Financial behaviour of Dutch pension funds: a disaggregated approach
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* Views expressed are those of the individual author and do not necessarily reflect official positions of De Nederlandsche Bank.
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Abstract

This paper examines the financial behaviour of 77 Dutch pension funds during 2002-2005. Using microdata, we investigate differences across various types of funds. Both the asset mix and the degree of home bias are related to the size of pension funds: large institutions invest more in equity and hold more foreign assets than smaller ones. Especially for industry-wide funds, bonds and equity transactions are consistent with rebalancing a strategically fixed asset mix. Finally, in the case of company-linked funds, a deterioration in the funding ratio is counteracted by a rapid increase in pension contributions. This response cannot be observed for industry-wide funds.

**JEL codes**: G23, J26

**Key words**: pension funds, ageing

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*De Nederlandsche Bank, Financial Stability Division, P.O. Box 98, 1000 AB Amsterdam, The Netherlands, email J.I.Kakes@dnb.nl. This article does not necessarily represent the position of De Nederlandsche Bank. I thank Jaap Bikker, Inge van den Doel, Peter van Els, David Gerber and Carry Mout for useful comments.
1 Introduction

On account of a continuous decline in interest rates and the stock market correction, pension funds have come under significant pressure in recent years. To improve the sector's financial position, contributions have been raised and pension promises have been cut down. Furthermore, there has been a reorientation in investment strategies, with a growing emphasis on asset liability management (ALM).

In this paper, we examine the behaviour of 77 Dutch pension funds over the period 2002-2005, using data from a quarterly survey. Our sample largely covers an episode during which pension funds had to take significant measures in order to restore their funding ratios. Furthermore, this panel dataset allows us to compare different types of pension funds, in particular industry-wide versus company-linked funds. This provides important value-added to other studies, which are mostly based on aggregate figures.¹

The paper is organised as follows. In the next section, we briefly discuss the second pillar of the Dutch pension system. Subsequently, in Section 3 we discuss our dataset and present regressions to analyse pension funds' behaviour. Section 4 concludes.

2 Dutch pension funds

Pension funds constitute the second pillar of the Dutch pension system. Participation in a funded pension scheme is compulsory for most employees. These pension schemes are complementary to the first pillar, the standard government retirement benefit for anyone older than 65, which is pay-as-you-go financed. On an individual basis, workers can build up additional third pillar investments such as life insurance.

This paper focuses on the second pillar. Dutch pension funds can be

¹The value-added of disaggregated data is clearly illustrated by the vast empirical literature on bank behaviour, see e.g. Kashyap and Stein (2000). For pension funds, studies based on microdata are scarce. Exceptions are Bikker et al. (2006) who analyse one single pension fund and Gerber (2005) who examines Swiss pension funds.
broadly divided into two categories: industry-wide and company-linked funds.\footnote{These two categories comprise almost about 97\% of the pension industry’s aggregate assets. In addition, there is a small category of pension funds for professionals and self-employed, while life insurers also provide pension schemes. These are not considered in our analysis.} Industry-wide pension funds are mostly organised by sector, such as the steel or health care industry. ABP, the pension fund for all government employees, is also classified as an industry-wide fund. Company-linked pension funds, by contrast, are typically related to one single company.

In terms of total assets and number of participants, the Dutch pension system is dominated by industry-wide funds (Table 1). The number of company-linked funds is much higher, though, reflecting the on average smaller size of these institutions. Table 1 also shows that annual benefit payments as a percentage of total liabilities—a proxy for a fund’s maturity—is somewhat higher for company-linked funds. Both types of pension funds have raised their annual pension contributions in recent years, but for company-linked funds this increase was clearly more pronounced than for industry-wide funds.

Table 2 gives an overview of pension schemes in the Netherlands. Two main conclusions can be drawn. First, in contrast with many other countries, the Dutch pension system largely remains defined benefit (DB), although there has been a massive shift from final-pay to average-pay DB schemes in recent years. Average-pay systems are easier to manage than final-pay systems because there are no past-service costs while adjustments in indexation are a more effective instrument.\footnote{Whereas in a final wage system indexation can only be adjusted for retirees’ benefits, in an average wage system this can be applied to the accumulated benefits of all participants, i.e. also active workers. This may provide an effective smoothing mechanism over time, by limiting indexation in bad years which can be compensated in good years.} Second, DC and combination schemes are more common for company-linked pension funds than for industry-wide funds. New accounting rules are an important reason to switch from DB to DC. According to the International Financial Reporting Standards (IFRS), implemented in 2005, listed firms have to incorporate a DB pension asset-liability gap in their financial statements. Hence, several Dutch firms—especially those with a company-linked fund—have indicated
that they are considering a switch to DC, to escape this IFRS reporting requirement.\textsuperscript{4}

Both the switch to average-pay DB schemes and the introduction of DC elements can be seen as a move to more hybrid systems, in which investment risk is more equally shared between the sponsor and the participants. This has probably increased the resilience and sustainability of the Dutch pension system.

3 Empirical results

3.1 Data

We use data from a quarterly survey (see data appendix). Our dataset includes 77 institutions, representing about three quarters of total pension assets in the Netherlands. This means that the smallest pension funds are underrepresented, although the survey does include a wide range of size categories. The data are available from 2002 onwards. This is a short sample, but largely covers an interesting episode during which pension funds had to deal with dramatic financial market developments. Unfortunately, our dataset does not include off-balance positions. Pension funds have an incentive to use derivatives to reduce interest rate risk, exchange rate risk and their exposure to the stock market. Presumably, such instruments will become more important with the introduction of a new, more risk-based regulatory framework in 2007.

Table 3 summarizes some basic characteristics of the survey data for different size classes, as well as industry-wide versus company-linked pension funds. Presented are averages per subcategory; medians and aggregate numbers are not presented but show a similar pattern. Size categories are quartiles, based on the institutions’ total assets in 2003Q4—our sample’s middle observation.

A large proportion of total assets is invested abroad, which can be largely

\textsuperscript{4}Since 2005, some middle-sized company-linked pension schemes have switched to so-called ‘collective DC’. These schemes try to retain the advantages of collective risk sharing across participants.
explained by risk diversification (see Davis, 2002, for a discussion). Large pension funds hold more foreign assets than small ones. Presumably, scale economies make it easier for large pension funds to operate on a global scale and deal with exchange rate risk. Differences in the asset mix are substantial as well: large pension funds invest more in stocks and real estate, while smaller institutions hold a higher proportion of fixed-income investments. On the basis of Swiss data, Gerber (2005) also establishes that smaller pension funds tend to invest less in equity than large ones.

The differences between industry-wide and company-linked funds are less pronounced. Interestingly, company-linked pension funds are more internationally oriented than industry-wide funds, despite the fact that they are much smaller. In addition, industry-wide funds invest more in real estate and less in stocks, while the proportion of fixed-income is similar for both categories.

3.2 Regression analysis

We carried out panel regressions to investigate pension funds’ financial behaviour, using a fixed effects estimator. We examine two important tools: financial transactions and changes in pension contributions. Financial transactions may be used to adjust the asset mix and risk profile, while contributions can be raised to improve the funding ratio $FR_t$. For financial transactions, we focus on net purchases of the most important asset categories: bonds $B_t^{trans}$ and equity $S_t^{trans}$, which can be separated from changes in their valuation ($B_t^{val}$ and $S_t^{val}$, respectively).

For the results presented below, we restricted our sample to the period 2002-2004, i.e. we excluded the observations for 2005. In that year, pension funds were anticipating two important regulatory changes, which probably affected their financial behaviour. First, a new supervisory regime was planned to be introduced in 2006—postponed to 2007 in September 2005.\(^5\) Second, in 2006 the new Act on Early Retirement and Lifecourse

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\(^5\)One of the major changes under the new rules is the replacement of the fixed 4% discount rate—which is used to calculate the liabilities in our dataset—with a market yield curve. In this context, market interest rates dropped to historically low levels—and
savings arrangements entered into force. The Act included changes in the
tax treatment of pensions schemes, aimed at discouraging early retirement.

Table 4 presents regressions for panels including all 77 pension funds, as
well as the two subcategories. In each regression, bond or equity transac-
tions are explained by three regressors: $FR_t$, $B_{t}^{val}$ and $S_{t}^{val}$. Each regression
is also carried out with lagged variables, as funds may not immediately re-
spond. The funding ratio is expressed relative to a fund’s sample average;
all other variables are scaled by pension funds’ liabilities. For each sub-
sample, the results are presented in three columns: one column explaining
bond transactions using ordinary least squares (OLS) regressions and two
columns explaining equity transactions using both OLS and an instrumen-
tal variables (IV) approach. Instrumental variables are added to take into
account potential simultaneity problems, as stock prices may simply react
to a pension fund’s purchases in the same quarter rather than the other way
around. For bond transactions, this is not really an issue on account of bond
markets’ high degree of homogeneity and liquidity.

The regression results show that pension funds do not reduce the risk
of their portfolio after a deterioration in their financial position. Rather,
a relatively high funding ratio is associated with a net purchase of bonds,
while the response of equity transactions is insignificant. An interesting
question is to what extent this is consistent with rebalancing, i.e. net pur-
chases that counteract price movements in order to restore a strategically
fixed asset allocation scheme. Rebalancing behaviour has been established
before on the basis of aggregate data for all Dutch institutional investors (De
Nederlandsche Bank, 2004). Indeed, all significant coefficients for $B_{t}^{val}$ and
$S_{t}^{val}$ show that bond and equity transactions are negatively related to cor-
responding price changes. This is most pronounced for industry-wide funds,
which respond instantaneously to both equity and bond prices. Company-
linked funds react immediately to changes in bond prices, while the response

far below 4%—in the summer of 2005. This would result in an immediate deterioration
of pension funds’ financial position under the new regime. Presumably, pension funds
were increasingly taking into account this new supervisory framework in the run-up to its
introduction.
to equity prices takes place with a one-period lag (OLS) or not at all (IV). Altogether, especially for industry-wide funds, our results are in line with rebalancing while the evidence for company-linked funds—and for all funds together—is less clear.

Pension funds may restore their financial position by raising their contributions. In our dataset, pension contributions include both regular premiums that are negotiated every year and ad hoc contributions by the sponsor. In a preliminary analysis, we investigated the relationship between pension contributions—as a proportion of total liabilities—and several lags of $FR_t$, $B_{val}^t$ and $S_{val}^t$. In all regressions, only (lags of) the funding ratio were significant, albeit not for industry-wide funds. The results are presented in Table 5. Each entry represents a separate equation with two regressors: a constant and one particular lag of $FR_t$. The difference between both types of funds is in line with a recent survey among the 25 largest Dutch pension funds, which shows that company-linked funds adjust contributions more rapidly than industry-wide funds (see De Nederlandsche Bank, 2005). Presumably, they can do this more easily because there are fewer parties around the table. Another reason may be that, as shown in Table 1, company-linked pension funds are on average more mature and therefore need to raise contributions more than industry-wide funds to produce the same effect.

3.3 Robustness

We carried out several robustness checks. First of all, we repeated all regressions using a market-based discount rate instead of the fixed interest rate that is included in our dataset. This is not a straightforward exercise, but with some assumptions (see data appendix) we were able to calculate a proxy for market-based liabilities. However, including these instead of the original liabilities only has a limited effect on the estimation results and does not change our conclusions.

Second, we repeated the analysis using pooled regressions instead of a fixed-effects estimator. For the equations in Table 4, this hardly changes the results, while the results in Table 5 become more pronounced. This indicates
that our findings are largely driven by general patterns rather than fund-specific characteristics.

Third, we examined possible changes over our sample period, particularly regarding rebalancing behaviour. Figure 1 presents recursive estimations of the coefficients for $B_{val}^t$ and $S_{val}^t$ in the equations for bond and equity transactions, for all pension funds. The impact of bond prices on bond transactions is quite stable: the instantaneous impact remains significantly negative around the same level, while the lagged impact is insignificant for all estimations. The immediate impact of stock prices is insignificant over the entire period—as reported in Table 4—although for the earlier observations, this coefficient is almost significant with a wrong (positive) sign. When this regressor is included with a lag, the coefficient remains significantly negative. Figure 2 presents the same recursive estimations for both subgroups of pension funds. Company-linked funds show the same pattern as the entire sample, with a wrong sign for the $S_{val}^t$ coefficient, while the results for industry-wide funds are consistent with rebalancing over the whole period. We also estimated coefficients for every individual observation, i.e. a one-quarter moving window (not reported). Interestingly, there is one large and significant positive outlier for the $S_{val}^t$ coefficient at the observation 2003Q2. Presumably, many pension funds temporarily suspended their rebalancing policies in this period, when stock prices had fallen to their lowest level and several funds were underfunded. Estimating the equations in Table 4 again without this observation hardly affects the regression outcomes, however.

Finally, we re-estimated all equations for the entire period 2002-2005, i.e. including the last four quarters prior to the (planned) introduction of the new regulatory framework and the Act on Early Retirement and Lifecourse savings. For the estimations in Table 4, this only leads to minor changes and does not change our conclusions. However, the results in Table 5 change substantially, as the coefficients of the (lagged) funding ratio turn insignificant or even positive. A closer inspection of the data reveals that at the end of 2005, for several funds the amount of pension contributions increased markedly, despite an improvement of their funding ratios—measured using a fixed discount rate. However, under the new market-based rules, fund-
ing ratios were deteriorating because the ongoing decline in interest rates. Anticipating this new regime, several sponsoring companies raised their pension contributions. In addition, a number of pension funds have indicated that extra contributions by the sponsor were related to changes in pension arrangements. The new Act prompted many funds to terminate pre-pension schemes, which the sponsor often compensated by a once-only contribution. For similar reasons, pensions plans that switched from DB to (collective) DC often received an ad hoc contribution.

4 Concluding remarks

We have established several interesting results. Pension funds show rebalancing behaviour, which is most pronounced for the largest institutions. More generally, large pension funds are more active on financial markets to manage their financial position, whereas smaller institutions and company-linked funds are more prone to adjust the level of pension contributions. Many industry-wide funds have made DB schemes more sustainable by moving from final-pay to career average systems, while several company-linked pension funds are shifting financial risks to their participants by introducing more DC elements. Altogether, pension funds are dealing differently with their exposures to financial risks.

What are the implications of our findings when future trends are taken into account? As the proportion of active members falls, it will become more difficult to prevent underfunding by raising contributions. Other trends in the economy are increasing job mobility, mergers and acquisitions, and sectoral shifts. As a consequence, pension funds increasingly will have to accommodate transfers of pension rights and deal with discontinuity issues. Differences across pension funds—as established in this paper—may be a further complication to the portability of pensions. Given these challenges and the limited tools to adjust a fund’s financial position, a growing focus on asset liability management will probably be important to protect the pension sector’s resilience.
Data appendix

The survey data  We use data from a quarterly survey that is carried out by Statistics Netherlands and De Nederlandsche Bank, which consists of three types of data:

- A detailed balance sheet of pension assets and liabilities. Assets include listed and nonlisted shares, real estate, bonds, loans and deposits. These are further split into subcategories: by counterparty (corporate sector, government, households) and domestic versus foreign investments. Liabilities are discounted with a fixed interest rate, consistent with the regulatory requirements during this period. From 2007 onwards, the fixed discount rate will be replaced by a market yield curve as part of a new regulatory framework.

- Flow data of the main investment categories. These are split into transactions and other changes (mainly changes in valuation).

- Costs and benefits, including contributions received and pension benefits paid. Pension contributions include both regular premiums and ad hoc contributions by the sponsor.

These data are available from 2002 onwards.

Market-based liabilities  Pension liabilities in our sample are calculated with a fixed discount rate, which is in line with the regulatory regime during our sample period. Translating these into market-based liabilities is not a straightforward exercise, for two reasons. First, we need to know the duration of every pension fund’s liabilities in order to use the corresponding market discount rate. Second, we need to know the level of the fixed rate pension funds have been using during our sample period; regulation only imposed a maximum of 4%, but pension funds were free to use a lower rate. As an approximation, we assume that for all pension funds, liabilities have a duration of 15 years—roughly the sector’s average—and use a corresponding
market interest rate. We also assume that pension funds used a 4\% fixed rate—the maximum allowed by the regulator—in their reports.

References


### TABLE 1  Industry-wide and company-linked pension funds

**General characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Number of institutions</th>
<th>Total assets (EUR billions)</th>
<th>Active members (x 1000)</th>
<th>Benefits (% of total liabilities)</th>
<th>Contributions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industry-wide funds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>79</td>
<td>199</td>
<td>3898</td>
<td>3.4</td>
<td>2.8</td>
</tr>
<tr>
<td>2004</td>
<td>101</td>
<td>295</td>
<td>5068</td>
<td>3.1</td>
<td>3.4</td>
</tr>
<tr>
<td><strong>Company-linked funds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>870</td>
<td>89</td>
<td>755</td>
<td>4.0</td>
<td>2.9</td>
</tr>
<tr>
<td>2004</td>
<td>701</td>
<td>132</td>
<td>857</td>
<td>4.0</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Source: De Nederlandsche Bank

### TABLE 2  Dutch pension schemes

**Proportion of aggregate assets**

<table>
<thead>
<tr>
<th></th>
<th>DB Final wage</th>
<th>DC Average wage</th>
<th>Combination scheme*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industry-wide funds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>0.82</td>
<td>0.01</td>
<td>0.06</td>
<td>1.00</td>
</tr>
<tr>
<td>2004</td>
<td>0.09</td>
<td>0.00</td>
<td>0.05</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Company-linked funds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>0.58</td>
<td>0.01</td>
<td>0.18</td>
<td>1.00</td>
</tr>
<tr>
<td>2004</td>
<td>0.38</td>
<td>0.02</td>
<td>0.32</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Mostly consisting of a DB component and—above a particular salary level—a DC component.

Source: De Nederlandsche Bank
### TABLE 3  Characteristics survey data in 2003Q4

Averages per category.

<table>
<thead>
<tr>
<th># Inst</th>
<th>Average assets (EUR billion)</th>
<th>Foreign assets</th>
<th>Asset mix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Outside EMU</td>
<td>Shares</td>
</tr>
<tr>
<td>top 5</td>
<td>5</td>
<td>51523</td>
<td>0.80</td>
</tr>
<tr>
<td>1st quartile</td>
<td>20</td>
<td>17714</td>
<td>0.75</td>
</tr>
<tr>
<td>2nd quartile</td>
<td>19</td>
<td>1278</td>
<td>0.55</td>
</tr>
<tr>
<td>3rd quartile</td>
<td>19</td>
<td>460</td>
<td>0.65</td>
</tr>
<tr>
<td>4th quartile</td>
<td>19</td>
<td>139</td>
<td>0.34</td>
</tr>
<tr>
<td>Industry-wide</td>
<td>26</td>
<td>10835</td>
<td>0.51</td>
</tr>
<tr>
<td>Company-linked</td>
<td>51</td>
<td>1797</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Subcategories of 'Assets abroad' and 'Asset mix' are expressed as proportions of total assets.

Source: Own calculations
### TABLE 4 Regression results: bond and equity transactions

<table>
<thead>
<tr>
<th></th>
<th>All pension funds</th>
<th>Industry-wide</th>
<th>Company-linked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B_t^{\text{trans}}$</td>
<td>$S_t^{\text{trans}}$</td>
<td>$B_t^{\text{trans}}$</td>
</tr>
<tr>
<td></td>
<td>OLS</td>
<td>OLS</td>
<td>IV</td>
</tr>
<tr>
<td>$FR_t$</td>
<td>0.05$^b$</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>$B_t^{\text{val}}$</td>
<td>-0.20$^a$</td>
<td>0.08</td>
<td>0.06</td>
</tr>
<tr>
<td>$S_t^{\text{val}}$</td>
<td>-0.07$^c$</td>
<td>0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td># obs</td>
<td>756</td>
<td>756</td>
<td>756</td>
</tr>
<tr>
<td>$FR_{t-1}$</td>
<td>0.01</td>
<td>-0.02</td>
<td>-0.03</td>
</tr>
<tr>
<td>$B_{t-1}^{\text{val}}$</td>
<td>0.03</td>
<td>-0.07</td>
<td>-0.04</td>
</tr>
<tr>
<td>$S_{t-1}^{\text{val}}$</td>
<td>0.04</td>
<td>-0.13$^a$</td>
<td>-0.08$^c$</td>
</tr>
<tr>
<td># obs</td>
<td>693</td>
<td>693</td>
<td>693</td>
</tr>
</tbody>
</table>

Explanation: the subscripts $a$, $b$ and $c$ denote, respectively, statistical significance at the 1%, 5% and 10% level. Net purchases of bonds ($B_t^{\text{trans}}$) and stocks ($S_t^{\text{trans}}$) are explained by a constant and three regressors together. In the IV regressions, a stock market index and the long-term interest rate are used as instruments. Estimation period: 2002Q1-2004Q4.
TABLE 5 Regression results: pension contributions

<table>
<thead>
<tr>
<th></th>
<th>All pension funds</th>
<th>Industry-wide</th>
<th>Company-linked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$PC_t$</td>
<td>$PC_t$</td>
<td>$PC_t$</td>
</tr>
<tr>
<td>$FR_t$</td>
<td>0.01$^c$</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>$FR_{t-1}$</td>
<td>-0.01$^c$</td>
<td>0.00</td>
<td>-0.01$^b$</td>
</tr>
<tr>
<td>$FR_{t-2}$</td>
<td>-0.01$^b$</td>
<td>0.00</td>
<td>-0.01$^b$</td>
</tr>
</tbody>
</table>

Explanation: the subscripts $a$, $b$ and $c$ denote, respectively, statistical significance at the 1%, 5% and 10% level. The level of pension contributions as a proportion of total pension liabilities ($PC_t$) is explained by a constant and one particular lag of the funding ratio, i.e. each entry represents a regression. Estimation period: 2002Q1-2004Q4.
Figure 1  Recursive estimations bond and equity transactions
All pension funds

The solid lines show how the coefficients of (lagged) bond and stock market valuations develop over time, for the bond and equity transactions equations presented in Table 4. Recursive OLS estimations are carried out for, respectively, 2002Q1-2002Q2, 2001Q1-2002Q3, …, and 2002Q2-2005Q4. Dotted lines mark a 90% confidence interval.
Figure 2  Recursive estimations bond and equity transactions

Industry-wide funds (grey) versus company-linked funds (black).

See Figure 1. Only point estimates are presented here.
No. 81  Arthur van Soest, Arie Kapteyn and Julie Zissimopoulos, Using Stated Preferences Data to Analyze Preferences for Full and Partial Retirement
No. 82  Dirk Broeders, Valuation of Conditional Pension Liabilities and Guarantees under Sponsor Vulnerability
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No. 107 Froukjein Wendt, Intraday Margining of Central Counterparties: EU Practice and a Theoretical Evaluation of Benefits and Costs
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