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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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Does it pay to pay performance fees? Empirical evidence from Dutch pension funds*

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Abstract

We analyze the relation between investment returns and performance fees for 218 Dutch occupational pension funds with an average total of 985 billion euro in assets under management from 2012 to 2015. Our dataset is free from self-reporting biases and includes total return, excess return and performance fees for six major asset classes. We find no statistical evidence that the returns of pension funds that pay performance fees to asset managers for active investing are significantly higher or lower than the returns of pension funds that do not pay performance fees. This is true for most asset classes and robust if we correct for risk and persistence in asset class returns. We also document that large and more specialized pension funds pay less performance fees for a given level of excess return in alternative asset classes such as hedge funds and private equity. This is possibly the result of better negotiation power due to their larger scale or higher level of expertise.

Keywords: pension funds, asset management, performance fees, investment costs.
JEL classifications: G11, G12, G23.

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1. Introduction

Performance-based investment fees are increasingly important for the pension fund industry. Pension funds typically pay performance fees for active investment strategies and alternative asset classes such as investments in hedge funds and private equity. Many pension funds increased their allocation to these alternative asset classes in recent years (Malkiel, 2013). A Towers Watson Global Pension Asset Study reveals that the 16 largest pension markets in the world increased the allocation to alternative asset classes from about 5% in 1995 to 20% in 2015 (Towers Watson, 2015). The reasons for this increased allocation to alternative asset classes are higher return expectations, better portfolio diversification and in some cases a better match with the pension fund's liabilities.

The increased allocation to alternative asset classes has led to an increase in performance fees expenses. The annual performance fees paid by Dutch pension funds, for example, increased by 36 percent from EUR 1.1 billion to EUR 1.5 billion between 2012 and 2015. As a percentage of total investment costs, performance fees rose from 24.8 to 26.8 percent in the same period. The present value of these fees over the long term represent the transfer of a significant fraction of the pension fund's capital from beneficiaries to asset managers. This is underlined by Sharpe (2013) who documents that small differences in investment costs compound to dramatic effects on terminal wealth. Paying performance fees, however, could well be economically rational if they enable pension funds to enhance their overall net performance by recovering these costs with superior returns or higher diversification benefits.[2]

From a theoretical perspective, performance fees can be a valuable mechanism to minimize the principal-agent conflict between pension funds and asset managers. Fees align the asset managers' incentives with the pension fund's goal by directly linking the managers' rewards to performance (Starks, 1987).[3] This should increase the effort from asset managers and thus translate into higher investment returns for the pension fund (Ackermann, McEnally and

[2] This would require some form of manager/fund selection skills from pension funds as Sharpe (1991) and French (2008) show that active management is a zero sum game before cost indicating that the aggregate alpha is zero and only a few funds are able to produce alpha. After costs, French shows that active management is a negative sum game.
[3] Starks (1987) shows that problems arise in the relationship between investors and asset managers due to the presence of moral hazard and the absence of costless and full information.

Ravenscraft, 1999; Das and Sundaram, 2002). However, performance fees also come with several drawbacks. For one, asset managers tend to receive the same fee whether performance comes from skill or luck. Moreover, they tend to create a skewed (call-option like) incentive structure as the asset manager typically only profits from positive excess returns, but does not suffer from losses. This may incentivize asset managers to take excessive risks in an attempt to generate high returns (see Goetzmann, Ingersoll and Ross, 2003; Kahn, Scanlan and Siegel, 2006). To counter some of these disadvantages, most investment mandates with performance fees include provisions such as high watermarks or '*clawbacks*' (French, 2008).

A better understanding of the relation between performance-based fees and investment returns is important for pension funds, as this will help improve their capital allocation and contracting process. Little empirical evidence, however, is available on how performance fees paid by pension funds relate to investment performance. There is a vast literature on whether pension funds are able to outperform their benchmarks (e.g., Lakonishok, Shleifer, Vishny, 1992; Coggin, Fabozzi and Rahman, 1993; Blake, Lehmann and Timmermann, 1999; Andonov, Bauer and Cremers, 2011). And there are also papers on the investment cost structure of pension funds (e.g., Bikker and De Dreu, 2009; Bauer, Cremers and Frehen, 2010, Broeders, van Oord and Rijsbergen, 2016). However, to the best of our knowledge there are no papers that examine the relation between performance fees and the net investment performance of pension funds. This can primarily be attributed to the absence of sufficiently reliable and detailed data.

This paper therefore introduces empirical evidence to the literature on the relation between the investment performance of pension funds and the performance-based fees they pay. We examine three main questions. *First*, we investigate if paying performance fees contributes to higher net total returns or net excess returns. This shows whether it pays for pension funds to pay performance fees at all. *Second*, we examine for what type of gross return, excess or total return, pension funds primarily pay performance fees. This provides us with more insight into the mandates pension funds typically close with their asset managers. *Third*, we test whether large pension funds and pension funds with more specialization in their investment portfolio pay less performance fees per basis point of (gross) excess return. This enables us to examine whether large or more specialized pension funds are able to negotiate more profitable contracts with asset managers.

To answer these research questions, we have unique panel data containing fund-specific investment returns, benchmarks and costs for 218 Dutch pension funds between 2012 and 2015. The Dutch system provides an interesting case study as it is well-developed and relatively large in terms of size, while Dutch pension funds allocate their money to a wide variety of asset classes given the lack of quantitative investment restrictions. Dutch pension funds do have to follow the so-called prudent person rule, which demands that pension funds invest in the interest of their beneficiaries, taking into account sufficient liquidity, diversification and quality of the investment portfolio. The dataset is free from self-reporting biases and highly detailed, making our paper the first to thoroughly distinguish between the returns and costs for different asset classes. We have information at the total portfolio level, as well as for six asset classes that pension funds invest in – namely fixed income, equities, real estate, private equity, hedge funds and commodities. We can further decompose these classes into thirteen sub-asset classes. In addition, we subject our findings to a range of robustness checks – including bootstrapped standard errors.

We document the following key findings. *First*, we find that the returns of pension funds that pay performance fees to asset managers are not significantly higher or lower than the returns of pension funds that do not pay performance fees.. There is, however, one minor exception. Pension funds that pay performance fees for hedge funds report 3.0 basis points higher net excess returns on average, but the effect disappears when we correct for risk. *Second*, we observe that performance fees primarily relate to gross excess returns for equities and hedge funds. Pension funds respectively pay 2.1 and 30.5 basis points in performance fees for every 100 basis points of gross excess return. For private equity, performance fees primarily correspond to gross total return. Investment mandates for private equity thus appear more focused on absolute returns than on outperforming some benchmark. *Third*, we find that large and more specialized pension funds are able to realize more profitable mandates with their asset managers, possibly as a result of better negotiation power due to their large scale or higher level of expertise. Also large pension funds might me more interesting for asset managers to have as clients, e.g. because of reputational reasons. For larger pension funds, this is the case for hedge funds. A tenfold increase in hedge fund investments, for instance, correlates with 5.5 basis points less performance fees per 100 basis points in gross excess return. For specialization, we find a significant effect for private equity and hedge funds.

Pension funds that increase their allocation to private equity by 1 percentage point pay 0.37 basis points less fees per 100 basis points gross excess return. For hedge funds, this reduction is 0.36 basis points. Although our dataset is highly detailed, it is important to note that a simulation study we perform shows that we probably underestimate the economic coefficients of our findings as our dataset contains information on performance fees and returns at the aggregate asset class level, but not at the individual mandate level.

This paper relates to three streams of literature. The first stream concentrates on pension fund performance and typically concentrates on the question whether pension funds are able to outperform their benchmark or the general market by selecting outperforming asset managers and investments. The academic evidence for that is mixed. Several studies find that pension funds, on average, are unable to outperform external benchmarks (e.g., Beebower and Bergstrom 1977; Brinson, Hood and Beebower 1986; Ippolito and Turner, 1987; Lakonishok *et al*., 1992; Coggin *et al*., 1993).[4] Lakonishok *et al*. (1992), for example, analyze the investment performance of U.S. pension funds and find that their equity investments underperform the S&P 500 index by 260 basis points on an annual basis. Blake *et al.* (1999) and Blake, Rossi, Timmermann, Tonks and Wermers (2013) study the asset allocations of U.K. pension funds and also find little evidence for market timing skills. Huang and Mahieu (2012) use an alternative risk adjusted performance measure, the so-called *z-score*, and find that Dutch pension funds are unable to consistently outperform their self-selected benchmarks. Gerritsen (2016) examines the equity investments of Dutch pension funds and also concludes that they are unable to outperform either their benchmarks or the general market index.

There are, on the other hand, also studies that find evidence of outperformance by pension funds. Using the CEM pension fund dataset, Bauer *et al.* (2010) study domestic equity investments of U.S. pension funds and document a positive and statistically significant net performance on a risk-adjusted basis. Andonov *et al.* (2011) examine different components of active management – asset allocation, market timing and security selection – for U.S. pension funds. They provide evidence that pension funds are able to beat the market as well as their

[4] Also note that there are several studies that investigate persistence in the performance of pension funds. There is, however, little consensus regarding persistence in pension fund performance (Blake *et al*. 2013).

benchmark, and find that all three components contribute to this outperformance.[5] Although some of these papers relate performance to investment costs (e.g. Ippolito and Turner, 1987; Bauer *et al.*, 2010; Andonov *et al.*, 2011), they are not able to directly investigate the relation between performance and performance-based fees.

The second stream of papers study the impact of investment fees on performance from the asset manager's perspective. These papers typically focus on (equity) mutual funds, private equity and hedge funds. For mutual funds, most studies document a robust negative relation between fees and net performance (Carhart, 1997; Fama and French, 2010), although Elton, Gruber and Blake (2003) observe that funds with symmetric fee structures report positive alphas. For hedge funds and private equity, the empirical evidence is mixed, although there appears to be a slight tendency towards studies that document a positive relation between performance fees and investment performance. Several studies (e.g. Ackermann *et al.*, 1999; Agarwal, Daniel, Naik, 2009; Ibbotson, Chen and Zhu, 2011) report that hedge funds with higher performance fees typically earn higher investment returns. Brown, Goetzmann and Ibbotson (1999), on the other hand, document that high fee funds perform no better than those with lower fees. Jennigs and Payne (2016) investigate the diversification benefits of (fund of) hedge funds after fees and find that the higher fees of these strategies overwhelm the diversification benefit.[6] In the private equity sector, Gompers and Lerner (1999) find no relation between performance fees and investment returns. Robinson and Sensoy (2011), however, study buyout and venture capital private equity funds and find that fund managers (i.e. general partners) with higher compensation earn their fees by generating higher gross performance.

The third stream of academic literature that our paper relates to concentrates on pension fund investment costs and the increased drive for more transparency on cost structures. Several papers examine pension fund investment costs and document strong evidence for economies of scale at the pension fund level (e.g. Bauer *et al.*, 2010; Bikker and De Dreu, 2009) as well as for

[5] The lack of consensus regarding the ability of pension funds to provide outperformance is in line with the large body of literature regarding mutual fund performance. Most studies conclude that mutual funds underperform their benchmark (e.g. Jensen, 1968, Malkiel, 1995, Carhart, 1997, Fama and French, 2010), whereas some studies find that subgroups of fund managers are able to produce outperformance net-of-costs (e.g. Kosowski, Timmermann, Wermers and White, 2006).

[6] This is the case for diversified and event-driven hedge fund strategies, but not so for macro strategies. The authors conclude that it is more cost-effective to directly invest in hedge funds (instead of through a funds of funds strategy) above USD 200 million.

several asset classes that pension funds invest in (Broeders *et al.*, 2016). The observed economies of scale are in line with academic evidence for the mutual fund sector (Malkiel, 2013; Indro, Jiang, Hu and Lee, 1999). Moreover, the economies of scale in the pension fund industry appear primarily driven by management costs, and not by performance-based fees (Broeders *et al.*, 2016). For equities, private equity and hedge funds, Broeders *et al.* (2016) find that larger Dutch pension funds pay higher performance fees than their smaller counterparts. In addition, there are many papers promoting full transparency of institutional investors regarding their investment costs (Keim and Madhavan, 1998; Barber, Odean and Zheng, 2005).

The remainder of this paper is as follows. Section 2 describes the data and variables used in our analysis. Section 3 presents the methodology. Section 4 shows the empirical results of whether performance fees contribute to higher net returns, whereas Section 5 presents a robustness check where we control for return persistence. The conclusions are set out in the final section.

2. Data

We use an unbiased panel dataset with annual investment-related data of 218 Dutch pension funds between 2012 and 2015. The dataset contains pension fund-specific (net and gross) investment returns, (self-reported) benchmark returns and investment costs. The investment costs can be decomposed in performance fees and management costs. The investment-related data are available at the pension fund level, as well as for the following six broad asset classes: fixed income, equity, real estate, private equity, hedge funds and commodities. We also have data on the actual allocation to these asset classes and are able to further decompose these asset classes into thirteen sub-classes with regard to fixed income (i.e. government bonds, inflation linked bonds, mortgages, corporate bonds and cash), equities (i.e. mature markets and emerging markets) and real estate (i.e. direct real estate, listed real estate and indirect real estate). For fixed income securities, we can also differentiate between credit rating classes. In addition, we use other pension fund-specific variables in the analysis, including pension fund size (assets under management), asset class size and the level of specialization in the investment portfolio (see Broeders *et al.*, 2016).

Our dataset contains a variety of pension fund sizes and types. The assets under management of the funds in the dataset rises from approximately 853 billion euro in 2012 to 1,116 billion euro in 2015. On average, this amounts to 97,5 percent of the total assets under management for all Dutch pension funds during the four years in our sample period. The data are collected by De Nederlandsche Bank (DNB), the prudential supervisor of Dutch pension funds. The dataset does not suffer from self-reporting biases as all pension funds in the Netherlands are obliged to submit their investment returns, costs and asset allocation to DNB. We consider the data quality to be relatively high as they are validated by the pension fund's external auditor.

2.1 Definition of variables

The key dependent variables in our analysis are investment returns and performance fees. We measure returns and fees at the pension fund level as well as for each asset class separately. In addition, we investigate the impact of certain pension fund-specific characteristics.

Investment returns

Pension funds report their annual investment returns in percentage points on a yearly basis. So we define the annual investment return as $R_{j,k,t}$ for pension fund j, where t denotes the year in the sample (2012-2015) and k represents the asset classes, which include fixed income, equity, real estate, private equity, hedge funds and commodities. Mark that this annual return $R_{j,k,t}$ is the return per asset class k and may be the result of several returns on different mandates and investment funds of pension fund j in asset class k. The dataset does not allow to disentangle different mandates. If k is suppressed it refers to the pension fund's total portfolio.

Our dataset also contains annual benchmark returns at the portfolio level and for the separate asset classes. Both are measured in a similar manner. The reported benchmarks are selected and reported by the pension funds themselves and allow us to differentiate between total returns and excess returns. The latter is constructed by subtracting the benchmark return from the reported (net) investment return. This enables us to examine whether pension funds are able to beat their self-selected benchmarks.

Investment costs

Investment costs include all costs incurred in the investment management process, from strategy, implementation to monitoring the portfolio.[7] In our analysis, we differentiate between two key components, namely management costs and performance fees (see, e.g., Drago, Lazzari and Navone, 2010). We define management costs as the cost of having assets professionally managed which includes the fees paid for security selection, execution and disclosure. Examples of management costs include the costs of trading facilities, financial research and risk management (see also Bikker and De Dreu, 2009). Management costs structures are typically a percentage of assets under management. Performance fees, on the other hand, are contingent on a specific performance objective. Finally, we are not able to separately investigate explicit trading costs (i.e. direct costs of trading such as broker commissions) and implicit trading costs (i.e. indirect costs such as the price impact of trades), as pension funds are not obliged to report these trading costs.[8] Trading costs are however included in our return definition, as trading costs are already deducted in the gross returns that pension funds report. We also note that pension funds can manage their investments in different ways. They can choose to manage their investments on an internal or external basis. We do not further elaborate on this differences as our dataset is not able to distinguish between this internal and external.

Performance fees

Performance fees come in many forms and are common in different asset classes, such as private equity, hedge funds and specialized equity funds. In practice, they are often combined with fixed management fees. Hedge funds typically employ a fee structure that consists of a (1.5 percent) fixed management fee and a (20 percent) performance fee (Ibbotson *et al.*, 2011),

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[7] We exclude general administrative costs such as personnel costs, rent and depreciation. We observe general administrative costs for all Dutch pension funds of 10 to 13 basis points (of total investments) per year during our sample period from 2012 until 2015.

[8] Some pension funds voluntarily also report transaction costs separately. Whilst transaction costs are also important, we exclude them from our analysis because the number of pension funds reporting these costs in our sample is too few. For the importance of transaction or trading costs in an institutional context, see Keimand Madhavan (1998) and Bikker, Spierdijk and Van der Sluis (2007). Bikker *et al.* (2007) examine the market impact and execution costs for one pension fund and find that they are substantial in terms of costs for the pension fund.

while private equity funds generally employ a constant percentage of committed capital in combination with performance-based fees through carried interest (Metrick and Yasuda, 2010). The performance fee can be charged on any positive return, on returns above some relative benchmark or on returns above some fixed hurdle rate.[9] Underlying all, however, is the fact that the payment of the fee is contingent upon the performance of the asset manager. Although we have no exact data on the way performance fees are derived by the pension funds in our sample, we measure performance fees PF for pension fund j in basis points as the fee in year t over the average assets under management in that year in the following manner:

$$PF_{j,k,t} = \frac{Performance\ Fees\ Paid_{j,k,t}}{\frac{1}{4}\sum_{i=1}^{4} Investments_{j,k,t,i}}$$

The fees are reported on an annual basis, whereas the assets under management are reported for every quarter i.

Pension fund-specific characteristics

Several academic papers document that size matters for pension fund performance. Huang and Mahieu (2012) find that large pension funds outperform smaller ones. Gerritsen (2016) concludes that large pension funds realize higher equity returns than their smaller counterparts. The current literature presents several explanations, such as more negotiation power, better monitoring of asset managers, more expertise in selecting superior asset managers and economies of scale in investment costs (see e.g. Andonov *et al*., 2011; Dyck and Pomorski, 2011; Broeders *et al*., 2016).

In addition, Andonov *et al*. (2011) argue that the relation between size and performance depends on the asset class. Large pension funds realize economies of scale in alternative asset classes due to better negotiation power and more available resources for monitoring these investments. At the same time, large pension funds suffer from liquidity constraints in public equity and fixed income markets leading to diseconomies of scale. Dyck and Pomorski (2011) also find strong evidence for economies of scale in alternative asset classes, both in gross returns and costs. Most notably in real estate and private equity, where large funds have access

[9] Metrick and Yasuda (2010) find that hurdle rates in the private equity domain are more prevalent among buyout funds than venture capital funds.

to more co-investment opportunities and are better able to identify the best performing managers. It is therefore interesting to examine whether size influences the relation between investment returns and performance fees. We measure the size of pension funds by either using the logarithmic value of total assets under management or by the log of the assets under management in a specific asset class.

We also study whether more specialized pension funds – i.e. funds that invest relatively more in a specific asset class – pay relatively less performance fees for a given level of return. Specialization is measured by dividing the asset under management invested in a particular asset class by total assets under management (i.e. relative allocation towards the specific asset class as a percentage of the total portfolio).

2.2 Descriptive statistics

Table I shows the descriptive statistics. Panel A discloses the net total returns (after fees and costs). The average annual total net portfolio return over the four years in the sample equals 9.72 percent. This is the equally weighted return across all pension funds for the full sample period. There is quite some dispersion in the sample. The 10th percentile shows a net return of -1.05 percent and the net return in the 90th percentile is 23.12 percent. This indicates that 10 percent of the pension funds in our sample earned a net return in excess of 23.12 percent. The wide dispersion occurs across all asset classes. For instance, the full sample difference between the best and lowest performance in fixed income is 37.32 percentage points (ranging from +31.15 to -6.17 percent). Equities is the best performing asset class over the four year window and shows the lowest dispersion across pension funds.

Panel B presents the net excess returns. These net excess returns are reported in annual basis points and derived by subtracting the (self-reported) benchmark returns from the realized net returns. The annual total net excess return across all pension funds over the full sample period equals 11.3 basis points. Yet, the data reveal a significant amount of variation. The 10 percent best performing pension funds report 166.5 or more basis points excess return. For the lowest performing pension funds the excess returns is -141.6 basis points. Private equity has the highest mean excess return with 139.4 basis points over the sample, but the variation is extremely high. The 10 percent best performing pension funds report a mean net excess return of 1,163 basis points for private equity, whereas the 10 percent least performing pension funds display an average underperformance of 766 basis points. Note that the benchmark returns are self-reported and may therefore not necessarily equal standard, broad accepted benchmarks such as the MSCI World index for equities. An advantage of the self-selected benchmark is that they are tailored to the specific investment beliefs and restrictions of the pension funds. E.g., if a pension fund excludes a specific industry it may correct a general benchmark for this. The dataset, however, contains no details on the exact composition of benchmarks reported by the individual pension funds.

Table II presents the details on performance fees, which are expressed in annual basis points. For the full sample, we find an annual equally weighted mean performance fee of only 3 basis points. The lower boundary is 0 basis points, while the top 10 percent pension funds with the highest performance fees pay 10.1 basis points per year on average. The highest average performance fees are being paid for investing in private equity and hedge funds, with 69.0 and 87.6 basis points respectively. The variation in performance fees over time is sometimes significant. The average performance fee for private equity rose from 22.1 basis points in 2012 to 91.7 basis points in 2015, whereas the performance fees for hedge funds are actually declining over time.

The distribution between pension funds that pay performance fees and those that do not during the four years in our sample period is relatively even for most asset classes. For fixed income and equities, our dataset consists of 613 observations between 2012 and 2015 where we document 128 and 202 cases of pension funds paying fees for these asset classes. For real estate this is 155 (out of 517 observations) and for commodities 34 (out of 191 observations). Finally, the ratio is somewhat higher for private equity (137 out of 207 observations) and hedge funds (113 out of 140 observations) where performance fees are more common practice.

3. Methodology

In this section we turn to the methodology for examining the three research questions on the relation between investment performance of pension funds and the performance fees they pay. First, we examine the relation between performance fees and net returns. Second, we analyze the drivers of performance fees. Third, we focus on the impact of pension fund specific characteristics on the amount of fees paid.

3.1 Performance fees and net returns

We use a cross-sectional regression model to examine our first research question whether pension funds that pay performance fees are able to earn higher net total or excess returns. We run the following model to explain the net investment returns R for pension fund j in year t:

$$R_{j,k,t} = \beta_1 Paying\ Fees_{j,k,t-1} + \beta_2 log(\ Size_{j,k,t}) + \beta_3 Spec_{j,k,t} + \sum_{t^*=2013}^{2015} I(t = t^*)\big(\beta_{4,t^*}\mathrm{DUR}_{FI,j,k,t} + \beta_{5,t^*}\mathrm{DUR}_{O,j,k,t} + X_{j,k,t}\beta_{6,k,t^*} + \ Y_{j,k,t}\beta_{7,k,t^*}\big) + \varepsilon_{j,k,t} \quad (1)$$

where R represents either the net total return or the net excess return. Index k indicates either one of the six different asset classes, namely fixed income, equity, real estate, private equity, hedge funds or commodities. Index k is suppressed if it refers to the pension fund's total portfolio. *Paying Fees* is a dummy variable that equals one if a pension fund pays performance fees in a given year and zero otherwise.[10] To avoid endogeneity – as performance fees paid in year t are dependent on the investment return in that same year t – we lag this variable by one year ($t - 1$). As pension funds typically not change their policy on whether they pay performance fees or not on a yearly basis, the lagged variable still allows us to examine whether paying performance fees contributes to a higher net return. We also include *Size* which is either defined as the pension funds' average total assets under management in a given year (for total portfolio) or as the amount that pension fund *j* invests in a specific asset class. *Spec* represents the level of specialization by dividing the assets under management in a particular asset class by total assets under management. Note that specialization by definition is not a meaningful measure at the total portfolio level.

In addition, we include several variables in regression (1) to control for the impact of differences in asset allocation between pension funds (see Broeders *et al*., 2016). For that, we include $I(t = t^*)$ as an indicator function that equals 1 if $t = t^*$ (i.e. years 2013, 2014 and 2015)

[10] Note that for most asset classes the amount of pension funds that pay performance fees is more or less similar to the amount that do not (see section 2.2).

and 0 when this is not the case, such that β_{6,t^*} represents the average returns on the sub asset classes in year t^*. If no sub asset classes exist for asset class k then the dummies represent the average return on asset class k in year t^*. Within the indicator function, DUR_{FI} is the duration contribution of the fixed income portfolio, while DUR_O represents the duration contribution of fixed income derivatives. We define the duration contribution of fixed income as the part of a pension funds' total duration ascribable to its bond portfolio. In addition, we define the duration contribution of overlay as the incremental duration due to the interest rate overlay exposure of interest rate derivatives (Broeders *et al.*, 2016). Both variables are measured in years and their coefficients (β_{5,t^*} and β_{6,t^*}) reflect the average interest rate changes in the years 2013, 2014 and 2015. X is a vector of control variables that represent the pension fund's asset allocation (weights add up to one), where the coefficients for β_{7,t^*} reflect the average return on the different sub-asset classes. Y is a vector that reports the allocation within the fixed income portfolio to different credit rating classes. Note that the vector Y and the duration variables are only included in the regressions for the total portfolio and fixed income. Finally, the error term is indicated by ε.[11] All standard errors are White standard errors corrected for heteroskedasticity. The coefficients and t-statistics for all control variables are reported in Table A (appendix).

3.2 Performance fee drivers

To test whether performance fees are primarily driven by gross excess or total returns we use a Tobit regression model. We solely observe positive performance fees in our dataset and a Tobit model takes account of the non-negative constraint of our key variable.[12] We define the

[11] We have also run regression (1) with an additional variable that measures the relative amount of performance fees that a pension fund pays in a specific year ($Fees/Return_{j,k,t-1}$). The outcomes of the variable, however, is difficult to interpret as our dataset does not contain figures per individual investment mandate, but at the asset class level. As such, the data on returns and performance fees per asset class likely represent the average return over the individual mandates and the sum of the performance fees paid over different mandates. A pension fund that invests in two mandates in a specific asset class may realize a positive return on the first mandate and a negative return on the second mandate, which may result in a return close to 0 at the asset class level. As the pension fund will probably pay performance fees for the first mandate (given the positive return), this would result in the fund paying a positive performance fees for a return close to 0 at the asset class level. Including the $Fees/Return_{j,k,t-1}$ variable in regression (1) does not result in a significant outcome (or an alteration of our findings in Table III) and these results are not reported in the interest of conciseness.

[12] In practice, performance fees can also be negative due to, for instance, clawback procedures. We do not experience negative performance fees in our sample, likely because the fees run over several mandates and investment funds within an asset category. Therefore, any negative performance fee in a given mandate is likely being compensated by the positive performance fees in other mandates or investment funds within that same asset class.

dependent variable $PF_{j,k,t}$ as the actual level of performance fees of pension fund j in a given year t for a given asset class k, and $PF^*_{j,k,t}$ as the latent variable that represents the level of performance fees if it would not be constrained.

As a result, we have the following equation:

$$PF_{j,k,t} = \begin{cases} PF^*_{j,k,t} \text{ if } PF^*_{j,k,t} > 0 \\ 0 \text{ if } PF^*_{j,k,t} \leq 0 \end{cases}$$

As a first step we examine whether performance fees relate to gross excess returns as investors typically pay these type of fees for returns in excess of a pre-defined benchmark. For that, we use the following regression to explain the performance fees PF for pension fund j in a given year t:

$$PF^*_{j,k,t} = \beta_{1,k} YR2012_{j,k} + \beta_{2,k} YR2013_{j,k} + \beta_{3,k} YR2014_{j,k} + \beta_{4,k} YR2015_{j,k} + \beta_{5,k} I\left(R^{G,A}_{j,k,t} > 0\right) R^{G,A}_{j,k,t} + u_{j,k,t} \quad (2)$$

where $R^{G,A}_{j,k,t}$ represents the gross excess investment return and $I\left(R^{G,A}_{j,k,t} > 0\right)$ is an indicator function that equals 1 when the gross excess return is positive and 0 when it is negative. Index k either represents the total portfolio level or one of the six different asset classes we distinguish: fixed income, equity, real estate, private equity, hedge funds and commodities.

We also test whether performance fees are related to total gross returns $R^{G,T}_{j,k,t}$ by including this variable in regression model (2):

$$PF^*_{j,k,t} = \beta_{1,k} YR2012_{j,k} + \beta_{2,k} YR2013_{j,k} + \beta_{3,k} YR2014_{j,k} + \beta_{4,k} YR2015_{j,k} + \beta_{5,k} I\left(R^{G,A}_{j,k,t} > 0\right) R^{G,A}_{j,k,t} + \beta_{6,k} I\left(R^{G,T}_{j,k,t} > 0\right) R^{G,T}_{j,k,t} + u_{j,k,t} \quad (3)$$

In Tobit regression models, a change in $R^{G,A}_{j,k,t}$ has two effects, namely an effect on the mean of $PF^*_{j,k,t}$ given that it is observed (an increase in the level of performance fees paid) and an effect on the probability of $PF^*_{j,k,t}$ being observed (pension funds paying performance fees). In our analysis we focus on the conditional mean that represents the expected value of the actual level of performance fees, conditional on fees being positive $E\left(PF_{j,k,t} \mid 0 < PF_t < \infty\right)$. In this setting, the estimation results indicate how a one unit change in an independent variable ($R^{G,A}_{j,k,t}$ or $R^{G,T}_{j,k,t}$) affects the observed performance fee, given that it is positive.

3.3 Pension fund specific characteristics

With our third research question we investigate whether pension fund specific characteristics influence the relation between performance fees and gross returns. We specifically look at pension fund size and the level of specialization. For that, we extend regression model (2) as follows:

$$PF_{j,k,t} = \beta_{1,k}YR2012_{j,k} + \beta_{2,k}YR2013_{j,k} + \beta_{3,k}YR2014_{j,k} + \beta_{4,k}YR2015_{j,k} + \beta_{5,k}\, log\big(Size_{j,k,t}\big) + \beta_{6,k}Spec_{j,k,t} + I\big(R^{G,A}_{j,k,t} > 0\big)\big(\beta_{7,k} + \beta_{8,k}\, log\big(Size_{j,k,t}\big) + \beta_{9,k}Spec_{j,k,t}\big)R^{G,A}_{j,k,t} + u_{j,k,t} \qquad (4)$$

, where $Size_{j,k,t}$ is the pension fund *j*'s average assets under management in euro in asset class k during year t and $Spec_{j,k,t}$ represents the average allocation towards a specific asset class, measured as the allocation to asset class k divided by the total assets under management. Note that the variable $Spec_{j,k,t}$ is only included in the regressions at the asset class levels as specialization is not possible at the total portfolio level. This regression enables us to investigate the direct impact of pension fund size ($\beta_{5,k}$) and specialization ($\beta_{6,k}$) on performance fees, as well as to examine whether size and specialization influence the proportion of gross excess return a pension fund pays in performance fees ($\beta_{8,k}$ and $\beta_{9,k}$).

3.4 Bootstrap procedure

We have to acknowledge the possibility that our findings are driven by small-sample biases or by the non-linearity in our performance fee models, and that observed correlations between performance fees and (net) returns are therefore spurious. As a robustness check, we also use a randomization-bootstrap procedure where we re-estimate all coefficients in regression models (1), (2), (3) and (4). We report the bootstrap t-statistics in all relevant tables. Following Efron (1979), we apply the following bootstrap procedure per asset category for every model:

1) Sample, with replacement, the same number of observations as when estimating the standard model.
2) Store the estimated coefficients
3) Repeat steps 1 and 2 *5000* times

4) Calculate the estimated coefficients as the average of the *5000* estimated coefficients and subsequently divide this average by the standard deviation of the *5000* estimated coefficients to construct the bootstrapped t-statistic.

4. Empirical results

We now turn to the empirical results. In Section 4.1, we examine our first research question whether pension funds that pay performance fees are able to earn higher net total or excess returns. We analyze our second research question in Section 4.2, namely if gross total or excess return primarily drives performance fees paid. In Section 4.3 we test our final research question if large pension funds or more specialized pension funds pay less performance fees.

4.1 Performance fees and net returns: does it pay to pay?

Table III presents the main findings on whether it pays to pay performance fees for pension funds.[13] Panel A of this table displays the results for total net returns from estimating regression (1). A key finding is that the total returns of pension funds that pay performance fees to asset managers are not significantly higher or lower than the returns of pension funds that do not pay performance fees.. Equity is an exception, although the economic size of the finding is negligible. Pension funds that pay performance fees report 0.8 basis point lower net total return per year. The finding is statistically significant at the 1 percent level and in line with the negative relation between fees and net performance that Carhart (1997) and Fama and French (2010) document for equity mutual funds.

Panel A also reports that pension fund size positively corresponds to net total returns for equities, real estate and hedge funds. Larger pension funds thus generate higher net total returns in these asset classes. A pension fund that is 10 times larger in terms of assets under management earns, on average, 0.66 basis point more net total return on equities. For real estate, this is 1.9 basis points more. A possible explanation is economies of scale. Furthermore,

[13] The coefficients for the control variables are not reported in Table III in the interest of brevity. Table A (appendix), however, shows the coefficients and relevant t-statistics for all control variables.

we find that specialization positively correlates with real estate, private equity and hedge funds. Allocating more to these asset classes appears to improve net total return. Pension funds that allocate one percentage point more towards these asset classes respectively report 0.32, 1.31 and 1.37 basis point more net total return. For commodities, on the other hand, specialization reduces total net return.

Table III, Panel B shows the estimation results of (1) for net excess returns. We find that pension funds that pay performance fees report a higher net excess return for hedge funds than pension funds that pay no fees. A pension fund that pays performance fees, on average, earns 3.0 basis points more net excess return in hedge funds. The result is statistically significant at the 5 percent level and in line with the majority of academic studies (e.g. Agarwal et al., 2009), although it should be noted that we measure excess return as the return over a benchmark that is self-selected by the pension fund. Nevertheless, paying performance fees apparently enable pension funds to incentivize hedge fund managers in realizing a higher net return. Panel B also reports that pension fund size positively relates to net excess returns for equities. A pension fund that is 10 times larger in terms of assets under management earns, on average, shows 0.56 basis points more net active equity return. Specialization only has a positive effect on the net excess hedge funds returns. If a pension funds allocates 1 percentage points more to hedge funds, it reports 0.82 basis point more net excess return on hedge funds.

4.2 Drivers of performance fees: gross excess or gross total return?

Table IV presents the results of our analysis in regression (2) where we examine what type of return drives performance fees. Panel A displays the relation between performance fees and gross excess returns for the total portfolio as well as for the six asset classes. The row '*excess return'* reports the annual amount of performance fees that pension funds pay for a gross excess return of 100 basis points, given that they pay (positive) performance fees. Our main finding from this panel is that performance fees are directly linked to gross excess returns for equities and hedge funds. For hedge funds, pension funds pay 30.45 basis points of performance fee for every 100 basis points of gross excess return. This is statistically significant at the 1 percent level and implies that performance fee constitute about 30 percent of the generated excess return by hedge funds. For equities, this ratio is substantially lower at 2.1 percent (significant at the 5 percent level), given that they pay positive performance fees.

Table IV, Panel B reports the results when we also include the gross total return in the analysis. The gross total return is a proxy for the market return. We find a statistically significant (at the 1 percent level) relation between performance fees and gross total returns for all alternative asset classes, namely real estate, private equity, hedge funds and commodities. For hedge funds, pension funds appear to pay both for net total and excess return. Pension funds that pay performance fees, on average pay respectively 7.3 and 23.3 basis points of performance fees for every 100 basis points in additional total and excess return for hedge funds. So while pension funds pay approximately 23 percent of their excess return on fees, this is about 7 percent for total returns. Note that we also find a significant relation between performance fees and excess return for real estate, but that the bootstrapped t-statistics are not statistically significant.

Interestingly, performance fees for private equity investments appear related to gross total return, but not to gross excess return. Pension funds, on average, pay 6.7 basis points on fees for every 100 basis points in gross total return. A possible explanation for the significant relation between performance fees and gross total returns could be that pension funds have investment mandates for private equity that contain (fixed) hurdle rates instead of focus on outperforming some benchmark. Metrick and Yusada (2010), for instance, find that hurdle rates are highly prevalent among buyout funds.

4.3 Drivers of performance fees: size and specialization

Next we test whether pension fund size and the level of specialization in their investment portfolio impact the amount of performance fees that pension funds pay per basis point of excess return. Table V presents the results for the impact of pension fund size and specialization on the relation between performance fees and gross excess returns. We document several interesting results.

First, larger pension funds appear to pay higher performance fees. This is statistically significant at the 1 percent level for the total portfolio as well as for fixed income, equities, real estate and hedge funds. However, we also find that large pension funds appear to pay less performance fees per basis point of gross excess return for hedge funds (see row '*Excess returns*Log size*' in Table V). A tenfold increase in pension fund's investments in hedge funds, for instance, corresponds with 5.5 basis points lower performance fees per 100 basis points in gross excess return. We therefore conclude that large pension funds are able to realize more profitable mandates with their asset managers than smaller pension funds. This is possibly the result of better negotiation power due to their large scale.

Second, more specialized pension funds, i.e. funds that invest a higher proportion of their assets in one specific asset class, appear to pay significantly more performance fees for private equity and commodities. Table V reports that increasing the allocation towards these asset classes with one percentage point leads to respectively 41.96 and 3.69 basis points more performance fees. More specialized pension funds, however, appear to pay a smaller proportion of their gross excess returns on performance fees for most asset classes (see row '*Excess returns*Specialization*' in Table VI). Pension funds that increase their allocation to private equity with 1 percentage point, for example, pay 0.37 basis point less fees per 100 basis points gross excess return. For hedge funds, this reduction is 0.36 basis point and statistically significant at the 1 percent level. Apparently, higher specialized pension funds have more power to negotiate lower fees per basis point of excess return for private equity and hedge funds.

5 Robustness checks

In addition to the randomized bootstrap procedure described in section 3.4 we also employ several robustness checks. First, we control for investment return persistence in regression model (1). In addition, we also perform the analysis on risk-adjusted net returns. And finally it is important to note that our dataset contains information on performance fees at the aggregate asset class level. We therefore perform additional analysis to examine the possible impact of individual investment mandates on regression models (2), (3) and (4).

5.1 Controlling for return persistence

To test if pension funds that pay performance fees are able to earn higher net returns, we use a cross-sectional regression model (1) where we lag the performance fee-related dummy variable *Paying Fees* one year to avoid endogeneity. The lagged variable for performance fees $(t-1)$, however, may also be related to the investment returns at $t-1$, which could influence our results if there is return persistence present (i.e. if returns at time t are correlated with returns at t – 1). There is academic evidence pointing to short-term return persistence for several asset classes, most notably private equity (e.g. Kaplan and Schoar, 2005; Hansen, Jenkinson, Kaplan and Stucke, 2014), real estate (e.g. Lin and Yung, 2004) and hedge funds (Harri and Brorsen, 2004). Kaplan and Schoar (2005) document return persistence in leveraged buyout funds as well as venture capital funds. They find that general partners who outperform the sector are likely to do so in the next year as well. Harris et al. (2014) also observe return persistence, although they conclude that the level of persistence for buyout funds is declining after 2000. Lin and Yung (2004) observe short-term return persistence for real estate mutual funds, whereas Harri and Brorsen (2004) find short term persistence for many different hedge fund strategies.

As a robustness check, we control for return persistence by running the following regression to explain the net investment returns R for pension fund j in year t:

$$R_{j,k,t} = \beta_1 Paying\ Fees_{j,k,t-1} + \beta_2 log(\ Size_{j,k,t}) + \beta_3 Spec_{j,k,t} + \beta_4 R_{j,k,t-1} + \sum_{t^*=2013}^{2015} I(t = t^*)\big(\beta_{5,t^*}\mathrm{DUR}_{FI,j,k,t} + \beta_{6,t^*}\mathrm{DUR}_{O,j,k,t} + X_{j,k,t}\beta_{7,t^*} + \ Y_{j,k,t}\beta_{8,t^*}\ \big) + \varepsilon_{j,k,t} \qquad (5)$$

where R represents the net total return or the net excess return. Index k indicates either one of the six different asset classes, namely fixed income, equity, real estate, private equity, hedge funds or commodities, and is suppressed if it refers to the pension fund's total portfolio. The independent variables are defined in a similar manner as in regression model (1), but with the addition of $R_{j,k,t-1}$ that represents the (lagged) net total or excess return at $t-1$.

Table VI presents the findings controlling for return persistence. Most of our key findings regarding performance fees, size and specialization remain economically and statistically significant. Panel B, for instance, displays that pension funds that pay performance fees, on average, report 3.2 basis points more net excess return a year later (statistically significant at the 5 percent level). This is nearly identical to our finding in Table III. And for equities we still observe a significantly negative relation between performance fees and total net returns as pension funds that pay performance fees report 0.85 basis point less net return a year later (statistically significant at the 1 percent level). Interestingly, Table VI documents evidence of return persistence for private equity as lagged returns ($R_{j,k,t-1}$) have a statistically significant positive effect on net returns ($R_{j,k,t}$). If a pension fund, for example, realizes 100 basis points of net total returns more for private equity at year t-1, then net returns at year t are 34.02 basis points higher. Panel B also reports significant return persistence for net excess returns for private equity.

5.2 Controlling for risk

It is important to assess risk-adjust returns when analyzing performance. Bauer *et al.* (2011), for instance, argue that this is important because benchmarks are typically chosen by the pension funds themselves, thereby creating an incentive to choose benchmarks that are relatively easy to beat. As a robustness check, we risk-adjust the net returns by including the volatility of net returns in the following regression where we explain the net investment returns R for pension fund j in year t:

$$R_{j,k,t} = \beta_1 Paying\ Fees_{j,k,t-1} + \beta_2 log(\ Size_{j,k,t}) + \beta_3 Spec_{j,k,t} + \beta_4 VOL_{j,k,t} + \sum_{t^*=2013}^{2015} I(t = t^*)\big(\beta_{5,t^*}\mathrm{DUR}_{FI,j,k,t} + \beta_{6,t^*}\mathrm{DUR}_{O,j,k,t} + X_{j,k,t}\beta_{7,t^*} + \ Y_{j,k,t}\beta_{8,t^*}\,\big) + \varepsilon_{j,k,t} \qquad (6)$$

Where all variables are defined in a similar manner as in regression model (1), but with the addition of $VOL_{j,k,t}$ which represents the volatility of net total or excess return.

Table VII displays the results for risk-adjusted net total returns (Panel A) as well as net excess returns (Panel B). We document several interesting findings. For one, risk appears to be an important driver for both net total and excess returns as the ‘volatility of returns’ coefficient is statistically significant for most asset classes.[14] In addition, we observe that our key finding is robust. After risk-adjustment, we find that the total returns of pension funds that pay performance fees to asset managers are not significantly higher or lower than the returns of

[14] Note that we find a negative coefficient for hedge funds and commodities. The latter can be explained by the persistently negative returns for commodities during our sample period. A possible explanation for hedge funds stems from the great variation in hedge fund strategies, also demonstrated by the large cross-sectional variation in the hedge fund returns in the different years. If some specific strategies had negative returns over the years 2013 to 2015 the negative coefficient may be caused by just these strategies in the case that the other strategies, generating positive returns, are not or not that much related to the exposure in terms of realized risk. In that case average returns are positive, but the average exposure (coefficient) to the realized risk is still negative. Also note that volatility of returns may not be the best measure of hedge fund returns as those are often highly skewed.

pension funds that do not pay performance fees. However, after risk-adjusting, we no longer find that pension funds that pay performance fees report a higher net excess return for hedge funds. The negative relation between paying performance fees and net total return for equities, on the other hand, does appear to be robust. This coefficient, however, is economically small.

5.3 Analyzing impact of individual investment mandates

Although our dataset is free from self-reporting biases and highly detailed, it contains two important limitations. The first is that the dataset provides for limited possibilities to risk-correct investment returns. We document investment returns on a quarterly basis, implying that we have 16 observations of investment returns between 2012 and 2015. This is too few to calculate reliable and stable Sharpe-ratio's. We address this limitation by examining excess as well as total (net) returns and by controlling for the asset allocation of individual pension funds, which is an important driver for the volatility or riskiness of investment returns. For example, when assessing the equity returns of pension funds we include variables that distinguish between the allocation to emerging and mature markets that differ in risk profile.

The second limitation is that our dataset contains information at the aggregate asset class level, but not for individual investment mandates. As such, the data on returns and performance fees per asset class represent the aggregate return over the individual mandates and the sum of the performance fees paid over different mandates. This may influence our results when we examine performance fees as pension funds typically employ different mandates within one asset class. Take for instance a pension fund that invests in two different hedge fund mandates. The pension fund may realize a positive return on the first mandate and a negative return on the second mandate, which may result in an aggregate return of approximately 0 for hedge funds. As the pension fund will probably pay performance fees for the first mandate (given the positive return), this would result in the pension fund paying a positive performance fee for a return close to 0 at the asset class level.

We address this limitation by running an additional robustness check in the form of a randomized bootstrap procedure and by performing a simulation study to examine the effect of the individual mandates on the aggregate asset class data we report. Consider the following model for the returns and performance fees of pension fund *j* at time *t* for its mandate or investment fund *l*.

$$PF^*_{j,t,l} = \alpha + \beta \times I(R_{j,t,l} > 0)R_{j,t,l} \qquad R_{j,t,l} \sim N(\mu, \sigma)$$
$$PF^*_{j,t} = \textstyle\sum_l PF^*_{j,t,l} \qquad R_{j,t} = \textstyle\sum_l R_{j,t,l} \tag{7}$$

where we set α at 0, while β represents the average ratio of performance fees paid over total gross return which we set at 20 percent. In addition, μ is the expected return for an individual mandate which we determine as 0 and σ is the standard deviation which we set at 10 percent. We then estimate the relation between the aggregate performance fees $PF^*_{j,t}$ and returns $R_{j,t}$.

$$PF^*_{j,t} = \alpha^* + \beta^* \times I(R_{j,t} > 0)R_{j,t} + \varepsilon_{j,t} \tag{8}$$

The standard deviation of $\varepsilon_{j,t}$ can be considered as the additional standard error due to the aggregation of the individual mandates to the asset class level that we report. As a result, the difference between β^* and β represents the bias in our model for the percentage of net total or net excess return that pension funds pay in performance fees.

Table VIII presents the results from the simulation study. Panel A shows the difference between the aggregate performance fees at the asset class as reported in our dataset (β^*) and the beta at the individual mandate level (β). We observe that the deviation between both beta's widens when a pension fund uses more investment mandates. Panel A shows that if a pension fund invests in two mandates for a given asset class, the difference between β^* and β is about 0,4% to 0,7%. The difference widens to approximately 4,2% to 4,8% if the pension fund invests in 100 mandates.[15] However, it is important to note that in all cases we tend to underestimate the economic effect of our findings at the aggregate asset class level. So the lack of individual mandate data leads to a bias, but a conservative one in nature.

Panel B of Table VIII reports the additional standard error in our regressions due to the aggregate nature of our data. Panel B shows that the additional standard error increases with the amount of investment mandates that the pension fund invests in for a given asset class. For most asset classes, our dataset consists of over 100 pension funds, although this is substantially lower for alternative asset classes (about 35 pension funds for hedge funds). At a sample of 25

[15] Note that the number of pension funds appears to have a limited effect.

pension funds, the additional standard error ranges from 0,8% when there are two mandates to 1,3% when the pension fund invests in 100 mandates. As a result of the inflated standard errors, it is possible that we observe non-significant relations that in practice are statistically significant. Therefore, it could be possible that the relation between performance fees and net returns reported in Table III is actually statistically significant for more asset classes than we observe (i.e. only for hedge funds). Again, it is important to note that although this is a bias inherent to our dataset, it is a conservative one in nature.[16]

6. Conclusions

We provide a comprehensive analysis of the relation between investment returns and performance fees for all occupational Dutch pension funds. Our unique dataset is free from self-reporting biases and includes risk-adjusted net total and active returns as well as performance fees per pension fund. We are able to distinguish returns and fees for the total portfolio level as well as for six separate asset classes: fixed income, equity, real estate, private equity, hedge funds and commodities. Our key findings are as follows.

First, we find that the returns of pension funds that pay performance fees to asset managers are not significantly higher or lower than the returns of pension funds that do not pay performance fees.. The findings are robust after controlling for risk and return persistence in asset class returns and using bootstrapped t-statistics. There is, however, one minor exception. For hedge funds, we find that pension funds that pay performance fees report, on average, 3.0 basis points more net excess return. This finding is in line with the majority of academic studies into hedge funds returns, but the statistical significance disappears when we adjust for risk.

Second, we document that specialization is positively related to net returns for private equity and hedge funds. Pension funds with a 1 percentage point higher allocation towards these asset classes report respectively a 1.31 and 1.37 basis point higher net total return. In terms of net

[16] Note that the simulation results are generated under the assumption that the returns of all mandates or investment funds of a pension fund within a category are uncorrelated. Typically different mandates and investment funds within the same asset category are not independent and significantly correlated, which implies that in practice the underestimation of the coefficients and the inflation of the standard errors is less than reported in Table VIII.

excess return, only specialization in hedge funds adds value. In addition, we find that larger pension funds have a significantly higher net total return for equities and real estate. For net excess return, size is only positively related to equities.

Third, performance fees are directly linked to gross excess returns for equities and hedge funds. For hedge funds, pension funds pay 30.45 basis points of performance fee for every 100 basis points of gross excess return. For equities, this ratio is substantially lower at 2.1 percent. We also find that gross total return is the main driver for performance fees in private equity. A possible explanation for this is that pension funds have investment mandates for private equity that focus on realizing a (fixed) hurdle rate instead of outperforming some benchmark.

Fourth, we find that large and more specialized pension funds are able to realize more profitable mandates with their asset managers, possibly as a result of better negotiation power due to their large scale or higher level of expertise. Larger pension funds, for instance, appear to pay significantly less performance fees for a given level of gross excess return for hedge funds. A tenfold increase in hedge fund investments, for instance, corresponds to 5.5 basis points less performance fees per 100 basis points in gross excess return. Regarding specialization, we find a significant effect for private equity and hedge funds. Pension funds with a 1 percentage point higher allocation to private equity pay 0.37 basis point less fees per 100 basis points gross excess return. For hedge funds, this reduction is 0.36 basis points. Again, it is important to note that we may underestimate the size of the economic coefficients due to the lack of data on individual investment mandates.

The combined results show that pension fund size and specialization are economically more important for net returns than paying performance fees. The impact of size and specialization is notably true for alternative asset classes. We find no statistical evidence that paying fees for most asset classes adds or subtracts value. Although our dataset is highly detailed, it is important to note that we are not able to investigate the relation between fees and return at the individual mandate level – where results could differ from the findings that we present in this chapter. To further strengthen our findings it would be helpful to have detailed knowledge on each specific mandate.

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Table I
Statistics on Pension Fund Investment Returns

Table I presents an overview of the main statistics on the pension fund investments returns for all years of the sample period. Panel A reports the mean net time weighted investment total returns, as well as the minimum (10th percentile) and maximum (90th percentile) observations one row lower. These net total returns are expressed as annual percentage points and derived by deducting all investment costs from gross returns. The full sample return is the equally weighted average across all pension funds for all years. Panel A also report the number of pension funds in the sample (N). Panel B displays the net excess investment returns in basis points, which are represented by net returns minus benchmark returns. The benchmark returns are self-reported by the pension funds. All numbers in Panel B are obtained in a similar manner as the numbers in Panel A.

Panel A: Net Total Returns (in percentage points)

	2012		2013		2014		2015		Full Sample	
Total Portfolio	13.35		1.91		22.27		0.96		**9.72**	
	9.65	17.04	-2.50	6.26	13.33	32.50	-1.66	3.64	-1.05	23.12
Fixed Income	13.82		-5.32		30.78		-1.13		**9.62**	
	9.40	18.76	-9.54	-1.05	17.33	45.79	-3.71	1.38	-6.17	31.15
Equity	16.03		16.93		14.26		6.86		**13.52**	
	13.70	18.18	12.64	22.54	9.62	18.70	2.00	10.58	6.40	18.90
Real Estate	6.45		0.51		10.68		8.11		**6.49**	
	-3.70	23.78	-4.06	4.36	0.11	26.50	0.05	15.44	-2.38	20.46
Private Equity	6.24		6.67		17.18		15.61		**11.54**	
	-1.30	14.10	-0.05	15.01	7.52	29.50	2.97	24.79	0.12	23.40
Hedge Funds	2.73		1.54		5.97		-0.35		**2.64**	
	-1.46	7.28	-4.73	9.74	0.00	18.40	-12.24	12.32	-4.00	12.20
Commodities	-1.06		-6.77		-20.21		-19.78		**-9.96**	
	-4.30	2.35	-13.60	-0.68	-33.69	-5.43	-33.20	-0.88	-27.23	0.03
N	210		210		218		207			

Table I (*continued*)

Panel B: Net Excess Returns (in basis points)

	2012		2013		2014		2015		Full Sample	
Total Portfolio	17.1		15.8		-2.9		15.5		**11.3**	
	-118.4	148.2	-148.2	149.2	-349.3	215.9	-110.5	120.7	-141.6	166.5
Fixed Income	82.7		14.3		-72.8		18.1		**10.2**	
	-125.3	259.7	-103.7	97.9	-279.3	173.1	-60.0	130.0	-118.0	165.9
Equity	70.9		34.5		7.9		72.3		**46.2**	
	-139.0	239.0	-200.0	230.0	-174.0	144.0	-58.0	250.0	-160.0	220.0
Real Estate	-33.8		-80.5		33.8		25.9		**-12.7**	
	-488.0	256.0	-392.0	66.0	-230.0	225.0	-120.0	254.0	-320.0	210.0
Private Equity	-163.5		-204.1		368.4		533.3		**139.9**	
	-1148.0	564.0	-1114.0	591.0	-260.0	1610.0	-76.0	1426.0	-766.0	1163.0
Hedge Funds	86.4		-3.7		111.4		-223.6		**12.1**	
	-264.0	364.0	-647.0	575.0	-260.0	530.0	-962.0	330.0	-610.0	450.0
Commodities	3.8		-11.7		36.0		-39.8		**-1.6**	
	-405.0	220.0	-152.0	372.0	-327.0	290.0	-200.0	260.0	-286.0	340.0

Table II
Statistics on Pension Fund Performance Fees

Table II displays the main descriptive statistics on the performance fees paid by pension funds for all years of the sample period. The row "Total Portfolio" reports the equally weighted mean performance fees at the portfolio level, while the table also presents the performance fees for six separate asset classes. The minimum (10th percentile) and maximum (90th percentile) observations are reported one row lower for all asset classes. The performance fees are expressed as annual basis points of the average assets under management in the applicable period.

	2012		2013		2014		2015		Full Sample	
Total Portfolio	3.0		3.3		2.9		2.9		**3.0**	
	0.0	10.0	0.0	10.7	0.0	9.5	0.0	10.5	0.0	10.1
Fixed Income	1.2		0.8		0.4		0.2		**0.7**	
	0.0	2.0	0.0	1.6	0.0	1.2	0.0	0.6	0.0	0.9
Equity	3.4		2.0		1.6		2.5		**2.4**	
	0.0	8.6	0.0	7.2	0.0	5.0	0.0	5.7	0.0	7.0
Real Estate	1.9		3.2		3.2		3.7		**3.0**	
	0.0	6.3	0.0	7.3	0.0	7.2	0.0	11.3	0.0	7.1
Private Equity	22.1		57.3		102.0		91.7		**69.0**	
	0.0	98.5	0.0	220.0	0.0	248.1	0.0	256.7	0.0	218.3
Hedge Funds	105.1		82.7		75.6		80.1		**87.6**	
	0.0	201.8	0.0	189.9	0.0	162.8	0.0	126.6	0.0	190.5
Commodities	1.8		1.3		0.6		0.2		**1.1**	
	0.0	6.1	0.0	5.2	0.0	4.4	0.0	0.5	0.0	4.1

Table III

Performance Fees and Net Returns: Does it Pay to Pay?

Table III displays the results of the panel regressions that investigate whether paying performance fees contributes to investment returns for 218 pension funds during the sample period from 2013 to 2015. For that, we run the following regression: $R_{j,k,t} = \beta_1 Paying\ Fees_{j,k,t-1} + \beta_2 log(Size_{j,k,t}) + \beta_3 Spec_{j,k,t} + \sum_{t^*=2013}^{2015} I(t = t^*)\big(\beta_{4,t^*}\mathrm{DUR}_{FI,j,t} + \beta_{5,t^*}\mathrm{DUR}_{O,j,t} + X_{j,t}\beta_{6,t^*} + Y_{j,t}\beta_{7,t^*}\big) + \varepsilon_{j,k,t}$, where $I(t = t^*)$ is an indicator function that equals 1 if $t = t^*$ (i.e. years 2013, 2014 and 2015) and 0 when this is not the case and contains several variables to control for differences in asset allocation. These variables are not reported in the interest of brevity (see Table A). Panel A presents the outcome for total net return, whereas Panel B displays the results for net excess return. The row '*Paying Fees*' reports the coefficients for a dummy which is 1 for pension funds that paid performance fees in the previous year and 0 otherwise. All results are reported at the total portfolio level as well as for six asset classes, namely fixed income, equities, real estate, private equity, hedge funds and commodities. The economic coefficients are measured as annual basis points, whereas the first number under the coefficient reports the t-statistic. The numbers in square brackets are the conditional bootstrap t-statistics. *,**,*** represent the statistical significance at the 10 percent, 5 percent and 1 percent level, using the most strict outcome between the t-statistic and bootstrap t-statistic. We use White standard errors to correct for heteroskedasticity. The table also reports the number of observations in the sample (N) and the R^2.

Panel A: Net Total Return

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Paying fees	-0.01	-0.02	-0.84***	0.53	0.75	1.60	0.91
	-0.11	0.05	-2.71	0.81	1.21	0.86	0.46
	[-0.18]	[-0.25]	[-2.86]	[1.08]	[1.24]	[0.78]	[0.59]
Log size	0.02	-0.13	0.66***	1.90***	0.38	1.74*	0.31
	0.13	-1.39	3.63	3.31	0.41	1.88	0.74
	[0.02]	[-0.22]	[3.89]	[4.29]	[0.33]	[1.82]	[0.35]
Specialization		0.01	0.03	0.32***	1.31***	1.37***	-1.34***
		1.31	1.57	2.83	3.34	4.11	-2.98
		[0.97]	[1.37]	[3.62]	[3.57]	[3.89]	[-2.90]
N	631	631	631	517	207	140	191
R^2	0.93	0.87	0.68	0.54	0.27	0.27	0.38

Table III (*continued*)

Panel B: Net Excess Return

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Paying fees	-0.58	-0.08	-0.01	0.31	1.37	3.02**	-0.13
	-1.77	-0.22	-0.07	0.86	0.95	2.12	-0.12
	[-1.11]	[-0.74]	[0.14]	[0.70]	[0.94]	[1.97]	[-0.29]
Log size	-0.34	0.19	0.56***	0.25	0.10	-0.06	0.71
	-1.60	1.17	4.39	1.24	0.12	-0.11	1.32
	[-1.15]	[2.21]	[4.83]	[1.61]	[0.09]	[-0.08]	[1.83]
Specialization		0.01	-0.01	-0.01	0.54	0.82***	0.18
		0.69	-0.98	-0.14	1.37	3.49	0.71
		[1.02]	[-1.15]	[-0.08]	[1.39]	[3.31]	[0.83]
N	631	631	631	517	207	140	191
R^2	0.19	0.07	0.05	0.05	0.16	0.18	0.02

Table IV
Drivers of Performance Fees: Gross Excess or Gross Total Return?

Table IV presents the results of Tobit random effects panel regressions to examine what investment returns are driving the performance fees of 218 pension funds during the full sample period (2012-2015). We perform two separate regressions to investigate different return targets. Panel A presents the results when we relate performance fees to gross excess returns. For that, we run the following regression to explain the latent component PF^* performance fees PF for pension fund j in a given year t: $PF^*_{j,k,t} = \beta_{1,k}YR2012_{j,k} + \beta_{2,k}YR2013_{j,k} + \beta_{3,k}YR2014_{j,k} + \beta_{4,k}YR2015_{j,k} + \beta_{5,k}I\left(R^{G,A}_{j,k,t} > 0\right)R^{G,A}_{j,k,t} + u_{j,k,t}$, where $R^{G,A}_{j,k,t}$ represents the gross excess investment return and $I\left(R^{G,A}_{j,k,t} > 0\right)$ is an indicator function that equals 1 when the gross active return is positive and 0 when it is negative. Panel B reports the results when we include both gross excess and total returns for a pension fund. We present the results both for the total portfolio level as well as for six asset classes, namely fixed income, equities, real estate, private equity, hedge funds and commodities. The economic coefficients are measured as annual basis points, whereas the number under the coefficient reports the z-statistic. The numbers in square brackets are the conditional bootstrap z-statistics, which in the interest of brevity are only reported for excess and total return. *,**,*** represent the statistical significance at the 10 percent, 5 percent and 1 percent level, using the most strict outcome between the z-statistic and bootstrap z-statistic. We use White standard errors to correct for heteroskedasticity. The table also reports the number of observations in the sample (N) and the R^2.

Panel A: Gross Excess Return over Self-Selected Benchmark

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Excess return	0.34	0.04	2.12**	2.02*	0.02	30.45***	0.68
	1.37	1.40	2.49	1.98	0.01	4.99	1.15
	[1.42]	[1.52]	[2.40]	[1.76]	[0.08]	[4.76]	[1.04]
2012	-0.02***	-0.11***	-0.17***	-0.43***	-1.15***	-1.18***	-0.24***
	-2.79	-5.57	-6.10	-4.16	-3.99	-3.40	-3.91
2013	-0.01	-0.11***	-0.18***	-0.27***	-0.14	-1.23***	-0.31***
	-1.21	-4.61	-5.67	-4.16	-0.62	-2.90	-4.65
2014	-0.02**	-0.13***	-0.19***	-0.29***	0.59**	-1.17***	-0.27***
	-2.12	-4.84	-6.16	-4.26	2.33	-2.96	-3.78
2015	-0.02**	-0.14***	-0.19***	-0.31***	0.52**	-0.39	-0.35***
	-2.32	-4.96	-6.22	-3.71	2.16	-1.04	-3.79
N	849	849	849	710	283	211	297
R^2	0.20	0.24	0.22	0.37	0.31	0.49	0.76

Table IV (*continued*)

Panel B: Gross Excess Return and Gross Total Return

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Excess return	0.01	0.04	2.21**	1.56	0.69	23.30***	0.22
	0.12	0.15	2.48	1.96	1.60	3.96	0.49
	[0.42]	[1.52]	[2.36]	[1.49]	[1.69]	[3.79]	[0.49]
Total return	0.12	0.05	0.21	0.50*	6.70***	7.34***	3.35**
	0.13	0.12	0.60	1.82	3.64	3.56	2.30
	[0.15]	[0.09]	[0.65]	[1.77]	[3.70]	[3.26]	[2.11]
2012	-0.03	-0.11***	-0.14**	-0.46***	-1.59***	-1.32***	-0.27***
	-1.58	-5.05	-2.37	-4.03	-4.97	-3.75	-4.08
2013	-0.01	-0.11***	-0.14**	-0.27***	-0.68**	-1.35***	-0.29***
	-1.25	-4.61	-2.18	-4.16	-2.51	-3.18	[-4.73
2014	-0.02	-0.14***	-0.16***	-0.34***	-0.52	-1.51***	-0.26***
	-0.78	-3.93	-2.86	-3.98	-1.37	-3.50	-4.00
2015	-0.02**	-0.14***	-0.18***	-0.35***	-0.39	-0.64	-0.35***
	-2.30	-4.97	-4.52	-3.63	-1.08	-1.57	-3.79
N	849	849	849	710	283	211	297
R^2	0.20	0.24	0.22	0.40	0.41	0.51	0.78

Table V

Drivers of Performance Fees : Size and Specialization

Table V presents the results of Tobit random effects panel regressions to examine whether pension fund size and the level of specialization in their investment portfolio influences the relation between performance fees and active returns for the 218 pension funds during the full sample period (2012-2015). We run the following regression: $PF_{j,k,t} = \beta_{1,k}YR2012_{j,k} + \beta_{2,k}YR2013_{j,k} + \beta_{3,k}YR2014_{j,k} + \beta_{4,k}YR2015_{j,k} + \beta_{5,k}\,log(Size_{j,k,t}) + \beta_{6,k}Spec_{j,k,t} + I(R^{G,A}_{j,k,t} > 0)(\beta_{7,k} + \beta_{8,k}\,log(Size_{j,k,t}) + \beta_{9,k}Spec_{j,k,t})R^{G,A}_{j,k,t} + u_{j,k,t}$, where $Size_{j,k,t}$ is pension fund j's average assets under management in euro in asset class k during year t and $Spec_{j,k,t}$ represents the average allocation towards a specific asset class. We present the results both for the total portfolio level as well as for six asset classes, namely fixed income, equities, real estate, private equity, hedge funds and commodities. The economic coefficients are measured as annual basis points, whereas the number under the coefficient reports the z-statistic and the numbers in square brackets are the conditional bootstrap z-statistics. *,**,*** represent the statistical significance at the 10 percent, 5 percent and 1 percent level, using the most strict outcome between the z-statistic and bootstrap z-statistic. We use White standard errors to correct for heteroskedasticity. The table also reports the number of observations in the sample (N) and the R^2.

Pension Fund Size and Specialization

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Log size	0.05***	0.04***	0.06***	0.08***	0.07	0.68***	0.04
	8.73	4.19	3.47	2.70	0.41	4.11	1.33
	[8.32]	[3.96]	[3.21]	[2.58]	[0.41]	[3.07]	[1.00]
Specialization		-0.12**	0.02	0.26	41.96***	12.29	3.69*
		-2.38	0.15	0.50	5.59	1.87	1.98
		[-2.25]	[0.25]	[0.49]	[5.33]	[1.65]	[1.92]
Excess return	0.22	0.08	2.02**	1.60	1.73	21.82***	0.96
	0.15	1.37	2.00	2.41	0.17	6.12	0.17
	[0.05]	[1.20]	[2.01]	[1.31]	[0.25]	[3.32]	[0.16]
Excess return*Log size	0.12	0.50	-1.10	-0.41	-1.86	-5.50**	-0.03
	0.44	0.96	-0.78	-1.91	0.82	-2.05	0.02
	[0.21]	[1.00]	[-0.85]	[-1.45]	[0.62]	[-2.13]	[0.17]
Excess return*Specialization		0.00	-0.03	-0.03	-0.37***	-0.36***	-0.14
		0.15	0.27	-1.98	-4.30	-3.04	-1.17
		[0.28]	[0.10]	[-0.81]	[-3.68]	[-2.72]	[-0.35]

Table V (*continued*)

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
2012	-0.34***	-0.24***	-0.51***	-0.78***	-2.70***	-4.48***	-0.54***
	-8.91	-3.60	-4.80	-4.82	-3.35	-5.41	-3.51
2013	-0.32***	-0.25***	-0.52***	-0.62***	-1.62**	-4.19***	-0.60***
	-8.82	-3.55	-4.70	-4.24	-2.05	-5.43	-3.96
2014	-0.34***	-0.27***	-0.54***	-0.65***	-0.81	-4.20***	-0.58***
	-8.93	-3.69	-4.76	-4.58	-0.96	-5.24	-3.40
2015	-0.34***	-0.28***	-0.54***	-0.68***	-1.04	-3.82***	-0.66***
	-8.74	-3.72	-4.86	-4.34	-1.34	-5.08	-3.72
N	849	849	849	710	283	211	297
R^2	0.35	0.55	0.35	0.59	0.53	0.64	0.85

Table VI

Pension Fund Performance Fees and Net Investment Returns controlling for Return Persistence

Table VI displays the results of the panel regressions that investigate whether paying performance fees contributes to investment returns for 218 pension funds during the sample period from 2013 to 2015 when controlling for return persistence. For that, we run the following regression: $R_{j,k,t} = \beta_1 Paying\ Fees_{j,k,t-1} + \beta_2 log(\ Size_{j,k,t}) + \beta_3 Spec_{j,k,t} + \beta_4 R_{j,k,t-1} + \sum_{t^*=2013}^{2015} I(t = t^*)\left(\beta_{5,t^*}\mathrm{DUR}_{FI,j,t} + \beta_{6,t^*}\mathrm{DUR}_{O,j,t} + X_{j,t}\beta_{7,t^*} + \ Y_{j,t}\beta_{8,t^*}\right) + \varepsilon_{j,k,t}$, where $I(t = t^*)$ is an indicator function that equals 1 if $t = t^*$ (i.e. years 2013, 2014 and 2015) and 0 when this is not the case and contains several variables to control for differences in asset allocation. These variables are not reported in the interest of brevity. Panel A presents the outcome for total net return, whereas Panel B displays the results for net excess return. The row '*Paying Fees*' reports the estimated coefficients for a dummy which is 1 for pension funds that paid performance fees in the previous year and 0 otherwise, while the row '*Lagged Return (t-1)*' displays the coefficients for the lagged net returns. All results are reported at the total portfolio level as well as for six asset classes, namely fixed income, equities, real estate, private equity, hedge funds and commodities. The economic coefficients are measured as annual basis points, whereas the first number under the coefficient reports the t-statistic. The numbers in square brackets are the conditional bootstrap t-statistics. *,**,*** represent the statistical significance at the 10 percent, 5 percent and 1 percent level, using the most strict outcome between the t-statistic and bootstrap t-statistic. We use White standard errors to correct for heteroskedasticity. The table also reports the number of observations in the sample (N) and the R^2.

Panel A: Net Total Return

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Paying Fees	-0.03	-0.01	-0.85***	0.30	1.96	1.14	0.91
	-0.25	0.15	-2.72	0.48	1.41	0.60	0.46
	[-0.19]	[-0.25]	[-2.86]	[0.79]	[1.37]	[0.49]	[0.56]
Log Size	0.01	-0.14	0.64***	1.59***	0.65	1.66*	0.27
	0.18	-1.40	3.53	3.56	0.72	1.79	0.29
	[-0.06]	[-0.22]	[3.76]	[4.51]	[0.56]	[1.83]	[0.32]
Specialization		0.01	0.02	0.21***	0.86**	1.29***	-1.32***
		1.24	1.56	2.62	2.21	4.10	-2.89
		[0.97]	[1.28]	[2.64]	[2.57]	[3.78]	[-2.85]
Lagged Return (t-1)	7.56	1.35	7.22	23.49***	34.02***	12.87	7.42
	1.63	0.31	1.53	4.51	4.15	1.19	0.68
	[2.64]	[0.01]	[1.71]	[4.95]	[4.01]	[0.91]	[0.48]
N	631	631	631	517	207	140	191
R^2	0.93	0.87	0.68	0.57	0.35	0.29	0.38

Table VI (*continued*)

Panel B: Net Excess Return

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Paying Fees	-0.55	-0.08	-0.05	0.27	0.68	3.18**	0.19
	-1.69	-0.21	-0.23	0.75	0.52	2.17	0.17
	[-1.08]	[0.74]	[-0.06]	[0.63]	[0.45]	[1.97]	[-0.35]
Log Size	-0.35*	0.20	0.53***	0.24	0.22	-0.06	0.46
	-1.67	1.18	4.18	1.22	0.25	-0.08	0.95
	[-1.16]	[2.20]	[5.51]	[1.55]	[0.23]	[-0.04]	[1.35]
Specialization		0.01	-0.01	-0.01	0.28	0.84***	0.13
		0.68	-1.02	-0.11	0.77	3.51	0.52
		[1.02]	[-1.13]	[-0.02]	[0.83]	[3.20]	[0.63]
Lagged Return (t-1)	-7.82	-0.91	4.86	4.58	50.59***	-4.60	3.44
	-1.46	-0.25	1.21	1.77	4.49	-0.50	1.22
	[-0.11]	[0.44]	[1.79]	[0.47]	[3.75]	[-0.63]	[1.65]
N	631	631	631	517	207	140	191
R^2	0.19	0.07	0.06	0.05	0.28	0.18	0.12

Table VII

Performance Fees and Net Returns: Does it Pay to Pay after Risk-Adjustment?

Table VII displays the results of the panel regressions that investigate whether paying performance fees contributes to investment returns for 218 pension funds during the sample period from 2013 to 2015 when adjusting for risk. For that, we run the following regression: $R_{j,k,t} = \beta_1 Paying\ Fees_{j,k,t-1} + \beta_2 log(Size_{j,k,t}) + \beta_3 Spec_{j,k,t} + \beta_4 Vol_{j,k,t} + \sum_{t^*=2013}^{2015} I(t=t^*)(\beta_{4,t^*}\mathrm{DUR}_{FI,j,t} + \beta_{5,t^*}\mathrm{DUR}_{O,j,t} + X_{j,t}\beta_{6,t^*} + Y_{j,t}\beta_{7,t^*}) + \varepsilon_{j,k,t}$, where $I(t=t^*)$ is an indicator function that equals 1 if $t = t^*$ (i.e. years 2013, 2014 and 2015) and 0 when this is not the case and contains several variables to control for differences in asset allocation. These variables are not reported in the interest of brevity (see Table A). Panel A presents the outcome for total net return, whereas Panel B displays the results for net excess return. The row '*Paying Fees*' reports the coefficients for a dummy which is 1 for pension funds that paid performance fees in the previous year and 0 otherwise. All results are reported at the total portfolio level as well as for six asset classes, namely fixed income, equities, real estate, private equity, hedge funds and commodities. The economic coefficients are measured as annual basis points, whereas the first number under the coefficient reports the t-statistic. The numbers in square brackets are the conditional bootstrap t-statistics. *,**,*** represent the statistical significance at the 10 percent, 5 percent and 1 percent level, using the most strict outcome between the t-statistic and bootstrap t-statistic. We use White standard errors to correct for heteroskedasticity. The table also reports the number of observations in the sample (N) and the R^2.

Panel A: Net Total Return

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Paying fees	-0.04*	-0.09	-0.58**	0.34*	0.59	0.31	0.15
	-1.86	-0.13	-1.99	1.74	1.09	0.19	0.11
	[-1.87]	[0.13]	[-2.05]	[2.26]	[1.12]	[0.30]	[0.23]
Log size	0.02	0.20	0.61***	0.21	0.29	0.29	0.70
	1.35	1.16	3.90	1.10	0.09	0.49	1.30
	[1.39]	[1.19]	[3.57]	[1.57]	[0.08]	[0.72]	[1.68]
Specialization		0.01	-0.01	0.02	0.57	0.42**	0.72
		0.78	-1.32	0.07	1.44	2.10	0.01
		[0.74]	[-1.16]	[0.04]	[1.44]	[2.39]	[0.09]
Return volatility	0.05	0.49***	0.57***	0.49***	0.12	-0.71***	-1.13
	0.98	3.55	4.96	6.09	0.88	-4.49	-3.73
	[1.26]	[3.41]	[3.08]	[4.68]	[0.65]	[-3.08]	[-0.98]
N	631	631	631	517	207	140	191
R^2	0.95	0.91	0.73	0.62	0.27	0.49	0.69

Table VII (*continued*)

Panel B: Net Excess Return

	Total Portfolio	Fixed Income	Equities	Real Estate	Private Equity	Hedge Funds	Commodities
Paying fees	-0.18	0.03	0.04	0.25	1.22	1.46	-0.11
	-0.69	0.07	0.20	0.73	0.83	1.23	-0.10
	[-0.80]	[0.13]	[0.25]	[0.94]	[0.88]	[1.40]	[-0.32]
Log size	-0.34	0.19	0.56***	0.25	0.10	-0.06	0.71
	-1.60	1.17	4.39	1.24	0.12	-0.11	1.32
	[-1.39]	[1.49]	[4.57]	[1.58]	[0.08]	[-0.18]	[1.68]
Specialization		0.01	-0.01	-0.01	0.54	0.82***	0.18
		0.69	-0.98	-0.14	1.37	3.49	0.71
		[0.74]	[-1.15]	[-0.04]	[1.43]	[2.38]	[0.92]
Return volatility	0.15***	-0.36***	0.15**	0.07	0.13	-0.64***	0.01
	2.66	-4.43	2.72	1.33	1.21	-4.14	0.15
	[2.26]	[-3.54]	[2.07]	[0.47]	[1.05]	[-3.07]	[0.09]
N	631	631	631	517	207	140	191
R^2	0.15	0.08	0.06	0.04	0.13	0.45	0.02

Table VIII

Simulation Study on Impact of Individual Mandates on Aggregate Asset Class Findings

Table VIII reports the results of a simulation study to examine the effect of individual investment mandates on the aggregate asset class data in our dataset. For that, we use the following model for the returns and performance fees of pension fund *j* at time *t* for its mandate or investment fund *l*: $PF^*_{j,t,l} = \alpha + \beta \times I(R_{j,t,l} > 0)R_{j,t,l}\ with\ R_{j,t,l} \sim N(\mu, \sigma)$. In addition, $PF^*_{j,t} = \sum_l PF^*_{j,t,l}\ and\ R_{j,t} = \sum_l R_{j,t,l}$, where we set α at 0, while β represents the average ratio of performance fees paid over total gross return which we set at 20 percent. In addition, μ is the expected return for an individual mandate which we determine as 0 and σ is the standard deviation which we set at 0.10. We then estimate the relationship between the aggregate performance fees $PF^*_{j,t}$ and returns $R_{j,t}$: $PF^*_{j,t} = \alpha^* + \beta^* \times I(R_{j,t} > 0)R_{j,t} + \varepsilon_{j,t}$. Panel A reports the average estimate of β* for different number of mandates and pension funds when we set β at 20 percent. The difference between β* and β represents the economic bias in our model for the percentage of net total or net excess return that pension funds pay in performance fees. Panel B shows the corresponding standard deviation of β*, namely $\varepsilon_{j,t}$, which can be considered as the additional standard error due to the aggregation of the individual mandates to the asset class level.

Panel A: Average estimate of β* when β is set at 20 percent

Number of mandates / Number of pension funds	2	5	10	25	50	100
5	19.6%	17.2%	16.7%	16.1%	15.9%	15.8%
10	19.4%	17.0%	16.4%	15.8%	15.6%	15.4%
25	19.4%	16.9%	16.3%	15.7%	15.4%	15.2%
100	19.3%	16.9%	16.2%	15.6%	15.4%	15.2%
200	19.3%	16.9%	16.2%	15.6%	15.3%	15.2%

Panel B: Corresponding standard deviation of β*, namely $\varepsilon_{j,t}$

Number of mandates / Number of pension funds	2	5	10	25	50	100
5	2.3%	2.9%	3.0%	3.1%	3.3%	3.7%
10	1.3%	1.7%	1.9%	1.9%	2.1%	2.2%
25	0.8%	0.9%	1.1%	1.2%	1.2%	1.3%
100	0.4%	0.5%	0.5%	0.6%	0.6%	0.6%
200	0.3%	0.3%	0.4%	0.4%	0.4%	0.4%

Table A

Performance Fees and Net Returns – including Asset Allocation Control Variables

Table A displays the same results as Table III, but also reports the coefficients and t-statistics for all asset allocation control variables at the total portfolio level. For that, we run the following regression: $R_{j,k,t} = \beta_1 Paying\ Fees_{j,k,t-1} + \beta_2 log(\ Size_{j,k,t}) + \beta_3 Spec_{j,k,t} + \sum_{t^*=2013}^{2015} I(t = t^*) \left(\beta_{4,t^*}\mathrm{DUR}_{FI,j,t} + \beta_{5,t^*}\mathrm{DUR}_{O,j,t} + X_{j,t}\beta_{6,t^*} + \ Y_{j,t}\beta_{7,t^*}\right) + \varepsilon_{j,k,t}$, where $I(t = t^*)$ is an indicator function that equals 1 if $t = t^*$ (i.e. years 2013, 2014 and 2015) and 0 when this is not the case. All variables are reported for net total returns (Table III, panel A) and net excess returns (Table III, panel B) and all numbers are obtained in a similar manner as in Table III.

	Net Total Return		Net Excess Return	
	Coefficient	T-statistic	Coefficient	T-statistic
Paying Fees	-0.01	-0.11	-0.58*	-1.77
Log Size	0.02	0.13	-0.34	1.60
Duration Fixed Income*2013	-0.04	-1.03	0.12	0.76
Duration Fixed Income*2014	0.06***	5.99	0.05**	2.19
Duration Fixed Income*2015	-0.09***	-2.58	0.05	0.24
Duration Overlay*2013	-0.07***	-6.49	-0.03	-0.65
Duration Overlay*2014	0.05***	3.82	-0.02*	-1.77
Duration Overlay*2015	-0.05***	-4.48	0.03	0.45
Government Bonds*2013	0.00	0.49	0.00	-0.11
Government Bonds*2014	0.01*	1.66	-0.03**	-2.31
Government Bonds*2015	0.01	1.58	0.01	0.68
Inflation Linked Bonds*2013	-0.02**	-2.03	0.01	0.17
Inflation Linked Bonds*2014	-0.03**	-2.19	0.04	1.35
Inflation Linked Bonds*2015	-0.02	-1.21	0.03	0.47
Mortgages*2013	0.05***	2.44	0.03*	1.81
Mortgages*2014	0.01	0.22	0.05**	2.04
Mortgages*2015	0.03	1.46	0.02	1.19
Corporate Bonds*2013	0.01	1.37	0.03	0.77
Corporate Bonds*2014	-0.01	-0.90	0.08***	2.87
Corporate Bonds*2015	0.01	1.37	-0.01	-0.30
Cash and Cash Equivalents*2013	0.02	0.77	-0.04	-1.29
Cash and Cash Equivalents*2014	-0.03*	-1.87	-0.03	-0.92
Cash and Cash Equivalents*2015	0.00	0.19	0.03	0.60
Equities – Mature Markets*2013	0.07***	3.89	0.01	0.56
Equities – Mature Markets*2014	0.03***	6.46	0.03	1.32
Equities – Mature Markets*2015	0.07***	5.78	-0.05	-1.59
Equities – Emerging Markets*2013	-0.01	-0.22	-0.01	-0.12
Equities – Emerging Markets*2014	0.00	0.15	-0.05	-0.43
Equities – Emerging Markets*2015	0.02	0.96	0.07	0.53

Table A (*continued*)

	Net Total Return		Net Excess Return	
	Coefficient	T-statistic	Coefficient	T-statistic
Direct Real Estate*2013	-0.01	-0.69	0.08	0.98
Direct Real Estate*2014	-0.01	-0.64	0.07*	1.86
Direct Real Estate*2015	-0.02	-0.93	-0.01	-0.06
Listed Real Estate*2013	0.02	0.65	0.03	0.26
Listed Real Estate*2014	0.07***	2.95	0.04	1.37
Listed Real Estate*2015	0.04**	1.96	0.05	0.50
Indirect Real Estate*2013	-0.00	-0.34	0.09	1.05
Indirect Real Estate*2014	-0.01	-0.45	-0.03	-0.30
Indirect Real Estate*2015	0.03	1.22	-0.07	-0.67
Private Equity*2013	-0.03	-0.98	0.03	0.23
Private Equity*2014	0.03	0.82	0.08	1.15
Private Equity*2015	0.02	0.65	-0.02	-0.11
Hedge Funds*2013	0.05*	1.72	0.09	0.76
Hedge Funds*2014	0.00	0.38	0.07	0.60
Hedge Funds*2015	0.02	0.74	-0.01	-0.69
Commodities*2013	-0.02	-0.67	0.11	0.81
Commodities*2014	-0.21***	-6.47	0.00	-0.02
Commodities*2015	-0.10***	-2.79	0.03*	1.84
AA-Rated Bonds*2013	0.01	1.49	0.01	0.17
AA-Rated Bonds*2014	-0.02**	-2.38	-0.07**	-1.98
AA-Rated Bonds*2015	-0.01	-1.11	0.00	-0.09
A-Rated Bonds*2013	-0.01	-0.83	0.02	0.23
A-Rated Bonds*2014	-0.01	-0.75	-0.10	-1.38
A-Rated Bonds*2015	-0.02	-0.76	0.11	1.08
BBB-Rated Bonds*2013	0.03**	2.16	0.01	0.22
BBB-Rated Bonds*2014	-0.02	-1.54	-0.01	-0.19
BBB-Rated Bonds*2015	0.01	0.74	-0.03	-0.44
<BBB-Rated Bonds*2013	0.02	0.90	0.06	0.77
<BBB-Rated Bonds*2014	-0.02	-1.02	-0.11	-1.34
<BBB-Rated Bonds*2015	0.01	0.62	0.03	0.35
Non-Rated Bonds*2013	-0.03*	-1.80	-0.04	-0.60
Non-Rated Bonds*2014	0.02	1.26	0.05	0.70
Non-Rated Bonds*2015	0.01	0.06	0.02	0.20

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