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* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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Abstract

One of the key missions of pension funds is to maximise returns on pension investments. The five largest pension funds in the Netherlands allocate their assets differently among possible investment products compared to the smaller pension funds. This allocation strategy has positively impacted their net returns over the past decade without significantly increasing their risk exposure. Additionally, they benefit from economies of scale when investing their assets. However, these large pension funds have lost their returns advantage due to less effective interest rate risk hedging strategies. Furthermore, performance fees – paid almost exclusively by the largest funds – negatively impact net returns, except for fees associated with private equity and hedge funds.

Keywords: Pension fund investment returns, scale economies, investment allocation, pension funds size-return relationship, performance fees, consolidation

JEL Classification: G23

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1. Introduction

Pension funds aim to achieve high net returns. Unlike smaller pension funds, large pension funds therefore invest more in risky and complex asset classes such as private equity and hedge funds. These investments come with higher costs but are also expected to yield higher returns. For instance, ABP, the largest Dutch pension fund, pays a staggering €3.4 billion in performance fees for external parties investing on their behalf in assets like private equity (ABP, 2023 Annual Report). This is just one of its cost components. Other large Dutch pension funds pay similarly large amounts (Financieel Dagblad, 2021; Pensioen Pro, 2022).

In this article, we examine whether the investment strategies of large pension funds are successful and – more broadly – whether they achieve higher returns than the smaller funds. We also explore whether the greater risk they take results in more volatile returns, and whether high performance fees contribute to higher returns or merely to higher costs. Research by Broeders *et al*. (2019) shows that pension funds that pay performance fees do not achieve higher returns than those that do not, especially when adjusted for risk.

One of the ways in which pension funds reduce costs is by utilising economies of scale. Previous research by Bikker and Meringa (2021, 2022) has shown that economies of scale have made only little difference in terms of cost savings in recent years. However, this research did not address economies of scale in investment returns. Other studies have found economies of scale (Dyck and Pomorski, 2011; Andonov, Bauer and Cremers, 2012; Keskiner and Matthias, 2018), although not in all cases (Smits, 2011). Larger funds may have more market power, access to more asset classes and better market analysis and risk management departments (as noted in the studies cited above, and by Cai, He and He, 2010, and Della Croce, 2012). If large pension funds invest more successfully than smaller ones due to economies of scale, further consolidation could lead to higher gains in the form of higher net returns.

We examine the relationship between returns and pension fund size as follows. First, we break down pension funds' net returns into six asset classes to determine the long-term returns and volatility of these classes. We focus on the period from 2012 to the second quarter of 2022 (2012-2022Q2) because the data for this period have been further disaggregated than in previous years, and have also been determined according to new definitions. We also look at the period from 2007 to 2011, which includes the financial crisis. Next, we break down the net returns into five pension fund size classes and further by asset classes. We then calculate the impact of differences in investment allocation among these size classes on the returns. We expect that larger pension funds will achieve higher returns due to their riskier investments, provided the costs of these investments are not excessively high. Any excess returns for large pension funds, meaning returns that cannot be attributed solely to size-specific allocation, can then be attributed to superior market analysis

and risk management. In our regression analysis, we first investigate whether economies of scale exist in net returns. Secondly, we assess the extent to which performance fees and other investment costs either pay for themselves or affect returns. By applying a pension fund size-weighted regression, we highlight the effects on the largest funds. Additionally, we conduct these regression analyses on individual assets.

The results confirm several expectations, including the presence of economies of scale and the positive effects of allocating more to riskier, potentially higher-yielding assets. Higher performance fees, primarily paid by larger pension funds, pay for themselves with respect to private equity and hedge funds but not with respect to fixed income and stocks. This is surprising, as it indicates that even the largest pension funds, often regarded as highly professional investors, could still enhance their investment strategies. Additionally, during many years of the review period, large pension funds hedged interest rate risk on investments less effectively than smaller funds, leading to significant losses. Consequently, from 2012 to 2022Q2, these large funds lost the excess returns they had gained from investing in high-yield securities and leveraging economies of scale and superior analytical departments. Overall, large pension funds perform comparably to smaller ones, which is an unexpected outcome. This conclusion of roughly equal returns also holds true for the financial crisis years (2007-2011), when riskier asset investments strongly underperformed compared to fixed assets.

This paper is structured as follows. Section 2 provides a literature review, and Section 3 offers an overview of the pension system in the Netherlands. Section 4 presents data on returns and analyses, including differences in returns and risk by size classes and the impact of investment allocation on returns. Section 5 includes regression analyses of net returns to identify any economies of scale and the effects of cost components, particularly performance fees. Section 6 describes a hypothetical simulation of large-scale consolidation to explore potential returns gains. The final section presents our conclusions.

2. Literature

Research on whether economies of scale exist in terms of net returns for pension funds and their underlying causes is quite limited, especially in recent years, and some of it remains unpublished. This limited literature is likely due to the confidentiality of pension funds' data on investments, returns and costs, which are therefore not publicly available. Andonov, Bauer, and Cremers (2012) examine investment costs and returns using data from a comprehensive international collection of large pension funds provided by CEM Benchmarking, a global benchmarking firm based in Toronto.[2] They find significant economies of scale in both costs and returns. Cost economies of scale are especially strong in alternative assets. Using a similar dataset, Dyck and Pomorski (2011) find that the largest pension funds outperform smaller ones, with a third to half of the gains arising from cost savings related to internal management, where costs are at least three times lower than

[2] Pension funds that provide their investment and cost data to CEM receive information on their performance compared to other anonymised pension funds.

those under external management. The superior returns of larger pension funds are primarily due to increased allocations to alternative investments and achieving greater returns in this asset class. In private equity and real estate investments, large pension funds benefit from both lower costs and higher gross returns. The ability to leverage economies of scale depends on the governance of pension funds, with better governance leading to higher benefits from economies of scale. Keskiner and Matthias (2018) also report higher returns for larger pension funds. However, they reference an unpublished study by CEM Benchmarking, with which they collaborate on data, that found no such link for a large sample of US pension funds.

There are also caveats. Andonov, Bauer, and Cremers (2012) find that the direct relationship between the size of assets under management and performance is significant only in terms of market timing, which smaller funds execute more effectively. In general, economies of scale in terms of costs do not lead to better overall performance for larger pension funds. Smits (2011) finds no significant relationships between pension fund size and absolute performance, relative performance, and funding ratios. Performance is mainly influenced by other factors, such as longevity risk and inflation risk.

The primary reason large pension funds achieve higher returns is their greater exposure to alternative assets, particularly private equity. Other possible explanations include their greater bargaining power (Andonov, Bauer, and Cremers, 2012), greater ability to diversify investments internationally (Dyck and Pomorski, 2011) and better access to illiquid investments (Keskiner and Matthias, 2018). Based on a large international OECD survey, Della Croce (2012) observes that only large pension funds have been able to acquire the knowledge, expertise and resources to invest directly in infrastructure. Cai, He and He (2010) find that large institutional investors are better informed.

Our research addresses a gap in the existing literature in three key areas. Firstly, much of the cited literature is rather outdated, making recent research a valuable addition. Secondly, existing studies primarily focus on international datasets, so research based on a Dutch dataset provides a useful new perspective. Lastly, the international data collections from CEM Benchmarking and the OECD survey only include data from large pension funds. A comprehensive comparison across different size classes necessitates a more extensive data collection, such as the one presented in this paper.

3. The pension system in the Netherlands

The institutional structure of the Dutch pension system is made up of three pillars, similar to the situation in most other developed countries. The first pillar consists of a public pension scheme and is financed on a pay-as-you-go basis. It offers a basic flat-rate pension to all retirees and aims to link the benefit level to the statutory minimum wage. The pension benefit age moved gradually from 65 years until 2012 to 67 years in 2024 and will increase to 70 years in 2070 (dynamically linked to life expectancy). The second pillar provides former employees with additional income from a collective, contribution-based supplementary scheme. The prescribed pension age is, in 2024, 68 years. The third pillar is composed of tax-deferred personal savings, which individuals undertake at their own initiative and expense. The supplementary or occupational pension system in the Netherlands is typically organised as a funded

defined-benefit (DB) or collective defined contributions (CDC) scheme. The benefit entitlement is determined by years of service and a reference wage, which in more recent years has been linked to wages over the years of service. The second pillar takes the public scheme benefits into account, while the third pillar's tax deduction takes the sum of the benefits from the first two pillars into account. Supplementary schemes are usually managed collectively by pension funds.

Three types of pension funds exist. The first is the *industry-wide* pension fund, which is organised for a specific industry sector (e.g. civil servants**,** construction, healthcare, transport). Participation in an industry-wide pension fund is mandatory for all employers in the relevant sector, with a few exceptions. An employer may opt out if it establishes a *company* pension fund that offers a better pension plan to its employees. Where a supplementary scheme is agreed by employers and employees, managed by either a company pension fund or an industry-wide pension fund, employee participation is mandatory, governed by collective labour agreements. The third type of pension fund is the *occupational* pension fund, organised for a specific group of professionals, such as the medical profession or notarial profession.

The Dutch pension fund system is comprehensive. In 2022, almost 89% of the employees are covered, but self-employed people need to arrange their own retirement savings. In that year, total pension fund assets in the Netherlands amounted to some €1,512 billion, or 158% of GDP, ranking the Dutch pension system, in terms of the assets-to-GDP ratio, as the largest in the industrial world.

The government, employees and employers have agreed to transform the pension system into a type of defined contribution system, resulting into the Future Pensions Act. This law revises the Dutch pension system and came into effect on 1 July 2023, Pension funds currently have until 2028 to switch to the new system. This system may have a collective buffer to soften setbacks, at the choice of the pension funds.

4. Data on returns and analysis

In this section, we begin by presenting pension fund data on returns and continue with a number of brief analyses based on these data. The calculations in this paper are based on quarterly data from 464 pension funds for the period 2007Q1-2022Q2, as reported to the supervisory authority, De Nederlandsche Bank (DNB). We excluded pension funds with fewer than 100 members (which were only four funds in 2022Q2) and those that did not report all the necessary items for our research. The number of pension funds decreased sharply over the period under review, from 453 in 2007 to 189 in 2022Q2, reflecting the consolidation process of recent decades. Over 2012-2022Q2, the selected funds covered 98.3% of the total pension investments, which amount to €1,512 billion.

This research analyses net returns, which consist of gross returns, including dividends, minus all investment costs. Risk is defined as the fluctuation in net returns over time, with the standard deviation being a simple and widely used measure

Table 1 presents the average net returns and risk of pension fund asset classes by quarter for two periods: before and after the 2012 change in the definition of investment assets. Since 2012, private equity, hedge funds and commodities have been classified as separate categories. Before 2012, they were considered part of equities.

Over the 2012-2022Q2 period, net investment returns from equities, alternative investments (mainly private equity) and real estate have been higher than those from fixed-income assets (bonds). The much smaller hedge funds and commodities categories achieved much lower or even negative returns over this period. The risks, as measured by the standard deviation, related to equities, private equity, hedge funds and fixed income have remained roughly the same. Risk-adjusted investment returns (net returns divided by the standard deviation) were slightly higher for equities than for fixed income, private equity and real estate, and close to zero or even negative for hedge funds and commodities. The overall average return in this period of 1.46% per quarter implies an annualised return of 5.97%.

Table 1. Risk and returns of pension fund asset classes (by quarter, as a percentage)

	Average returns		**Standard deviation**		**Avg. return/Std. deviation**	
	2007-2011	*2012-2022Q2*	*2007-2011*	*2012-2022Q2*	*2007-2011*	*2012-2022Q2*
Fixed-income	1.66	0.43	6.15	6.05	0.28	0.07
Equities	-0.48	2.44	10.36	7.15	-0.05	0.34
Real estate	-0.72	1.92	7.68	5.17	-0.09	0.37
Private equity		3.09		5.97		0.47
Hedge funds		0.07		7.82		0.09
Commodities		-0.90		10.15		-0.06
Total	**0.87**	**1.45**	**5.01**	**4.87**	**0.17**	**0.30**

Source: DNB, own calculations.

The earlier period, 2007-2011, is obviously characterised by the financial crisis that started in 2007/2008. Fixed income performed well due to falling interest rates, while equities and real estate achieved negative returns on average. On an annual basis, the average total return at the time amounted to 3.53%.

4.1 Differences in allocation

The allocation across asset classes differs systematically between pension funds with different sizes of assets under management. Table 2 shows the asset distribution for five different size classes based on assets in 2018Q1, the time-average base quarter also chosen in Bikker and Meringa (2021). The size breakdown is also based on this base quarter. Pension funds remain in the same size class throughout the period to avoid bias. Class 1 pension funds have at least €28 billion in total assets in the first quarter of 2018. This group includes the five largest pension funds, referred to as the 'large pension funds'. Class 2 includes pension funds with total assets between €10 billion and €28 billion, class 3 includes pension funds with total assets between €2.8 billion and €10 billion, class 4 includes pension funds with total assets between €0.8 billion and €2.8 billion, and class 5 includes pension funds with total assets below €0.8 billion. The numbers of pension funds in each class are 5, 12, 34, 60 and 79, respectively.

Interestingly, the allocation to equities is almost the same for all five classes, at around 30%. At over 10%, the real estate share of large pension funds is twice as large as that of smaller funds In addition, the share of private equity, hedge funds and commodities is substantial in large pension funds and minimal in small funds. Fixed income is the largest investment category, averaging around 60% for all size classes

but only 46% for the largest pension funds. This indicates that large pension funds invest more in high-yield and riskier asset classes. We have omitted the 'other investments' category, as this asset class is very small (0.07%).

For comparative purposes, the bottom panel shows the average allocation over 2012-2022Q2, also based on the size class breakdown in 2018Q1. This allocation is not much different from that in 2018Q2.

Table 2. Distribution of assets by size class, as a percentage (2018Q1)

Size classes	**1**	**2**	**3**	**4**	**5**	**Total, in EUR billion**
Allocation in 2018Q1						
Fixed-income	46.3	59.9	59.1	61.2	60.4	*708*
Equities	30.1	30.2	29.1	31.0	31.7	*411*
Real estate	10.0	6.4	7.9	5.9	5.0	*118*
Private equity	7.0	2.6	2.1	0.9	0.5	*68*
Hedge funds	2.4	0.6	1.0	0.4	0.2	*23*
Commodities	4.1	0.5	0.7	0.5	0.6	*36*
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	
EUR billion	*776*	*254*	*188*	*79*	*38*	*1.336*
Average allocation over 2012-2022Q2						
Fixed-income	*53.2*	*60.1*	*60.4*	*62.6*	*62.1*	*694*
Equities	*29.8*	*30.2*	*28.4*	*30.1*	*30.2*	*396*
Real estate	*10.4*	*7.0*	*7.9*	*5.9*	*4.2*	*117*
Private equity	6.1	2.8	2.3	0.9	0.3	*72*
Hedge funds	2.1	0.7	1.1	0.6	0.4	*26*
Commodities	*2.6*	*0.9*	*1.0*	*0.8*	*0.7*	*3*
Total						
EUR billion						*1.297*

Source: DNB, own calculations.
Note: The size classes are explained in the text.

4.2. Differences in returns by size class

Table 3 breaks down the net returns for the years 2012-2022Q2 by five size classes. First, we look at the second-last row in the first panel: "total (reported)", over 2012-2022Q2. For the largest pension funds, the total quarterly return averages 1.50%, gradually decreasing to 1.38% for the medium-sized funds and rising again to 1.49% for the smallest funds. The difference in average returns between the largest and smallest pension funds therefore appears to be negligible. We will elaborate on this – unexpected – outcome by discussing the underlying statistical choices. Here, we first look at the returns by category.

The weighted average net returns of assets *x* in size class *y* ($r_{x,y}$) – the cells in the first six rows of Table 3 – are defined as:

$$r_{x,y} = \frac{\sum_{i=1}^{P_y} \sqrt[42]{\prod_{t=1}^{42} r_{i,x,t}} \times TA_{i,x,t=25}}{\sum_{i=1}^{P_y} TA_{i,t=25}}$$

where the two summations are over de pension funds *i* from size class *y* (i=1,…,P_y, where P_y is the total number of pension funds in class *y*). The square term is the geometric mean returns of asset *x* of pension

fund *i* over the quarters of 2012-2022Q2, with $r_{i,x,t}$ the net return of asset *x* of pension fund *i* in time period *t*. The first TA term is total assets of asset *x* of pension fund *i* in *t*=2018Q1 and the second TA term is total assets of all pension funds in size class *y* in also *t*=2018Q1.

The average returns on equities, real estate, private equity and hedge funds of large pension funds (first column) are consistently higher than the average for all funds (last column). Large funds therefore achieve higher average returns due to better market analysis, risk management and their size (economies of scale, market power). Among the smallest funds, we observe the opposite pattern. Since all returns are net, the results *suggest* that the high performance fees for private equity in particular do indeed pay for themselves.

However, the average returns on fixed income, by far the largest asset class, tell a different story with respect to the returns and pension fund size relationship: at 0.33% per quarter, the returns of large funds are half those of the smaller and smallest funds, at 0.64% and 0.59% respectively. The main cause is that large funds have hedged the interest rate risk on investments to a lesser degree in many of the years in the period under review. The rise in interest rates in the first two months of 2022 in particular caused huge losses. This interest rate risk may also include interest rate risks on liabilities (future benefits). Furthermore, large funds have achieved very low average returns on hedge funds at 0.66%, while returns on commodities have been considerably in the negative.

Table 3. Average quarterly returns of pension funds by size class

Types of assets / Size class	**Largest**	**2**	**3**	**4**	**Smallest**	**Total**
2012-2022Q2						
Fixed-income	0.33	0.56	0.54	0.64	0.59	*0.43*
Equities	2.50	2.47	2.34	2.19	2.03	*2.44*
Real estate	2.12	1.77	1.79	1.14	0.75	*1.92*
Private equity	3.58	2.33	3.37	1.18	0.46	3.09
Hedge funds	0.66	-0.88	-0.38	1.45	0.16	0.07
Commodities	-0.97	-0.84	-0.84	-0.55	-0.70	*-0.90*
Total (reported)	**1.50**	**1.40**	**1.38**	**1.47**	**1.49**	**1.45**
Total (derived)	*1.69*	*1.54*	*1.41*	*1.46*	*1.45*	*1.60*
2007-2011						
Fixed-income	1.49	1.88	1.70	1.66	1.45	*1.66*
Equities	-0.46	-0.86	-0.56	-0.48	-0.58	*-0.48*
Real estate	-0.19	0.05	-0.46	-0.72	-0.39	*-0.72*
Total (reported)	**0.87**	**0.95**	**0.75**	**0.88**	**0.85**	***0.87***
Total (derived)	*0.72*	*1.08*	*1.06*	*1.15*	*1.01*	***0.87***
2007-2022Q2						
Fixed-income	0.71	0.98	0.92	0.97	0.87	*0.81*
Equities	1.54	1.39	1.40	1.29	1.10	*1.47*
Real estate	1.37	1.30	1.10	0.57	0.42	*1.25*
Total (reported)	**1.30**	**1.26**	**1.22**	**1.28**	**1.38**	***1.26***
Total (derived)	*1.37*	*1.39*	*1.32*	*1.41*	*1.40*	***1.37***

Source: Own calculations with DNB data;
Note: The residual category "Other investments" has been omitted.

During the period under review (2012-2022Q2), large pension funds lost the advantage they had gained from investing in high-yield securities and benefiting from economies of scale and better analytical departments due to choices such as less hedging and investments in hedge funds and commodities. On balance, rather than outperforming them, large pension funds performed about as well as smaller funds

During the financial crisis period (2007-2011), average total returns for the five size classes were roughly the same (see the middle panel in Table 3). Large pension funds invested more in equities and real estate during this period, but their returns were negative on average. This flat pattern across pension fund sizes is also observed for the entire period under review (2007-2022Q2), see the bottom panel.

Underlying these figures are statistical choices. The most significant choice is related to the quality of reporting for smaller pension funds, which was lower, especially in the past. The incidence of zero returns for individual asset classes is relatively high. Since these zeros largely indicate that no reports were available, for example, in the absence of any investment in the category in question, we do not include the zeros in the average returns. This has an upward effect on the returns of the smallest pension funds compared to the situation where the zeros are taken into account.

Some pension funds, particularly smaller ones, do not report data on returns on a quarterly basis and have a lower reporting frequency. To be included in the data, pension funds must report their data for at least half of the quarters in the period under review. This requirement has only a very limited effect on outcomes.

There is also the “other investments” category, which is small as an asset class (0.07%) but in terms of returns is a collection of costs and benefits that are often not attributable to individual asset classes. Pension funds sometimes use this category to reconcile the total returns with those of individual assets. Furthermore, “other investments” includes (1) short-term receivables and loans held for margin obligations or derivatives exposure, (2) inflation-linked swaps, which are a combination of inflation-linked bonds, (3) structured notes, (4) total return swaps and (5) hedging products not included in individual assets (such as in overlay portfolios).

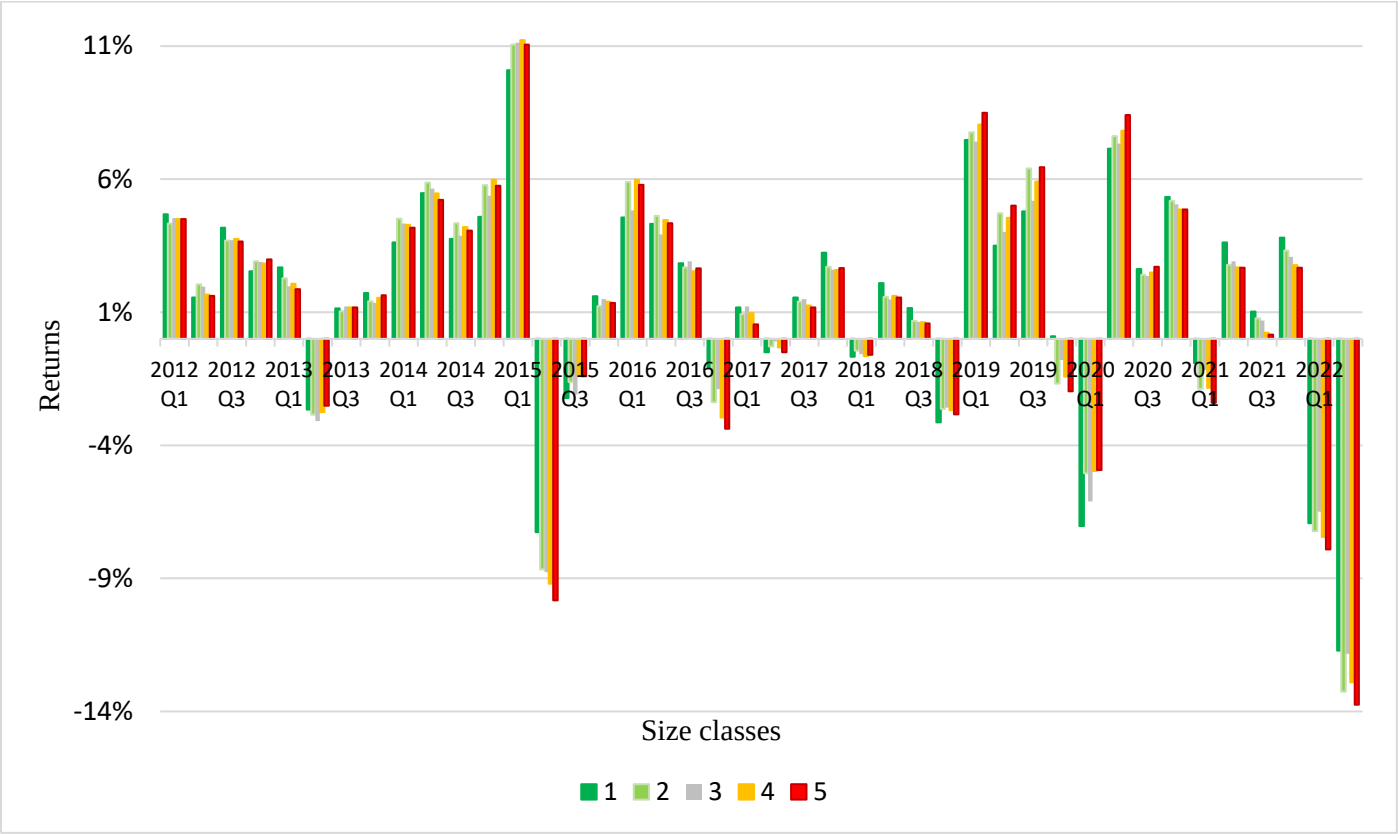
The eighth row in Table 3, “Total (derived)”, shows the weighted average of returns by size class, where the calculated return of pension fund x is weighted by its share of total assets in that size class. These outcomes differ from “Total (reported)” due to several reasons: (1) The derived totals and the cells per asset are based on long-term averages and then averaged based on the asset allocation in 2018Q1 to provide a general impression, while reported totals are based on the detailed data of the year under review and then averaged over the period 2012-2022Q2. It should be noted that the reporting of pension funds by period also does not exactly match their own “Total” because not all their internal data are completely consistent and some costs cannot be attributed to individual asset classes. This is why pension funds report adjusted data in addition to their original data to ensure accuracy. (2) The derived totals are affected by the filtering we applied, while the reported totals include all pension funds. Differences are mainly found among the smaller pension funds. The derived totals are therefore constructed in nature. They show that this total figure for the largest pension funds over 2012-2022Q2 results in a quarterly return of 1.69% on average for the largest pension funds, roughly decreasing to 1.45% for the smallest funds, thus suggesting more positive returns for the largest funds. For 2007-2011, this picture is exactly

reversed (more negative returns for the largest funds), while the average returns for the overall period 2007-2022Q2 are completely flat across size classes.

4.3. Differences in risk

The question remains whether larger pension funds, in addition to achieving higher returns on equities, real estate and private equity, also took higher risks during the 2012-2022Q2 period. Funds could achieve higher returns by taking more risk, without having a better investment strategy (if by “better” we mean higher risk-adjusted returns). Figure 1 illustrates the data by showing average quarterly returns for pension funds from the five size classes. The average returns reported in Tables 1 and 3 hide large fluctuations over time as is evident from Figure 1. The outliers reflect the realised risk the funds were exposed to through their investments.

Figure 1. Returns and risk over time by pension fund size classes (as a percentage; 2012-2022Q2)



Source: Own calculations with DNB data;
Note: Classification as in Table 2. Class 1 comprises the largest pension funds and Class 5 the smallest.

For the present analysis, it is particularly important to see that the fluctuations are roughly the same for the five size classes. The average quarter-on-quarter change in value is smaller for the largest pension funds at 4.01%, while it is larger for the smallest pension funds, at 4.22%. Zooming in on details, it appears that in percentage terms, the most negative quarterly returns of the smallest pension funds at -13.8% are slightly more negative than those of the largest funds, at -11.7%. The lower risk for the largest pension funds is surprising, given their investment in more risky assets. Their risk management seems to be adequate, although this applies to a lesser extent to their management of interest rate risk hedging.

4.4. Impact of allocation

Large pension funds benefit from their allocation strategy, which focuses more on higher-yielding assets, and from their economies of scale. In this subsection, we examine the impact of this strategy on returns. In Table 4, the first row shows the potential returns that pension funds can achieve by size class, based on the average returns from the “Total” column in Table 3 (the overall return average by asset type) and the average allocation over 2012-2022Q2 from the bottom panel of Table 2. Larger allocations to real estate, private equity, hedge funds and commodities, at the expense of fixed income, result in potential returns of 1.32% per quarter for the largest pension funds compared to 1.09% for the smallest. The potential return

based on the allocation of 2018Q1 (top panel of Table 2) is shown in brackets. The outcome is essentially the same.

Table 4. Potential returns by size class based on asset allocation, averaged over the relevant period (resp. in 2018Q1)

Size categories	Largest	2	3	4	Smallest
	2012-2022Q2				
Allocation-only	1.32 (1.31)	1.21 (1.19)	1.17 (1.18)	1.14 (1.16)	1.09 (1.14)
Incl. economies of scale	1.35 (1.34)	1.26 (1.25)	1.20 (1.20)	1.14 (1.15)	1.01 (1.04)
	2007-2011				
Allocation-only	0.41	0.55	0.56	0.67	0.81
Incl. economies of scale	0.50	0.68	0.14	0.75	0.72
	2007-2022Q2				
Allocation-only	0.98	0.99	0.98	0.98	0.95
Incl. economies of scale	1.00	1.08	1.02	0.96	xx

Source: Own calculations with DNB data;

The second row shows the potential returns that pension funds can achieve by class based on the average net returns by asset type from their *own* size class, the cells from the top panel of Table 3, and the average allocation over 2012-2022Q2. Here, larger funds benefit from their economies of scale in investment costs (and in the costs of market analysis and risk management in particular) and from their market power. Consequently, the potential returns of the largest pension funds increase from 1.32% per quarter to 1.35%, while those of the smallest decrease from 1.09% to 1.01%. Although these economies of scale seem modest, they are somewhat distorted by the low returns of the largest funds on fixed income, which include the less effective hedging of interest rate risk.

The conclusion therefore is that large pension funds could have achieved higher returns over 2012-2022Q2 based on their allocation strategy and economies of scale. During the crisis period, 2007-2011, this was strongly reversed, as returns in riskier assets were negative, as shown in the bottom rows of Table 4. Over the overall period 2007-2022Q2, the two opposite period effects cancel each other out: the losses on more risky assets during the financial crisis are recouped in the following decade, albeit only just.

5. Regression analysis of net returns

To better understand the factors that determine the net return of pension fund size classes, we use a regression model. In this model, the returns per pension fund and per quarter as a percentage are explained by several factors: (i) the size of the fund, expressed as the logarithm of the assets invested, (ii) the investment costs, divided into management costs, performance fees and transaction costs, as a percentage of assets, (iii) the riskiness of the investments, measured by the average standard deviation of the returns, (iv) the funding ratio, (v) the wealth of the members (assets divided by the number of members), (vi) the average age of the members, (vii) two dummy variables for company pension funds and occupational pension funds, respectively, and (viii) the distribution of assets across various asset

classes as a percentage of the total. The dummy for industry-wide pension funds and the percentage of fixed assets have been omitted to avoid multicollinearity.

Table 5 presents the estimated results for the central period of our study, 2012-2022Q2, as well as for the longest possible period, 2007-2022Q2. In addition to the usual unweighted results, we also show the estimated results weighted by pension fund size. In these weighted estimates, the largest pension funds carry the most weight, meaning every euro of invested assets is equally significant in the regression. We believe this is the most relevant estimation approach in economic terms. The t-values in the table are based on clustered standard errors, where each pension fund defines a cluster. The variation in net returns is mainly determined by market conditions, such as stock market index movements. However, our focus here is on pension funds' size and investment behaviour. The goodness of fit as measured by the adjusted R^2 is low for all regressions. Nevertheless, the overall F-test indicates the significance of the model specifications.

Table 5. Explanation of net returns of pension funds in percentages

	2012-2022Q2				***2007-2022Q2***			
	unweighted		*weighted*		*unweighted*		*weighted*	
		t-value		*t*-value		*t*-value		*t*-value
Log(total assets)	0.000	*-0.50*	0.004	*2.63*	0.001	*3.37*	0.002	*3.67*
Cost margin management	0.002	*0.98*	0.193	*0.31*	0.003	*1.49*	2.060	*1.77*
Cost margin perform. fees	-0.296	*-0.80*	-12.953	*-9.31*	-0.205	*-0.62*	-13.127	*-7.72*
Cost margin transactions	0.001	*0.07*	-1.815	*-0.95*	0.003	*0.29*	-2.875	*-1.25*
Standard deviations returns	0.132	*3.87*	-0.101	*-0.55*	0.212	*9.76*	0.080	*0.74*
Funding ratio	-0.004	*-1.95*	-0.037	*-2.23*	-0.001	*-1.78*	-0.026	*-3.85*
Log(assets/members)	0.002	*4.66*	0.010	*4.34*	0.002	*6.05*	0.008	*4.28*
Average age	0.000	*-4.21*	-0.001	*-2.59*	0.000	*-2.05*	0.000	*-1.72*
Company PF	-0.004	*-5.30*	-0.009	*-2.21*	-0.004	*-5.17*	-0.010	*-3.44*
Occupational PF	-0.006	*-3.63*	-0.013	*-2.39*	-0.004	*-2.97*	-0.010	*-3.44*
% Stocks	-0.015	*-3.75*	0.012	*0.34*	-0.026	*-9.76*	-0.018	*-0.85*
% Real estate	-0.046	*-4.06*	-0.081	*-1.64*	-0.052	*-6.50*	-0.090	*-2.15*
% Hedge funds	0.061	*4.35*	0.187	*1.39*	-0.044	*-2.75*	0.034	*0.47*
% Commodities	0.075	*3.72*	0.135	*1.85*	0.103	*6.18*	0.133	*5.13*
% Private equity	-0.095	*-3.81*	-0.100	*-1.19*	-0.083	*-3.45*	0.057	*1.12*
R^2, adjusted	0.011		0.213		0.015		0.163	
F-statistic (*P-value*)	8.16	*0.000*	176.41	*0.000*	18.12	*0.000*	224.35	*0.000*
Number of observations	9,511		9,511		16,773		16,773	

The pension fund size coefficient, expressed as (logarithm of) total assets, is statistically significant for the weighted regressions, indicating a clear presence of economies of scale in returns when adjusted for other regression variables. This aligns with the outcomes observed in previous subsections. However, for one of the two unweighted regressions, the economies of scale are not statistically significant. In our previous research we found economies of scale in the costs of market analysis and risk management (Bikker and Meringa, 2021). These economies of scale are reflected in net returns: larger pension funds have lower costs per euro invested, resulting in higher net returns. The greater bargaining power of large pension funds (Andonov, Bauer, and Cremers, 2012) may also contribute to economies of scale in returns.

The coefficients of management and transaction cost margins are insignificant in almost all regressions. However, this does not apply to the coefficients of performance fees in the weighted regressions, which are significantly negative at the 99.9% confidence level. This implies that performance fees do not seem to pay for themselves overall, as found by Broeders *et al.* (2019). This surprising result raises questions about the current use of external investment advice, which we will analyse in more detail in the subsection below. The degree of risk, measured by the standard deviations of returns, has a significant sign in only one of the regressions, which is positive as expected based on the theory that higher risk is associated with higher expected returns.

A higher funding ratio, i.e. a higher buffer, means pension funds can take on more risk with expected higher returns as a result. However, we do not see this reflected in the estimates. Wealthy pension funds, with higher assets per member, consistently have significantly higher returns. On behalf of their participants, they can take more risk, which is apparently reflected in the returns. As the average age of pension fund members increases, returns go down. This is consistent with the life-cycle theory that taking a lot of risk is beneficial for young people, but less so for older people. Apparently, pension funds' investment policies take this into account, as previously found in Bikker *et al*. (2012). Company and occupational pension funds consistently have significantly lower returns compared to industry-wide pension funds. In line with this, Bikker and De Dreu (2009) and Alserda *et al*. (2018) found that these two pension fund types had higher administrative and investment costs compared to (mandatory) industry-wide pension funds.

The allocation of asset classes does not present a plausible picture, i.e. higher average returns for the higher-yielding and riskier asset classes. The wildly fluctuating movements in returns over time, as shown in Figure 1, distort a potentially theoretically plausible picture. If the sample is split into quarters with stock price gains and quarters with stock price losses, the coefficients of the share rate are highly significant positive and negative, respectively. Omitting the investment distribution in the regression would not change the picture of the other model outcomes.

5.1. Impact of performance fees on returns by asset class

To examine the impact of performance fees more closely, particularly how this impact varies across asset classes, it is important to first take a closer look at the cost components.

Table 6 shows the investment costs, split into three constituent parts, for the individual asset types. They are relatively low for fixed assets, stocks and commodities, ranging from 0.19% to 0.25% of the assets involved, and also quite low for real estate (0.74%). These costs mainly consist of management and transaction costs. For private equity and hedge funds, on the other hand, investment costs are sky-high (3.36%-3.49%). Performance fees account for the lion's share of this, but managements costs are also high (1.37%-1.63%). Of total performance fees, private equity and hedge funds account for 76%, while these asset classes account for only 7% of investments. Table 1 shows that private equity's net returns are on average high enough to bear these costs; indeed, its net returns are higher than in any of the other

categories. However, this does not apply to hedge funds, where net returns over the relevant period have been close to zero.

Table 6. Average cost components across asset types (2012-2022Q2)

	Fixed income		**Stocks**		**Real estate**		**Private equity**		**Hedge funds**		**Commodities**		**Total**	
	Billion euro	*In % of assets*	*Billion euro*	*In % of assets*	*Billion euro*	*In % of assets*	*Billion euro*	*In % of assets*	*Billion euro*	*In % of assets*	*Billion euro*	*In % of assets*	*Billion euro*	*In % of assets*
Managem. c.	8.0	*0.10*	7.1	*0.16*	7.5	*0.56*	10.1	*1.37*	4.5	*1.63*	0.5	*0.15*	41.4	*0.28*
Perform. cost	0.6	*0.01*	1.5	*0.03*	1.5	*0.11*	14.8	*2.02*	4.1	*1.48*	0.0	*0.01*	25.1	*0.17*
Transact. cost	5.6	*0.07*	2.7	*0.06*	0.9	*0.07*	0.8	*0.10*	0.7	*0.26*	0.2	*0.07*	13.4	*0.09*
Simple sum	14.1	*0.18*	11.3	*0.25*	9.9	*0.74*	25.7	*3.49*	9.3	*3.36*	0.8	*0.24*	79.9	*0.55*
Total		*0.10*		*0.08*		*0.07*		*0.18*		*0.06*		*0.01*		*0.55*

Source: DNB, own calculations.

Performance fees vary widely, not only across asset classes, but also within those classes across pension funds. Table 6 shows average cost margins across all pension funds, but many of them pay no performance fees at all. For fixed income, pension funds pay on average 1/18th of investment costs in performance fees but most pay no fee at all. Among those funds that do pay performance fees, this cost margin amounts to as much as 1/3rd of total investment costs. For stocks, these fractions are 1/12th and 2/3rds, respectively. These significant differences in the choice of hiring external advice (and paying performance fees) between pension funds make it all the more interesting to zoom in on cost analysis by asset class.

Table 7. Explanation of net returns of pension funds in percentages by asset type (2012-2022Q2)

	Fixed income		**Stocks**		**Real estate**		**Private equity**		**Hedge funds**		**Total assets**	
		t-value		*t-value*		*t-value*		*t-value*		*t-value*		*t-value*
Unweighted												
Management cost	0,003	*0,20*	0,027	*1.88*	-0,210	*-1.59*	0,747	*1.24*	-0,197	*-0.41*	0,002	*1.16*
Performance cost	-2,119	*-2,34*	-5,364	*-4.29*	0,480	*1.30*	3,729	*3.21*	9,969	*4.79*	-0,524	*-1.40*
Transaction cost	-0,265	*-0,74*	-0,005	*-0.01*	0,393	*1.57*	2,017	*1.01*	0,856	*0.66*	0,006	*0.55*
Std. dev. returns	0,234	*4,63*	0,112	*3.18*	0,040	*0.60*	0,055	*0.25*	-0,452	*-1.63*	0,136	*4.58*
Avg age	0,000	*-1,99*	0,000	*-4.07*	0,000	*-0.55*	0,000	*-1.19*	-0,001	*-2.24*	0,000	*-4.88*
Funding ratio	-0,012	*-2,20*	0,006	*4.68*	0,006	*0.92*	0,066	*4.99*	0,007	*2.28*	-0,004	*-1.92*
Company PF	0,001	*0,51*	0,000	*-0.12*	-0,003	*-2.21*	0,000	*-0.05*	0,008	*0.85*	-0,005	*-6.28*
Occupational PF	0,001	*0,72*	0,000	*-0.42*	-0,003	*-1.17*	0,001	*0.12*	0,013	*1.55*	-0,005	*-4.48*
Ln (assets/members)	0,000	*-0,48*	0,002	*4.22*	0,002	*2.59*	0,000	*-0.25*	0,002	*0.45*	0,002	*5.04*
Ln (assets)	-0,001	*-2,77*	0,001	*4.51*	0,001	*2.88*	0,001	*1.66*	-0,001	*-0.41*	-0,001	*-6.16*
Constant	0,029	*3,67*	0,000	*-0.06*	-0,008	*-0.91*	-0,054	*-1.56*	0,071	*1.36*	0,034	*8.58*
R^2, adjusted	0.011		0.005		0.003		0.012		0.017		0.006	
F-stat. (*P-value*)	9.35	*0.000*	3.92	*0.000*	2.72	*0.002*	4.72	*0.000*	3.47	*0.000*	6.93	*0.000*
Number of observat.	8,100		8,076		6,063		2,917		1,358		9,511	
Weighted by total assets												
Management cost	2,745	*1,70*	0,581	*0.51*	-1,058	*-1.73*	-2.704	*-1.01*	-5,741	*-2.28*	1,166	*1.55*
Performance cost	-15,284	*-5,69*	-16,718	*-4.91*	-5,415	*-1.90*	6.601	*2.51*	14,721	*4.91*	-13,710	*-6.18*
Transaction cost	-8,013	*-2,41*	-5,017	*-2.48*	0,778	*0.59*	-0.239	*-0.53*	2,546	*0.51*	-5,570	*-2.39*
Std. dev. returns	0,420	*1,64*	0,024	*0.10*	-0,358	*-1.89*	-0.001	*-1.83*	-0,805	*-1.37*	0,152	*0.81*
Avg age	0,000	*0,28*	-0,001	*-1.61*	0,000	*-1.92*	-0.018	*-2.27*	-0,003	*-3.11*	0,000	*-0.93*
Funding ratio	-0,122	*-6,28*	0,024	*1.10*	0,069	*3.05*	-0.014	*-0.41*	0,086	*2.04*	-0,039	*-2.17*
Company PF	0,000	*0,12*	-0,021	*-3.01*	-0,012	*-2.26*	0.100	*4.42*	0,011	*0.57*	-0,011	*-2.42*
Occupational PF	0,002	*0,35*	-0,020	*-2.05*	-0,012	*-1.36*	0.007	*1.86*	0,001	*0.37*	-0,011	*-1.94*
Ln (assets/members)	0,011	*3,72*	0,013	*3.55*	0,003	*1.44*	0.452	*0.45*	0,006	*1.16*	0,011	*4.08*
Ln (assets)	0,003	*2,20*	0,006	*3.88*	0,004	*2.55*	0.005	*3.34*	0,025	*0.61*	0,004	*3.75*

Constant	0,029	*0,90*	-0,107	*-2.00*	-0,079	*-1.84*	-0.138	*-2.06*	-5,741	*0.37*	-0,034	*-0.96*
R^2, adjusted	0.210		0.159		0.190		0.309		0.142		0.202	
F-stat. (*P-value*)	216.6	*0.000*	162.0	*0.000*	151.7	*0.000*	137.2	*0.000*	23.8	*0.000*	251.8	*0.000*
Number of observat.	8,100		8,076		6,063		2,917		1,358		9,511	

We now apply the regression analysis of Table 5 in a modified way to the individual asset categories, both unweighted and weighted, as shown in Table 7. As expected, the impact of performance fees appears to vary widely. For private equity and hedge funds, these fees have both an economically and statistically significant positive coefficient (both for the weighted and unweighted regressions), meaning these costs pay for themselves by a considerable margin. Surprisingly, for fixed income, stocks and real estate, we see the opposite picture in the weighted estimates: performance fees have a significant negative impact on net returns (and for stocks also in the unweighted regressions). Here, the advice underlying performance fees has cost money rather than earned money. When considering the total portfolio, we see a significant negative effect in the weighted estimates. This is quite striking, because expressed in billions of euros, private equity and hedge fund performance fees account for three quarters of total performance fees. On the other hand, these two asset classes account for only 7% of total investments.

The coefficients of management costs are significant only in a few instances, with varying signs. Overall, management costs are not significant. It is conceivable that some of these costs are not 'waste' but have a positive impact, for example those related to market analysis. That would explain a roughly zero effect. Where transaction costs are significant, the sign is negative, implying that these costs are mainly waste. Apparently, the changes in investments do not pay off. Focusing on the weighted regressions we find that (1) funds with older members on average have investments which are less risky and have lower returns, (2) company and occupational funds have lower returns, (3) wealthy funds which can take more risk have higher returns, and (4) larger funds have higher returns (scale economies), all as observed also in Table 5.

6. Hypothetical simulations of large-scale consolidation

Bikker and Meringa (2022) calculated the potential investment cost savings for smaller pension funds if they grew to the size of the sixth-largest fund or were taken over by such a large fund. We now conduct such a hypothetical simulation of large-scale consolidation for investment returns, in three steps.

In the first step, we apply the allocation strategy of the five largest funds to all smaller pension funds. This results in an increase of the national investment returns of pension funds by 5.9% on average. With assets totalling €1.512 billion (2022Q2) and an average return of 1.45% per quarter, this translates to an additional return of €1.3 billion per quarter or €5.2 billion annually (see Table 8).

In the second step, we align the investment returns of all smaller pension funds with those of the five largest funds, except for fixed-income returns. This adjustment reflects the economies of scale of the smaller pension funds being superimposed on those of the five largest, without replicating the less effective interest rate risk hedging decisions of the largest funds. The returns then increase by 5.2% (cumulative 11.1%), resulting in over €1.1 billion per quarter or €4.6 billion annually. Cumulatively, these amounts are €2.4 and €9.8 billion annually.

In the third step, we apply the interest rate risk hedging decisions of Class 2 pension funds to the five largest funds, reflecting the 'best of all worlds'. This increases national investment returns by an average total of 15.5%, amounting to €3.4 billion per quarter or €13.9 billion annually. Compared to the hypothetical consolidation simulations with respect to economies of scale of investment costs alone from Bikker and Meringa (2022), these amounts are substantial.

Table 8. Annual effects of hypothetical simulation of consolidation based on 2022Q2

			Step 1	**Step 2**	**Step 3**
	As at end 2022Q2		*Allocation of*	*Returns of*	*Interest rate risk*
	Assets	Returns	*largest pension funds*	*largest pension funds excluding FI*	*hedging according to class 2 funds*
Additional net returns in %			5.9	5.2	4.4
Cumulative				11.1	15.5
In EUR billion per year	1,511	87.6	5.2	4.6	3.9
Cumulative				9.8	13.7

7. Conclusions

It is logical to expect that large pension funds invest more effectively than smaller ones due to their ability to benefit from economies of scale and their higher level of professionalism in investments. Also, their larger size allows them to invest more in relatively riskier and potentially higher-yielding asset classes. Much suggests that size and allocation strategy have worked in favour of the large pension funds. However, when examining the net returns of large pension funds over both 2007-2011 and 2012-2022Q2, they do not outperform the smaller pension funds. The primary cause is that the large pension funds hedged the interest rate risk of their investments to a lesser degree, which led to significant losses. Consequently, the returns of the largest pension funds on the largest asset class of fixed income over 2012-2022Q2 were roughly half those of the smaller funds. Investments in hedge funds have also yielded minimal returns. During the financial crisis years of 2007-2011, riskier investments resulted in negative returns, further disadvantaging the largest pension funds.

Large pension funds rely heavily on external investment advice and spend substantial amounts on performance fees. The results of this study indicate that such costs more than proportionally pay for themselves with respect to private equity and hedge funds, making them part of a sound investment policy. However, this does not apply to external investment advice for fixed income and stocks.

There has been significant consolidation in the pension sector in recent years. The estimates of the effect of scale on returns from this study basically indicate that continuing this trend could benefit net returns on pension investments. In principle, their superior allocation strategy and higher return per investment (in our study, this applies to equities, real estate and private equity) contribute favourably. Simulations underline that this involves substantial amounts. However, there are some caveats. The interest rate risk hedging decisions of the large pension funds have had an adverse effect, making it difficult to recommend consolidation outright. In addition, consolidation involves more than financial

arguments alone. The linking of some of the pension funds to industries and their collective agreements, and their varying funding ratios, create obstacles to consolidation.

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