 4. Estimation results for pension fund's equity holdings

		All firms	Listed firms	Non-listed firms
<i>Hypothesized variables</i>	Predicted sign from hypotheses			
Defined benefit dummy	H6: + ; H7: -	-0.036 (0.029)	0.062*** (0.016)	-0.042 (0.027)
Sponsoring firm's leverage _{<i>t</i>-1}	H8: + ; H9: -	-0.000 (0.005)	0.037 (0.029)	-0.002 (0.006)
<i>Control variables</i>				
Sponsoring firm's profitability _{<i>t</i>-1}		0.008 (0.008)	0.027 (0.030)	0.009 (0.009)
Sponsoring firm's size _{<i>t</i>-1}		0.007*** (0.002)	0.002 (0.004)	0.010*** (0.002)
Pension fund's funding ratio _{<i>t</i>-1}		0.114*** (0.021)	0.174*** (0.036)	0.105*** (0.025)
Pension fund's profitability _{<i>t</i>-1}		-0.142 (0.099)	0.070 (0.170)	-0.101 (0.099)
Pension fund's size _{<i>t</i>-1}		0.035*** (0.003)	0.038*** (0.004)	0.036*** (0.003)
Pension fund's maturity _{<i>t</i>-1}		-0.046*** (0.016)	0.046 (0.033)	-0.077*** (0.016)
Pension fund's use of reinsurance _{<i>t</i>-1}		-0.327*** (0.108)	-0.155** (0.522)	-0.254** (0.125)
Conditional indexation dummy		0.024 (0.019)	0.026 (0.035)	0.030 (0.023)
No indexation dummy		0.048** (0.023)	0.086* (0.047)	0.043 (0.029)
Wald test for sponsor variables		13.22***	2.47	34.55***
Pseudo <i>R</i> ²		0.288	0.402	0.327
Number of observations		1101	379	722
Number of funds		208	58	151

Explanatory note: The feasible GLS estimator has been used, allowing for the presence of first-order autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels. Funding ratio, fund profitability and the use of reinsurance have been instrumented by their lagged values. Standard errors are given within parentheses; *, ** and *** indicate statistical significance at 10, 5 and 1 % levels, respectively. Year dummies and an intercept have been included (not reported). Wald test gives the χ^2 statistic for the overall statistical significance of the sponsoring firm's variables.

Table 5. Estimation results for pension fund's bond holdings

		All firms	Listed firms	Non-listed firms
<i>Hypothesized variables</i>				
	Predicted sign from hypotheses			
Defined benefit dummy	H6: - ; H7: +	0.024 (0.037)	-0.169*** (0.020)	0.050 (0.039)
Sponsoring firm's leverage _{<i>t</i>-1}	H8: - ; H9: +	-0.007 (0.007)	-0.017 (0.028)	-0.006 (0.006)
<i>Control variables</i>				
Sponsoring firm's profitability _{<i>t</i>-1}		-0.006 (0.012)	0.017 (0.033)	-0.012 (0.013)
Sponsoring firm's size _{<i>t</i>-1}		-0.006*** (0.002)	-0.022*** (0.005)	-0.004* (0.002)
Pension fund's funding ratio _{<i>t</i>-1}		-0.145*** (0.024)	-0.112*** (0.041)	-0.155*** (0.024)
Pension fund's profitability _{<i>t</i>-1}		-0.255** (0.114)	0.077 (0.190)	-0.486*** (0.131)
Pension fund's size _{<i>t</i>-1}		-0.026*** (0.003)	-0.021*** (0.006)	-0.023*** (0.003)
Pension fund's maturity _{<i>t</i>-1}		-0.008 (0.017)	-0.087** (0.036)	0.007 (0.019)
Pension fund's use of reinsurance _{<i>t</i>-1}		0.090 (0.151)	2.122*** (0.444)	-0.052 (0.177)
Conditional indexation dummy		-0.028 (0.021)	-0.037 (0.029)	-0.054* (0.033)
No indexation dummy		-0.101** (0.026)	-0.049 (0.059)	-0.132*** (0.036)
Wald test for sponsor variables		9.96**	26.91***	5.13
Pseudo R ²		0.144	0.438	0.114
Number of observations		1101	379	722
Number of funds		208	58	151

Explanatory note: The feasible GLS estimator has been used, allowing for the presence of first-order autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels. Funding ratio, fund profitability and the use of reinsurance have been instrumented by their lagged values. Standard errors are given within parentheses; *, ** and *** indicate statistical significance at 10, 5 and 1 % levels, respectively. Year dummies and an intercept have been included (not reported). Wald test gives the χ^2 statistic for the overall statistical significance of the sponsoring firm's variables.

the tax deductibility of both pension contributions and interest payments on debt (Black, 1980). This evidence rejects the opposite hypothesis H2 following from the risk shifting theory and the capital market imperfections theory. As indicated in Section 3.4, Webb's (2007) risk shifting argument seems to be less relevant for the Netherlands because of the strict legal separation of the sponsor and the pension fund and the absence of mandatory supplementary sponsor contributions. The rejection of Cooper and Ross's (2002) capital market imperfections prediction suggests that Dutch sponsors take tax incentives more into consideration than financial constraints.

The results for the sponsor contributions show a significantly negative effect of the pension fund's performance (except for listed firms where the effect is insignificant). The negative effect on sponsor contributions suggests that sponsors contribute less, not more, when their pension funds are making more profits. Hence, capital markets hypothesis H4, according to which firms are more willing to pay higher contributions if the pension fund's investment performance is good (Cooper and Ross, 2002), is rejected. This result suggests that Dutch sponsors' board representatives are more likely to renegotiate lower rather than higher contributions when the pension fund's investment income is high.

As to the control variables, the funding ratio has a negative coefficient, which suggests that sponsors contribute less when their pension funds are already funded well. This finding confirms the results of Cocco and Volpin (2007) for the UK. Rauh (2009) argues that a similar finding for the US may reflect the existence of mandatory supplementary contributions for US firms. As mandatory supplementary contributions are absent in the Netherlands, our finding is not driven by this factor.

We further find that sponsor contributions are generally lower for larger and more mature pension funds. Sponsor contributions, especially by listed firms, are lower for pension funds with higher equity investments. According to Black (1980) and Tepper (1981), tax reasons may cause firms to contribute less when pension assets are allocated in equity and not in bonds. Sponsor contributions are found to be higher for funds using reinsurance, maybe because of stipulations of reinsurers.

6.2 Portfolio allocation

In this section, we test the hypotheses on pension funds' portfolio allocation. Tables 4 and 5 present the results for the proportion of equity and bonds in the pension fund's assets, respectively. We discuss these tables together as equity and bonds form the two major counterparts in funds' portfolios, so that most of the coefficients in the equations for equity and bonds have opposite signs.

The defined benefit dummy coefficient is positive for equity and negative for bonds, particularly for listed firms, which implies that defined benefit funds invest more in equity and less in bonds than their defined contribution counterparts. This is consistent with H6 and inconsistent with H7, suggesting that risk shifting incentives (Treynor, 1977) play a bigger role for Dutch firms than tax shield considerations (Black, 1980). However, as explained in Section 3.4, the risk shifting argument is probably not so much the reason for this result than the incentives of Dutch

employees' board representatives to promote equity investments as a way to generate higher investment returns and avoid missing indexation.

Unlike Cocco and Volpin (2007), sponsoring firms' leverage is found to be statistically insignificant for the asset allocation of pension funds, rejecting both H8 and H9. This result is consistent with our expectation (Section 3.4) that neither risk shifting nor risk management incentives are very relevant for the Dutch case, because of the strict legal separation of sponsor and pension fund and the absence of mandatory supplementary contributions, respectively.

The effects of the control variables are generally in line with our expectations. We find a significantly positive relationship between a pension fund's funding ratio and its equity investments, and a negative one with investment in bonds, as was also found by Rauh (2009). This partly reflects regulation, which takes portfolio risk into account when setting minimum funding requirements. Required funding ratios are higher for funds that invest more in risky assets such as equity. Further, we find that larger funds invest more in equity and less in bonds. Large funds, often being relatively sophisticated investors, can better diversify risk in their portfolio and are therefore able to invest more in equity. More mature funds, having shorter investment horizons, are found to invest less in equity. This result corroborates the findings of Rauh (2009). As an exception to the mirroring of the coefficients' signs for equity and bonds, more mature funds also invest less, not more, in bonds, although this finding is only statistically significant for listed firms. Unreported regression results indicate that more mature funds invest more in other cash-like assets, such as deposits and short-term loans. The results further suggest that funds that use more reinsurance generally invest less in equity, and more in bonds (although the latter is found only for listed firms' funds), maybe because of stipulations of reinsurers. Unlike Petersen (1996), sponsors' profitability is found to be insignificant.

Summarizing the evidence, the results seem to be mixed. Table 6 presents a summary of the findings. The table gives for the nine hypotheses the predicted and estimated signs of the relation between the dependent variable and the explanatory variables; '+' denotes a positive relation, '-' a negative one. For the sponsor contributions, the evidence is consistent with theories of capital market imperfections and tax effects. For the asset allocation between equity and bonds, the finding that defined benefit pension funds invest more in equity and less in bonds is in accordance with the risk shifting theory. However, the desire of the employees to increase investment yields so as not to miss indexation probably played a bigger role. We do not find any significant effects of the sponsoring firms' leverage on pension asset allocation decisions.

7 Conclusion

This study presents empirical evidence on the funding and portfolio allocation of corporate pension funds, with a special focus on the influence of the sponsoring firm. Nine hypotheses taken from the theoretical literature are tested using data for around 200 Dutch corporate pension funds and their sponsoring firms over the period 1996–2005. Several of the hypotheses have not been examined before in the empirical

Table 6. *Summary of findings*

		Sponsor contributions		Equity holdings		Bond holdings	
		Predicted	Estimated	Predicted	Estimated	Predicted	Estimated
<i>Hypothesis</i>	<i>Theory</i>	<i>Dependent variable:</i>					
		<i>Explanatory variable</i>					
H1	Capital market imperfections	Sponsor profitability	+	+			
H2	Capital market imperfections, risk shifting	Sponsor leverage	–	+			
H3	Tax effects	Sponsor leverage	+	+			
H4	Capital market imperfections	Pension fund profitability	+	–			
H5	Capital market imperfections	Sponsor size	+	+			
H6	Risk shifting	Defined benefit			+	+	–
H7	Tax effects	Defined benefit			–	+	+
H8	Risk shifting	Sponsor leverage			+	0	–
H9	Risk management, risk shifting	Sponsor leverage			–	0	+

Explanatory note: ‘Predicted’ gives the signs of the relations between the dependent and the explanatory variables as predicted by the hypotheses; ‘+’ and ‘–’ denote a ‘positive’, ‘negative’ sign. ‘Estimated’ gives the signs of the estimated coefficients for the explanatory variables, where ‘+’ and ‘–’ denote that at least one significantly positive, negative coefficient was found for either ‘all firms’, ‘listed firms’ or ‘unlisted firms’; ‘0’ denotes that no statistically significant coefficient was found at all.

literature. Moreover, this study is the first to address the issue of the relationship between sponsor and pension finance for the Netherlands.

As for the sponsor's influence on pension finance, the results for the funding side indicate that unprofitable and small firms contribute less to their pension funds than profitable and large firms, consistent with theories of capital market imperfections. Sponsor contributions are found to be positively correlated with leverage, suggesting that tax effects play a role.

The results for pension asset allocation indicate that defined benefit funds invest relatively more in equity and less in bonds than their defined contribution counterparts, which is in accordance with the risk shifting theory. We do not find any significant effects of leverage on pension asset allocation decisions.

Hence, the results seem to be mixed. On the funding side, the evidence is consistent with theories of capital market imperfections and taxes. On the asset allocation side, some of the evidence is in accordance with the risk shifting theory.

The findings for the control variables used in explaining funding and asset allocation are mostly in line with theoretical predictions and corroborate some of the earlier findings for the US and the UK. Sponsors contribute less to well-funded funds and more to underfunded ones. As mandatory supplementary sponsor contributions are non-existent in the Netherlands, this mostly reflects unrestricted sponsor policy. Large, well funded and less mature funds are found to invest more in equity.

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