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The Role of Fees in Pension Fund Performance. Evidence from Spain*

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Abstract
Pension funds represent a substantial part of welfare systems, so efficient management is important for beneficiaries. However, performance may be seriously affected by fees. This fact led us to analyze the relation between fees and performance in Spanish equity and bond pension funds with a European investment focus. We apply a model that relates performance and fees, employing several performance measures (the alphas from the Fama and French model, the Carhart model, and two models with bond benchmarks) in order to observe if the relation changes depending on the type of pension fund analyzed. The analysis reveals a significantly negative relation for both types of pension funds, so we observe that worse-performance pension funds charge higher fees and better-performance pension funds charge lower fees. Finally, we confirm that after-fee performance is lower than before-fee performance.

1. Introduction

In recent years the pension fund industry in Spain has been booming. At the end of 2011, Spain occupied seventh place in Europe, with assets of €82,000 million according to data from INVERCO (the Spanish Association of Collective Investment and Pension Funds). This boom has stimulated the study of these products to explain their role in the financial markets and the economy.

Pension fund investors expect to enjoy certain financial advantages (professional management, security, and information). This implies that the managing entity will follow the evolution of markets and financial assets, ensuring suitable diversification of portfolio assets. Thus, as Martí and Matallín (2008) affirm, efficient pension fund management implies that the beneficiary will receive higher payments when the contingency covered occurs. For this reason, better or worse management may have important social repercussions.

Nonetheless, a key issue in the evaluation of management is the influence of fees. Brown et al. (1992), Dellva and Olson (1998), and Otten and Bams (2002) observe that fees set by managers may contribute to negative performance. Indeed, Kumples and McCrae (1999) and Blake et al. (1999) find that high fees imply a reduction in the assets accumulated; although Ippolito and Turner (1987) point out that poor pension fund results are not related to the setting of high fees.

Several studies prove that differences in fund expenses are one of the reasons for diverse risk-adjusted returns across funds, since they explain most of the variation

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in after-expense performance (Carhart, 1997). However, most of the performance studies on mutual funds and pension funds focus on analyzing the variation in performance due to the existence of managers with superior stock-picking skills (Chevalier and Ellison, 1999). Few studies explore the fee-performance relation, especially in pension funds. As a consequence, many investors are not aware of the fees and their impact on returns (Alexander et al., 1997).

In this paper we study the fee-performance relation by exploring the relation between before-fee performance and fees in the Spanish pension fund industry. The sample is divided into equity and bond pension funds, so we apply several models in order to better capture the relation between fees and performance in each type of pension fund. Moreover, we study whether a fund's characteristics (age and size) affect this relation and whether the relation changes over time, dividing the sample into three sub-periods.

We apply a model that relates before-fee performance as the dependent variable and management fees as the independent variable. Furthermore, we use several performance measures, starting with the alphas from the Fama and French (1993) model and the Carhart (1997) model. After that, we use the alpha from a model with bond benchmarks, as one of the samples is made up of fixed-income funds. Finally, we employ the alpha of a multi-index model (bond benchmarks and asset benchmarks), because Spanish equity pension funds are required to invest more than 75% of their portfolios in equities, while the rest may be invested in other assets such as fixed-income securities.

Finally, we prove whether after-fee performance is lower or higher than before-ee performance, considering the results obtained in the fee-performance study.

The article is organized as follows. In Section 2, we provide a literature review. Section 3 gives the methodology. In Section 4, we describe the data and in Section 5, we show the results. Finally, Section 6 concludes.

2. Literature Review

The empirical evidence shows that fees influence performance. Indeed, abnormal returns (after expenses and trading costs) are close to zero in investment funds (pension funds and mutual funds). Blake et al. (2002) find that the slight underperformance of the median fund manager in UK pension funds is due to the incentive effects of fee structures, since the fee structure provides a weak incentive to add value. Dobronogov and Murthi (2005) prove that pension fund charges are likely to reduce returns on individual account balances in four countries: Croatia, Hungary, Kazakhstan, and Poland. Sy and Liu (2010) show that the performance of Australian pension funds is significantly correlated with their average costs.

Nonetheless, the relation between fees and performance is not clear, and several studies find a different relationship between these two variables. Elton et al. (1993) indicate that funds with higher fees deliver significantly lower before-fee returns. Malkiel (1995) finds evidence of a significantly negative correlation between the costs and risk-adjusted return of mutual funds. Indeed, when he distinguishes between investment-related costs and operative costs; he finds a significantly positive relationship between management costs and raw risk-adjusted return. Gruber (1996), Carhart (1997), Harless and Peterson (1998), Chevalier and Ellison (1999), Christofferssen and Musto (2002), Gil-Bazo and Ruiz-Verdú (2007), Houge and Wellman (2007), and Gil-Bazo and Ruiz-Verdú (2009) also confirm the power of high fees to predict underperformance.

Additionally, Martí et al. (2007) demonstrate a significantly negative relationship between fees and the net-of-fees risk-adjusted return on pension plans. However, Droms and Walker (1996) reveal that funds bearing higher costs obtain high returns that compensate for these costs, although according to Annaert et al. (2003) this may be due to the existence of survivorship bias.

The reasons that some funds charge higher fees than others depend on several factors. Christoffersen and Musto (2002) argue that funds with worse past performance face less elastic demand, since performance-sensitive investors may leave funds with a bad past performance.

An alternative hypothesis, proposed by Gil-Bazo and Ruiz-Verdú (2008), is that fund managers with different abilities target different segments of investors. They argue that high-ability managers compete for the money of sophisticated investors, so their fees are pushed down. On the other hand, worse fund managers target unsophisticated investors, charging higher fees.

Moreover, fund characteristics may be another reason: if fund size or fund age is positively correlated with performance, funds display economies of scale or learning economies, allowing them to charge lower fees (Malhotra and McLeod, 1997).

These results depend on the model or measure applied to study this relation. Specifically, the alpha of Jensen (1968) is the most common measure, but the appropriateness of the benchmark used may affect it. According to Sharpe (1992), Elton et al. (1993), and Ferson and Schadt (1996), the omission of benchmarks may generate biases in the measurement.

To avoid this bias, Gruber (1996) and Matallín (2003) propose models that integrate benchmarks representing the type of assets in which the sample funds could invest. Matallín (2007) shows that the models based on factors and on benchmarks show similar biases, but as pension fund studies tend to use multi-index models rather than factor models this problem can be solved.

In order to reveal the relation between fees and performance, we apply several models in this study. Firstly, we follow the work of Gil-Bazo and Ruiz-Verdú (2007) to estimate the performance measure, and after that, we analyze the relation between fees and performance. Secondly, taking into account that our sample is divided into equity and bond funds, following Elton et al. (1996) and Martí and Matallín (2008), we incorporate various bond indexes and benchmarks that represent the types of assets in which our pension funds invest. Therefore, we examine if the relationship between fees and performance varies depending on pension fund type, and if we should use different models to analyze each type.

3. Methodology

In this section we describe some traditional models for measuring the performance of a fund, and we present a model for exploring the relation between fees and performance.

3.1 Fund Performance Estimation: The Relationship between Performance and Fees

One traditional model for measuring abnormal return was developed by Jensen (1968), based on the Capital Asset Pricing Model (CAPM):

$$r_{it} = \alpha_i + \beta_i r_{mt} + \varepsilon_t \tag{1}$$

where r_{it} is the excess performance of fund i at time t over the risk-free asset; r_{mt} is the excess return of the market benchmark over the risk-free asset; coefficient β_i is the beta with the market and represents systematic risk (we assume this to be constant); α_i represents Jensen's alpha and measures the skill of the manager; and ε_{it} is the error term.

After that, the Arbitrage Pricing Theory (APT) of Ross (1976) states that, for no arbitrage opportunities, the return in excess of the risk-free rate of any asset i is:

$$r_{it} = \beta_i R_t^F + \varepsilon_{it} \tag{2}$$

The APT model supposes that asset returns in excess of the risk-free interest rate follow a K-factor model, where $\mathbf{R_t^F}$ is the vector of excess returns at time t of the corresponding K-factor portfolios, $\boldsymbol{\beta_i}$ is the vector of asset i's exposures to the factors, and ε_{it} is a zero-mean error term capturing idiosyncratic risk.

As a consequence, if α_{it} denotes the ability of fund i's manger to generate before-fee returns above those earned by any portfolio with identical exposure to the risk factors, then fund i's before-fee return in excess of the risk-free rate is:

$$r_{it} = \alpha_{it} + \beta_i R_t^F + \varepsilon_{it} \tag{3}$$

Therefore, fund i's net (or after-fees) alpha is: $\alpha_{it}^n \equiv \alpha_{it} - f_{it}$, and fund i's after-fee return in excess of the risk-free rate is:

$$n_{it} = \left(\alpha_{it} - f_{it}\right) + \beta_i R_t^F + \varepsilon_{it} = \alpha_{it}^n + \beta_i R_t^F + \varepsilon_{it} \tag{4}$$

Therefore, market equilibrium requires that fees adjust to make all after-fee alphas equal to zero (Berk and Green, 2004); that is to say:

$$\alpha_{it} = f_{it} \text{ for all } i \tag{5}$$

Consequently, as Gil-Bazo and Ruiz-Verdú (2007) illustrate, before-fee alphas and fees will be positively and linearly related in equilibrium if there are no market frictions. Moreover, the slope of the linear relation has to be one.

However, if there are market frictions, deviations from condition (5) may appear, with some funds offering small and negative after-fee alphas and others small and positive alphas. While these deviations are not correlated with fund fees, before-fee performance and fees will be related in a linear and unit slope, as in equation (5).

To evaluate the equilibrium condition, Gil-Bazo and Ruiz-Verdú (2007) estimate the following equation:

$$\hat{\alpha}_{it} = \delta_{0t} + \delta_1 f_{it} + \varepsilon_{it} \qquad i = 1,\ldots,N, \qquad t = 1,\ldots,T_i \tag{6}$$

where $\hat{\alpha}_{it}$ is the estimate of α_{it}, and whilst the measurement error in $\hat{\alpha}_{it}$ is uncorrelated with fees, it will not introduce any bias into the estimation; f_{it} stands for the fund's expenses (management fees in our case); and the intercept is allowed to vary over time to adjust for cross-sectional correlation of residuals.

In order to estimate fund performance $\left(\hat{\alpha}_{it}\right)$, we use the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model.

For this purpose we follow Carhart's (1997) two-stage estimation procedure, obtaining a panel of monthly risk-adjusted fund performance estimates.

In the first stage, we estimate each fund's exposure to risk factors (*betas*) every month over the previous three years. If less than three years of previous data are available for a specific fund-month, we require the fund to have been active for at least 24 months in the previous three years and we then use the available data to estimate its betas. In particular, the factor exposures are estimated as the slope coefficients in the OLS regressions of the Fama and French model and of the Carhart model, respectively:

$$r_{is} = \beta_{0,it}^{FF} + \beta_{rm,it}^{FF} r_{ms} + \beta_{smb,it}^{FF} SMB_s + \beta_{hml,it}^{FF} HML_s + e_{is}^{FF} \tag{7}$$

$$r_{is} = \beta_{0,it}^{C} + \beta_{rm,it}^{C} r_{ms} + \beta_{smb,it}^{C} SMB_s + \beta_{hml,it}^{C} HML_s + \beta_{pr1y,it}^{C} PR1YR_s + e_{is}^{C} \tag{8}$$

Model (7) estimates the factor exposures according to the Fama and French (1993) three-factor model and model (8) estimates the factor exposures according to Carhart's (1997) model.

In both expressions r_{is} is fund i's before-fee return in month s ($s = t–36; t–35, \ldots, t–1$) in excess of the risk-free interest rate; r_{ms} is the market portfolio return in excess of the risk-free rate; and SMB, HML, and PR1YR denote the return on portfolios which proxy for common risk factors associated with size, book-to-market, and momentum effects.

The size, book-to-market, and momentum factors applied are the European factors developed by Fama and French (2012).[1]

In the second stage, we estimate the fund's risk-adjusted performance in month t as the difference between the fund's before-fee returns and model-implied returns given the fund's estimated exposure to risk factors:

$$\hat{\alpha}_{it}^{FF} \equiv r_{it} - \hat{\beta}_{rm,it}^{FF} r_{mt} - \hat{\beta}_{smb,it}^{FF} SMB_t - \hat{\beta}_{hml,it}^{FF} HML_t \tag{9}$$

$$\hat{\alpha}_{it}^{C} \equiv r_{it} - \hat{\beta}_{rm,it}^{C} r_{mt} - \hat{\beta}_{smb,it}^{C} SMB_t - \hat{\beta}_{hml,it}^{C} HML_t - \hat{\beta}_{pr1y,it}^{C} PR1YKR_t \tag{10}$$

Finally, we obtain each fund's risk-adjusted performance as the average of the annualized monthly alphas over the fund's life in the sample.

3.2 Model for Bond Pension Funds

Considering that we are studying equity and bond pension funds but the Fama and French model and the Carhart model display some shortcomings in explaining the performance of funds that have a significant fraction of their holdings in fixed-income assets, we also apply two different models that incorporate bond benchmarks

[1] The factors are obtained from the website of Fama and French:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Developed

and the type of assets that funds may invest in, as equity funds may also invest in fixed-income securities.

First, we apply the model presented by Martí and Matallín (2008) with two bond benchmarks representing short-term fixed-income and long-term fixed-income securities. Afterwards, we estimate the alpha with a two-step process:

$$r_{it} = \alpha_i + \beta_m r_{mt} + \beta_d r_{dt} + \beta_l r_{lt} + \varepsilon_t \tag{11}$$

where r_{it} is the excess performance of fund i at time t over the risk-free asset, and r_{mt} is the excess return of the market benchmark over the risk-free asset (we use the risk-free asset and the market benchmarks supplied by Fama and French for European markets[2]).

The fixed indexes (d) and (l) represent the return on a portfolio made up of Treasury bonds and Treasury bills, respectively. Index (d) is the return on a portfolio made up of EMU Treasury bonds with ten-year maturity, and index (l) is the return on a portfolio made up of Spanish Treasury bills with one-year maturity. To build the long-term index we choose 10-year EMU bonds, because they are the most representative of long-term fixed-income securities in Spain. In the case of the short-term fixed-income index, there are no European bills, so we opt for domestic bills.

Additionally, like Elton et al. (1996) and Martí and Matallín (2008), we include three additional benchmarks in model (12): small, growth, and value assets, representing the types of assets in which the pension funds could invest.

$$r_{it} = \alpha_i + \beta_m r_{mt} + \beta_d r_{dt} + \beta_l r_{lt} + \beta_s r_{st} + \beta_g r_{gt} + \beta_v r_{vt} + \varepsilon_t \tag{12}$$

The style indexes used are the Morgan Stanley Capital International (MSCI) style indexes: the smallcap index (s), the growth index (g), and the value index (v). These data are obtained from MSCI.[3]

Subsequently, we apply the previous two-stage process to estimate the fund's risk-adjusted performance in month t.

We expect different results from models (11) and (12) compared to those from models (9) and (10), because the last two analyze management style, while models (11) and (12) consider fixed-income benchmarks and represent the type of assets in which the pension funds invest, so the latter model considers size (small assets), value, and growth assets separately.

4. Data

4.1 Brief Description of the Spanish Pension Fund Market

Pension funds are one of the main investment products in Spain, second only to mutual funds. Though these instruments appeared late compared to other European countries such as the United Kingdom and Germany, they have grown constantly since their creation in 1987. In fact, the assets managed increased from €152 million in 1988 to over €82,900 million in 2011.

The fees which may be charged at present are a management fee and a custodial fee. The management fee is the most significant one. This fee is paid to

[2] Information obtained from the Fama and French webpage: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Developed.

[3] Data obtained from MSCI: www.msci.com.

the management company for managing the fund's assets. Moreover, the Spanish legislation (Legislative Decree 1/2002 and Article 84 of Royal Decree 304/2004) sets a maximum legal limit on this fee at an annual 2% of the pension plan's assets. Nonetheless, each pension plan may set its own fees within this limit.

On the other hand, the custodial fee is paid to custodial companies for custody and deposit of the securities. According to the current Spanish legislation, custodial companies are credit institutions—essentially banks, saving banks, and credit co-operatives. This fee cannot exceed 0.5% of the assets under management per annum.

Among these fees, we focus our study on management fees only, because this is the only case where we possess data for the entire period analyzed.

4.2 Description of the Sample

We obtain our data from Thomson Reuters. The database comprises all equity and bond private pension funds with a European investment vocation for sale in Spain (a total of 82 equity pension funds and 158 bond pension funds) in the period from January 1999 to September 2010. For each fund, we possess the monthly returns, monthly TNA (total net assets), and annual management fees as percentage of assets under management.

According to the Spanish Association of Investment and Pension Funds (INVERCO) classification criteria, bond pension funds are those whose portfolios are made up of fixed-income securities and do not comprise equities, while equity pension funds are those whose portfolios comprise more than 75% of equities.

All the pensions funds included in the sample are required to have shown data for at least 24 months to ensure consistency of the analyses.

Table 1 is divided into three panels. Panels A and B contain the summary statistics (mean, median, standard deviation, maximum, minimum, skewness, and kurtosis) of the variables analyzed for equity and bond funds: returns, management fees, TNA, and age. Panel C displays the statistics (mean, median, standard deviation, maximum, minimum, skewness, and kurtosis) of the four risk factors used: market excess return, size (SMB), book-to-market (HML), and momentum (PR1YR).

Panels A and B show that bond pension funds have a higher mean return (1.61%) than equity pension funds (0.58%). Moreover, bond funds show less dispersion (less standard deviation, a higher minimum, and a lower maximum). However, the mean management fees are higher in equity pension funds. Additionally, the mean size of bond funds (€65.2 million) is larger than that of equity funds (€27.4 million). Finally, equity funds are five months older on average.

In panel C, the SMB factor displays the lowest mean return and the PR1YR demonstrates the highest mean return. The momentum factor also exhibits the lowest minimum and the highest maximum, although the market excess return is the risk factor with more dispersion. Moreover, all the risk factors show considerable kurtosis (higher than three), and all factors have negative skewness.

5. Results

In this section we report the results of the relation between before-fee performance and fees, considering the different measures presented.

Table 1 Summary Statistics

	Panel A: statistics of equity pension funds						Panel B: statistics of bond pension funds					
	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
Returns	0.0058	0.0483	-0.2541	0.3333	-0.4389	4.9741	0.0161	0.0053	-0.0652	0.0904	-0.4031	25.3676
Mangment fee	0.0179	0.0055	0.0010	0.0250	-1.3678	4.1857	0.0147	0.0049	0.0010	0.0260	0.2122	2.8579
TNA	27.4	52.4	0.00001	421	3.2960	16.5600	65.20	137.00	0.00001	1110	3.6106	17.7010
Age	94.1342	33.5689	33	141	-0.2617	1.9587	89.8165	37.3949	27	141	-0.1040	1.7549
	Panel C: Statistics of risk factors											
	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis						
Market excess return	0.0031	0.0560	-0.2214	0.1378	-0.5838	4.6073						
SMB	0.0025	0.0242	-0.0694	0.0931	-0.2076	4.3698						
HML	0.0072	0.0285	-0.0957	0.1096	-0.0243	5.5952						
PR1YR	0.0085	0.0525	-0.2596	0.1380	-1.1252	7.3522						

Notes: Table 1 shows the summary statistics (mean, median, standard deviation, minimum, and maximum) of the variables: returns-after-fee (annualized), management fees (in percentage points), TNA (total net assets in millions of euros), and age (in months) for equity pension funds (panel A) and bond pension funds (panel B). Panel C shows the summary statistics of the four risk factors of the Carhart model (market excess return, SMB, HML, and PR1YR). Values of zero for TNA are due to rounding.

Table 2 Before-Fee Risk Adjusted Returns and Fees

	Panel A: equity pension funds				Panel B: bond pension funds			
Performance measure	Estimated coefficient	Standard error	*p*-value	Adjusted R^2	Estimated coefficient	Standard error	*p*-value	Adjusted R^2
Fama-French 3-factor	-0.1638***	0.0393	0.000	0.227	-0.0365***	0.0055	0.000	0.276
Carhart 4-factor	-0.1009***	0.0379	0.008	0.223	-0.0335***	0.0054	0.000	0.239

Notes: Table 2 is divided into two panels. Panel A corresponds to equity pension funds and panel B to bond pension funds. Both panels display the estimated slope coefficients for the OLS regression of the pension fund's risk-adjusted before-fee monthly returns on monthly management fees (model 6). The table also reports the heteroskedasticity-robust standard errors, the *p*-values of the coefficients, and the adjusted R^2.

*, **, *** indicate significant at 10%, 5%, and 1% level, respectively.

Table 3 Before-Fee Risk Adjusted Returns and Fees by Size

	Panel A: equity pension funds				Panel B: bond pension funds			
Performance measure: Fama-French	Estimated coefficient	Standard error	*p*-value	Adjusted R^2	Estimated coefficient	Standard error	*p*-value	Adjusted R^2
First decile	-0.0467*	0.0801	0.056	0.281	-0.0130	0.0096	0.177	0.298
Second decile	-0.1126	0.0838	0.180	0.201	-0.0318**	0.0138	0.021	0.219
Third decile	-0.3428**	0.1627	0.035	0.209	-0.0017*	0.0298	0.095	0.276
Fourth decile	-0.3251***	0.1108	0.003	0.251	-0.0388***	0.0139	0.005	0.201
Fith decile	-0.1725	0.2129	0.418	0.229	-0.0412**	0.0160	0.010	0.200
Sixth decile	-0.1840*	0.2613	0.082	0.192	-0.0800***	0.0294	0.007	0.210
Seventh decile	0.2231	0.2299	0.332	0.294	0.0077	0.0220	0.727	0.240
Eighth decile	-0.1445*	0.2782	0.063	0.221	-0.0261	0.0166	0.116	0.239
Ninth decile	-0.0535*	0.1534	0.072	0.264	-0.0465**	0.0193	0.016	0.248
Tenth decile	-0.2827*	0.1642	0.086	0.277	-0.0985***	0.0207	0.000	0.312
	Panel C: equity pension funds				Panel D: bond pension funds			
Performance measure: Carhart	Estimated coefficient	Standard error	*p*-value	Adjusted R^2	Estimated coefficient	Standard error	*p*-value	Adjusted R^2
First decile	-0.0045*	0.0792	0.095	0.241	-0.0128	0.0094	0.176	0.310
Second decile	-0.0911	0.0822	0.268	0.212	-0.0263*	0.0137	0.056	0.274
Third decile	-0.2655*	0.1561	0.089	0.219	-0.0011*	0.0288	0.097	0.264
Fourth decile	-0.2290**	0.1060	0.031	0.291	-0.0332**	0.0136	0.015	0.216
Fith decile	-0.0799	0.2059	0.698	0.237	-0.0342**	0.0158	0.031	0.211
Sixth decile	-0.1264*	0.2520	0.061	0.202	-0.0823***	0.0292	0.005	0.221
Seventh decile	0.1203	0.2176	0.580	0.310	0.0098	0.0218	0.655	0.246
Eighth decile	-0.2742**	0.2715	0.031	0.309	-0.0183	0.0165	0.269	0.254
Ninth decile	-0.0271*	0.1478	0.085	0.286	-0.0422**	0.0191	0.028	0.242
Tenth decile	-0.1473*	0.1596	0.056	0.290	-0.0975***	0.0206	0.000	0.324

Notes: Table 3 is divided into four panels. Panels A and B show the results from model (6) using the alpha of the Fama-French model for equity and bond pension funds, respectively. Panels C and D show the results from model (6) using the alpha of the Carhart model for equity and bond pension funds, respectively. All panels display the estimated slope coefficients for the OLS regression of the pension fund's risk-adjusted before-fee monthly returns on monthly fees by size (deciles). The standard errors are heteroskedasticity-robust.

*, **, *** indicate significant at 10%, 5%, and 1% level, respectively.

5.1 Relationship between Performance and Fees

To begin with, we estimate models (7) and (8) to calculate (9) and (10), obtaining the fund's risk-adjusted performance as the average of the annualized monthly alphas over the fund's life in the sample. After that, we estimate model (6) in order to analyze the performance-fee relation.

We estimate the model (6) coefficients by pooled OLS, computing White's heteroskedasticity-robust standard errors. *Table 2* reports the equity pension fund results in panel A and the bond pension fund results in panel B.

When the alpha is measured according to the Fama-French three-factor model, the estimated regression coefficients are both negative and statistically significant at the 1% level. In particular, investing in equity pension funds with a one percent higher annual fee ratio reduces the expected annual alpha before fees by 16.38 basis points (bp). However, investing in bond pension funds with a one percent higher annual fee ratio reduces the expected annual alpha before fees by 3.65 bp.

The estimated negative δ_1 suggests that pension funds with worse before-fee performance charge higher fees. This evidence is also found in Gil-Bazo and Ruiz-Verdú (2007) for US mutual funds.

With regard to the model with the Carhart alpha as the performance measure, the results are almost the same, although this negative relation is less severe in bond and equity funds when the momentum factor is taken into account.

This inverse relationship may be because the fees charged (in our sample) are close to the legal limit, with an average of 1.6%. Therefore, if fees are high, performance is adversely affected. Consequently, it is possible that if this limit was lower, performance would improve. Conversely, if the limit was higher, or if it did not exist all, the opposite situation might not occur; that is to say, funds could increase fees, emphasizing the inverse relation. However, it could be the case that pension funds with more resources and better performance could apply lower fees, leading to a situation where the market rejects inefficient pension funds, i.e., those with worse performance and high fees.

Nonetheless, in order to evaluate the robustness of the results, we consider two fund characteristics (size and age) and we divide the sample into three sub-periods to examine whether this relation has changed over time.

5.1.1 Size Effect

It is plausible that our results are influenced by fund size. Larger funds might enjoy economies of scale and apply lower fees. In order to study the possible size effect, we re-estimate model (6), dividing the sample into deciles by assets under management. These results are shown in *Table 3*.

Table 3 is divided into four panels. Panels A and B show the results from model (6) with the Fama-French alpha for equity and bond pension funds, respectively. Panels C and D display the equity and bond pension fund results for the model with the Carhart alpha.

Table 3 demonstrates that the negative relation between fees and performance remains for equity and bond funds, although the coefficients of some deciles are not significant (i.e. there is no relationship between fees and performance).

Given that the results do not exhibit major differences between deciles (the coefficients are significantly negative or not significant), we do not observe evidence of economies of scale in fund management.

These results are not in line with Gil-Bazo and Ruiz-Verdú (2007) for a US mutual fund sample. These authors argue that mutual fund management is likely to exhibit scale economies, since a significant fraction of the costs of managing a fund are fixed. Our results may differ because we study pension funds and the management fees are not fixed, as they are a percentage of the assets.

On the other hand, Otten and Bams (2002) and Annaert et al. (2003) show, in European equity funds, that in a situation where the volume of assets is too high, diseconomies of scale may appear. Additionally, Chen et al. (1992) and Indro et al. (1999) find, in US mutual funds, a significantly positive relationship between size and risk-adjusted return, although they find a negative relationship in funds in the top size decile. As a consequence, we find mixed evidence of the existence of scale economies.

5.1.2 Age Effect

Similarly to the size effect, older funds may develop learning economies and apply lower fees. So, in order to analyze the age effect, we divide the sample into age quartiles and re-estimate model (6). *Table 4* displays the results.

Table 4 is divided into four panels. *Panels A and B* show the results from model (6) with the Fama-French alpha for equity and bond pension funds, respectively. Panels C and D display the results for equity and bond pension funds with the Carhart alpha.

Panels A and C demonstrate that the relation is not statistically significant for equity pension funds, except for the second quartile, where a significant negative relation persists.

Nevertheless, panels B and D show a negative relation between fees and performance. Moreover, the coefficients are more significantly negative for the top quartiles than for the bottom quartiles, so older funds tend to charge higher fees for the same increase in performance. This evidence demonstrates a reverse learning effect and it may indicate that funds with more experience have more prestige, so they demand higher fees for the good management obtained.

5.1.3 Analysis by Sub-Periods

The relation between fees and performance may vary across time. Therefore, with the purpose of assessing temporal stability we divide the sample into three sub-periods (1999–2002, 2003–2006, and 2007–2010).

We consider these three sub-periods because we want to observe if economic cycles influence the fee-performance relation. As a consequence, we take the periods of the dot.com crisis (1999–2002), the expansive cycle from 2003 to 2006, and the current economic crisis (2007–2010).

We display the results in *Table 5*. Panels A and B show the results from model (6) with the Fama-French alpha for equity and bond pension funds, respectively. Panels C and D display the results for equity and bond pension funds with the Carhart alpha.

Table 4 Before-Fee Risk Adjusted Returns and Fees by Age

	Panel A: equity pension funds				Panel B: bond pension funds			
Performance measure: FF	Coefficient	St. error	*p*-value	Adjusted R^2	Coefficient	St. error	*p*-value	Adjusted R^2
1st quartile	-0.0443	0.0446	0.322	0.311	-0.0205***	0.0074	0.006	0.327
2nd quartile	-0.1793***	0.0531	0.001	0.259	-0.0291***	0.0108	0.007	0.351
3th quartile	-0.1755	0.1610	0.276	0.267	-0.0482***	0.0109	0.000	0.361
4th quartile	-0.1437	0.1364	0.292	0.291	-0.0534***	0.0147	0.000	0.295
	Panel C: equity pension funds				Panel D: bond pension funds			
Performance measure: Carhart	Coefficient	St. error	*p*-value	Adjusted R^2	Coefficient	St. error	*p*-value	Adjusted R^2
1st quartile	-0.0324	0.0433	0.454	0.342	-0.0190***	0.0073	0.009	0.330
2nd quartile	-0.1355***	0.0519	0.009	0.261	-0.0213**	0.0106	0.044	0.358
3th quartile	-0.0999	0.1548	0.519	0.271	-0.0482***	0.0109	0.000	0.373
4th quartile	-0.0830	0.1319	0.529	0.290	-0.0537***	0.0145	0.000	0.305

Notes: Table 4 is divided into four panels. Panels A and B show the results from model (6) using the alpha of the Fama-French model for equity and bond pension funds, respectively. Panels C and D show the results from model (6) using the alpha of the Carhart model for equity and bond pension funds, respectively. All panels display the estimated slope coefficients for the OLS regression of the pension fund's risk-adjusted before-fee monthly returns on monthly fees by age (quartiles). The standard errors are heteroskedasticity-robust. *, **, *** indicate significant at 10%, 5% and 1% level.

Table 5 Before-Fee Risk Adjusted Returns and Fees. Sub-Periods Analysis

	Panel A: equity pension funds				Panel B: bond pension funds			
Performance measure: FF	Coefficient	St. error	*p*-value	Adjusted R^2	Coefficient	St. error	*p*-value	Adjusted R^2
Sub-period 1999–2002	-0.1701***	0.0618	0.006	0.310	-0.0179**	0.0078	0.022	0.350
Sub-period 2003–2006	-0.1210**	0.0550	0.028	0.291	-0.0528***	0.0069	0.000	0.311
Sub-period 2007–2010	-0.2108**	0.0925	0.023	0.271	-0.0461**	0.0150	0.002	0.351
	Panel C: equity pension funds				Panel D: bond pension funds			
Perf. measure: Carhart	Coefficient	St. error	*p*-value	Adjusted R^2	Coefficient	St. error	*p*-value	Adjusted R^2
Sub-period 1999–2002	-0.1207**	0.0579	0.037	0.321	-0.0171**	0.0077	0.026	0.356
Sub-period 2003–2006	0.0117	0.0558	0.834	0.301	-0.0445***	0.0068	0.000	0.321
Sub-period 2007–2010	-0.2189**	0.0892	0.014	0.290	-0.0464***	0.0148	0.002	0.361

Notes: Table 5 is divided into four panels. Panels A and B show the results from model (6) using the alpha of the Fama-French model for equity and bond pension funds, respectively. Panels C and D show the results from model (6) using the alpha of the Carhart model for equity and bond pension funds, respectively. All panels display the estimated slope coefficients for the OLS regression of the pension fund's risk-adjusted before-fee monthly returns on monthly fees by sub-periods (1999–2002, 2003–2006, 2007–2010). The standard errors are heteroskedasticity-robust. *, **, *** indicate significant at 10%, 5% and 1% level, respectively.

Table 5 confirms a negative relation in all periods and pension funds, although the negative relation has increased over time, especially for equity pension funds. Equity funds display more significant negative coefficients during 2007–2010. These funds increase their fee ratios with worse performance, but charge lower fees with good performance during the last crisis period, mitigating losses or compensating benefits.

In all these analyses we find a negative relation. Although this topic has not been analyzed previously in Spain as far as we know, we should note that this evidence could also be explained by the concentration in the Spanish pension fund market. Specifically, the Spanish pension fund market is highly concentrated—there are 61 management groups, but four groups manage more than 50% of the market according to INVERCO.[4] As a result, the biggest pension funds can achieve better results and charge lower fees. By contrast, the rest of the funds have fewer resources and are not able to achieve good performance, so charge higher fees. Consequently, the negative relation between fees and performance may be due to high concentration.

5.2 Performance-Fee Relationship Considering Bond Benchmarks

In this section the performance measures considered are the alphas of models (11) and (12). The last models include bond benchmarks because our sample is divided into equity and bond funds. However, equity fund portfolios contain more than 75% equities (according the INVERCO classification criteria), so it is possible that these funds also invest in fixed-income securities.

Moreover, the Fama and French model and the Carhart model may not correctly indicate the performance of bond funds.

As a consequence, we also apply a two-stage process to obtain the fund's risk-adjusted performance and compare this analysis with the previous results.

Table 6 reports the results of model (6) using the alpha of model (11).

The significant negative relation between fees and performance disappears for equity pension funds. The negative relation persists for bond funds and the coefficient is more negative and significant. As a consequence, this model finds a stronger negative relation between fees and performance for bond funds, but it is not correct to capture the relation between fees and performance for equity funds because these funds invest at least 75% in equity, so the proportion of fixed-income securities is negligible and this model does not reflect the complete relation in these pension funds.

Table 7 shows the results from model (6) with the alpha of model (12).

The coefficients are significantly negative in both types of funds, again demonstrating a negative relation between fees and performance.

This model is able to capture the influence of fixed-income securities for both equity and bond pension funds, confirming the generalized negative relation. Therefore, the first two models (with the Fama and French alpha and Carhart alpha) capture the relation not only for equity funds, but also for bond funds, because the last two models' results are very similar.

[4] Data obtained from INVERCO: www.inverco.es.

Table 6 Before-Fee Risk Adjusted Returns and Fees with Bond Performance Measure

	Panel A: equity pension funds				Panel B: bond pension funds			
	Coef-ficient	St. error	*p*-value	Adjusted R^2	Coef-ficient	St. error	*p*-value	Adjusted R^2
Performance measure: model (11)	0.2126***	0.0472	0.000	0.256	-0.3062***	0.0095	0.000	0.263

Notes: Table 6 is divided into two panels. Panels A and B show the results from model (6) using the alpha of model (11) for equity and bond pension funds, respectively. Both panels display the estimated slope coefficients for the OLS regression of the pension fund's risk-adjusted before-fee monthly returns on monthly management fees. The table also reports the heteroskedasticity-robust standard errors, the *p*-value of the coefficients, and the adjusted R^2. *, **, *** indicate significant at the 10%, 5%, and 1% level, respectively.

Table 7 Before-Fee Risk Adjusted Returns and Fees with Model (12)

	Panel A: equity pension funds				Panel B: bond pension funds			
	Coef-ficient	St. error	*p*-value	Adjusted R^2	Coef-ficient	St. error	*p*-value	Adjusted R^2
Performance measure: model (12)	-0.1404***	0.0363	0.000	0.256	-0.2054***	0.0082	0.000	0.263

Notes: Table 7 is divided into two panels. Panels A and B show the results from model (6) using the alpha of model (12) for equity and bond pension funds, respectively. Both panels display the estimated slope coefficients for the OLS regression of the pension fund's risk-adjusted before-fee monthly returns on monthly management fees. The table also reports the heteroskedasticity-robust standard errors, the *p*-value of the coefficients, and the adjusted R^2. *, **, *** indicate significant at the 10%, 5%, and 1% level, respectively.

Nonetheless, the last model considers investment in fixed-income securities, so it is more relevant to bond funds and portfolios with some fixed-income securities.

5.3 Before-Fee and After-Fee Performance

The previous analyses demonstrated a negative relation between fees and performance. In this section, we examine the effect of fees on performance.

We estimate models (7), (8), (11), and (12) on a pool basis with net returns and gross returns and we then compare the results.

The Fama-French model (7) exhibits a significant alpha of 0.0147 with gross returns but a significant alpha of -0.0038 with net returns at the 1% level in equity funds. On the other hand, we observe a significant alpha of 0.0136 with gross returns but a significant alpha of -0.0011 with net returns at the 1% level of significance in bond funds.

The Carhart model (8) displays a significant alpha of 0.0160 with gross returns but a significant alpha of -0.0025 with net returns in equity pension funds (at the 1% level of significance). Alternatively, bond funds exhibit a significant alpha of 0.0137 with gross returns but a significant alpha of -0.0011 with net returns at the 1% level of significance.

Model (11) shows a significant alpha of 0.0151 with gross returns but a significant alpha of 0.0319 with net returns at the 1% level of significance in equity pension funds. On the other hand, bond funds demonstrate a significant alpha of 0.0137 with gross returns but a significant alpha of -0.0005 with net returns at the 1% level of significance.

Finally, model (12) exhibits a significant alpha of 0.007 with gross returns but a significant alpha of 0.0238 with net returns at the 1% level in equity funds. Finally, we find a significant alpha of 0.0131 with gross returns but a significant alpha of -0.0012 with net returns at the 1% level in bond funds.

All these cases display better performance with gross returns than with net returns. Consequently, fees adversely affect fund returns and performance.

6. Conclusions

Pension funds are saving and investment products, so good performance and efficient management are important for beneficiaries. However, performance may be seriously affected by fees.

This fact led us to analyze the relation between fees and performance in a Spanish pension fund sample divided into equity and bond funds with a European investment vocation. To this end, we used monthly returns, TNA, and fees for the period from January 1999 to September 2010.

In order to examine the relation between fees and performance we applied several models that relate the two variables, and we used different performance measures. Initially, we employed the alpha of the Fama and French model and the alpha of the Carhart model as performance measures.

This analysis found a significantly negative relation between performance and fees in equity and bond pension funds. Therefore, worse-performance pension funds charge higher fees and better-performance pension funds charge lower fees.

This evidence is also found by Gil-Bazo and Ruiz-Verdú (2007) for US mutual funds. These authors and Christoffersen and Musto (2002) argue that funds with worse past performance have investors with a less elastic demand and are not sensitive to fund performance. Gil-Bazo and Ruiz-Verdú (2007) also propose that funds with low expected performance set high fees because they target unsophisticated investors and are not able to compete with better-performance funds in a market with sophisticated investors. In addition, better funds keep their fees low because they operate in a more competitive market with performance-sensitive investors.

We also carried out several robustness tests: size effect, age effect, and subperiod analysis, finding a general negative relation.

We then used the alphas of two models with bond benchmarks, because our sample is divided into bond and equity pension funds, but the latter could also invest in fixed-income securities or other assets, since they are only required to invest more than 75% of their portfolios in equities (according the INVERCO definition).

Furthermore, the Fama and French and Carhart models may not explain the performance of funds that have a significant fraction of their holdings in fixed-income assets.

For these reasons, we considered two additional performance measures: the alpha of a bond benchmark model and the alpha of a multi-index model (with bond benchmarks and three types of asset investment: small, growth, and value).

The results revealed a negative relation between performance and fees for bond funds, so the previous models (with the alphas of the Fama and French or Carhart models) explain the relation in the same way.

However, the bond benchmark model is not correct for equity funds, because it assumes that all investment is realized in fixed-income securities.

Finally, the multi-index model was able to capture investment in fixed-income and equity securities, confirming a negative relationship.

As a result, we observed a negative relation between performance and fees, so better-performance funds charge lower fees and worse-performance funds charge higher fees. Consequently, better funds do not charge higher fees for quality performance and they compensate their customers with lower fees. On the contrary, worse fund managers charge higher fees to extract rents and compensate for their bad results, impacting more negatively on the customer's return.

Additionally, we need to clarify that we only focus on management fees, because we do not possess data to study custodial fees. Nonetheless, this could be another important topic for further research. In fact, these fees also have legal limits in Spain and may influence performance.

Although there is not much literature about custodial fees in pension funds, Martí and Matallín (2008) analyze performance according to the legal status of the group in a Spanish pension plan sample, finding that bank groups and independent companies charge higher management and custodial fees. For this reason, we think that custodial fees also influence pension fund performance, possibly in the same way as management fees. Nonetheless, to confirm this we would have to study it in further research by comparing the two fees and examining possible differences in detail.

Furthermore, another potential avenue of future research is the study of other countries where there are no legal limits on fees. We could examine their level and compare the results, because if fees are increased, performance may decrease, although there may be greater competition and only those pension funds with competitive fees and good performance will survive.

This study has implications for academics, professionals, and investors, illustrating that fees reduce managers' performance. Additionally, certain types of pension funds charge higher fees but do not pay high risk-adjusted returns; on the contrary, they display poor performance. In consequence, there is not enough competition in some market segments to guarantee that pension fund management services are adequately priced, thus allowing underperforming funds to survive.

Consequently, we should note that this study could be used to solve, or at least reduce, these inefficiencies. In particular, managers should realize this situation and correct it either by trying to achieve good performance or by not penalizing investments by charging higher fees and thus supporting lower results, without affecting investors. Otherwise, if investors notice this inverse relation, they will withdraw their investments from pension funds with worse performance and higher fees, thereby damaging the funds.

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