An empirical analysis of the performance of pension funds: evidence from UK

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An Empirical Analysis of the Performance of Pension Funds: Evidence from UK

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1. Introduction

There has been a growing interest in pension fund returns and performance owing to their increasing importance as institutional investors as well as to their substantial role within welfare systems (Beebower and Bergstrom, 1977; Harrison and Sharpe, 1983; Bodie, 1991, Tonks, 2005; Bauer and Kicken, 2008). The aim of this study is to analyse the performance of UK pension funds using three performance attribution models and to test if the abnormal returns generated by the pension funds can be explained by factors mimicking size, book-to-market value, market returns and momentum. This paper uses two robust estimations of returns i.e. gross returns and returns net of expenses across bond and equity universes. Our results indicate that the abnormal returns of the UK pension funds cannot be explained entirely by factor mimicking portfolios and they may be explained by other factors. We find that the returns of the bond universe is higher than that of the equity universe and that small funds outperform larger funds in the time period examined.

Pension funds have grown sharply over the last decade, in the UK the value of their total assets reached £809 billions in 2011[1]. They also play a major role in the welfare system. Originally funded occupational pension schemes were designed around Defined Benefits (DB) pensions while Defined Contribution (DC) plans accounted for a smaller fraction of employer-sponsored pensions. However, over the past decade there has been a gradual shift, predominantly in the private sector, towards DC plans. Recently in the UK the shift from DB to DC schemes has gained momentum and many large DB plans have been closed to new employees. The recent acceleration towards DC plans is largely due to factors that have reduced the incentives for employers to offer DB plans, such as pension under-funding and the effects of increased longevity on plan costs.

[1] http://www.pensionfundsonline.co.uk/leaguetables/valueofpensionfunds.aspx

The evolution towards DC pension plans reallocates risk within the financial system. In DB pension plans responsibility for funding and investment management lies with the firm sponsoring the plan while DC schemes place the financial risk and responsibility with the employee. This shift of risk from the corporate sector to the household sector may have important implications for future financial stability. Pension funds are exposed to the risks of the capital markets with the objective of gaining abnormal returns for their members. Therefore in this study we attempt to test whether they do earn abnormal returns by using three well established asset-pricing models.

The main contribution of this paper is that it adds to the existing literature on pension funds performance by conducting a comprehensive asset pricing study based on a dataset for the UK pension funds. Previous studies on pension fund performance (Beebower and Bergstrom,1977; Ippolito and Turner,1987 and Lakonishok et al. 1993 apply usual mutual fund measures of performance such as the Sharpe ratio (Sharpe, 1966); the Treynor ratio (Treynor, 1966); the Jensen's measure (Jensen, 1968). We argue that these measures may not necessarily have the ability to capture other crucial risk factors. To our knowledge this is the first comprehensive study that investigates the performance of UK equity and bond pension funds relative to standard linear factor models such as the CAPM, Fama and French (1993), and Carhart (1997).

A number of theoretical and empirical studies have examined the performance of managed funds. Beebower and Bergstrom (1977) found that pension fund performance in the US were 1.44% higher than the S&P 500. However, Ippolito and Turner (1987) as well as Lakonishok et al. (1993), who use the CAPM to test the performance of US funds found evidence of underperforming the S&P 500 by 44 and 260 basis points respectively. A number of papers have focused on the study of return differences between pension fund and mutual fund returns (Bauer and Frehen, 2008; Bauer and Kicken, 2008). The evidence

indicate that pension funds are able to generate higher returns than their mutual fund counterparts, even after taking into account expenses, investment style and risk differences. Goetzmann and Ibbotson (1994) and Brown and Goetzmann (1995) find evidence of persistence in mutual fund performance over short-term horizons. Rompotis (2011) examine the performance of ETFs and find that the returns of ETFs strongly persists at the short-term level. However, Carhart (1997) argues that this effect can be mainly attributable to simple momentum strategies, and not to superior expertise or skill of fund managers.

Using a sample of UK equity pension funds, Tonks (2005) finds strong evidence of persistence in abnormal returns generated by fund managers over a one-year horizon. However, this evidence becomes weaker for longer periods. Clare et al. (2010) study 734 actively managed pooled funds, they find evidence that the performance of these funds is better than the performance of actively managed mutual funds however the authors are cautious in their assessment of active funds in the long term. These studies analyse the performance of funds by using net returns which represents returns after expenses are deducted.

Previous studies, however, deal with only one, or at most two different performance models. Gallagher (2001) argues that the use of the models proposed by Sharpe (1966) and Treynor and Mazuy (1966) have caused controversy as they may not have the ability to fully capture crucial risk factors. Thus, this has led to the use of extended models that control for stock market anomalies. For instance, Fama and French (1993, 1996) add proxies for size and book-to-market, while Carhart (1997) introduces a stock-momentum variable. This acknowledges the fact that fund managers change their portfolios over time, based on observable information variables (Otten and Bams 2004).

This study examines the performance of UK equity and bond pension funds between 1990 and 2008. The performance of ten portfolios of equity funds and ten portfolios of bond funds,

sorted by fund size are evaluated relative to standard linear factor models such as the CAPM, Fama and French (1993), and Carhart (1997). We find that pension funds exhibit superior performance relative to the linear factor models.

The paper is organized as follows. In Section 2 we provide a review of the relevant literature on pension fund performance. In Section 3 we describe our sample selection procedure, the variables used and the methodology applied. In Section 4 we present our results and in Section 5 we draw our conclusions.

2. Pension Fund Performance

Previous studies have examined pension funds performance using attribution models, primarily the CAPM, but found mixed empirical results. Beebower and Bergstrom (1977) were among the first to look into the performance of 148 US Pension Funds using the CAPM framework. They find that on a yearly basis pension fund performance is around 144 basis points higher than the S&P 500. A successive study that uses the CAPM to measure the performance of a sample of US pension funds from 1977 to 1983 by Ippolito and Turner (1987) finds that these funds underperform the S&P 500 by 44 basis points every year. Lakonishok et al. (1993) examine a sample of US based pension funds from 1983 to 1989 and find they underperform the S&P 500 by 260 basis points every year.

More recently, Tonks (2005) uses the CAPM, the Fama and French as well as the Fama and French plus Carhart models, to study a sample of 2,175 UK equity pension funds for the period between 1983 to 1997. He shows that there is a role for active fund managers and finds evidence of significant persistence in performance of fund managers at the 1-year time horizon and a weaker evidence of persistence at longer time intervals. Tonks finds that a long position in a portfolio of fund managers that performed well over the last 12 months and a short position in a portfolio of fund managers performing poorly would yield an

annualised abnormal return of 1.56%. With the addition of the momentum factor this value reduces to 1.48% per annum. Clare et al. (2010) use log-odds ratios and find little evidence of persistence in funds returns. However they show that in the long-term, investments in passive vehicles outperform active management styles due to higher fees.

In addition to market risk factors, previous literature considers size as a determinant factor of fund performance (Fama and French, 1993; Thomas and Tonks, 2001; Blake et al., 2002, Chen et al., 2004; Ammann and Moerth, 2005). Blake et al. (2002) find a negative relation between fund size and performance for UK equity funds. Their conclusions agree with Stein's (2002) who explains that the inverse relation between fund size and performance is due to the greater capacity smaller funds have to process soft information (i.e., information that cannot be directly verified by anyone other than the agent who produces it). By contrast, larger funds are less flexible and efficient owing to hierarchy costs. Chen et al. (2004) confirm this finding with their study on American mutual funds, they find that fund returns, before and after fees, decline with fund size. They attribute the inverse relationship between performance and size to investment liquidity, as the relationship appears stronger for funds investing in small cap, less liquid stocks. Further they argue that diseconomies in the organisation of large funds such as hierarchy costs also play an important role in the erosion of returns within large funds. We regard size as an additional crucial aspect and we take it into consideration dividing the pension funds into size deciles to investigate whether fund size has an impact on pension fund returns.

Managed fund expenses play an important role in determining overall fund profitability and performance. Ambachtsheer and Bauer (2007) examine the role of fees in their study of equity mutual and pension funds in the Canadian market and find a significant gap in performance between the two. They conclude that investors are paying a high premium for the management of their equity mutual funds. Bauer and Kicken (2008) in

their study of Canadian mutual and pension funds, observe a similar difference between domestic fixed income portfolios of pension funds and fixed income mutual funds. They find that pension funds outperform mutual funds by 1.8% per annum on average and conclude that this result is due to the cost difference between the two types of funds as mutual fund fees significantly reduce the net returns of their investors. In this study we analyse both net and gross returns of pension funds, where net returns represent the returns less expenses.

Differences in the performance levels of fixed income and equity funds have been analysed by a number of authors (see Blake et al., 1999; Blake, 1999; Blake and Timmermann, 2005; Bauer and Kicken, 2008; Khorana et al., 2007 amongst others). Khorana et al. (2007) find that the Canadian fixed income mutual fund is more severely affected by high expense ratios, while Blake et al. (1999) show that US pension funds feature greater investment in lower volatility domestic bonds. Hence, this study also analyses the differences in the performance of equity and bonds separately.

The literature on the performance of managed funds has not just been restricted to the UK, the US and Canada. Kumara and Pfau (2012) find that international diversification is beneficial for pension funds. Robson (1986) uses risk-adjusted measures to analyse the investment performance of a sample of unit trusts and mutual funds in Australia and find that funds on an average are unable to earn abnormal returns. Hallahan (1999) analyses the past and future performance of investment funds, namely, rollover funds. He finds that there is evidence of persistence when performance is measured in the terms of Jensen's alpha. Antolin (2008) examines the investment performance of privately managed pension funds across OECD, Latin American and CEE countries and finds that pension funds have generally underperformed the markets. He also finds evidence that investment restrictions have had a negative impact on performance. Romacho and Cortez (2006) in their study on

Portuguese mutual funds find that managers do not exhibit selectivity and timing abilities. Barros and Garcia (2007) analyse the performance of the Portuguese pension fund industry using a stochastic frontier model. Ferruz, Vicente and Andreu (2007) find short run persistence in the Spanish pension fund performance. Calum, Fifield and Power (2007) find that institutional investors use bottom up approach when assessing the investment process in Central and Eastern (CEE) regions. This paper aims to assess the overall performance of the UK pension funds by using three asset-pricing models and to establish which model best explains the overall performance.

3. Data and Method

The source of our data is CAPS-Mellon survey data. The Russell Mellon CAPS survey is the standard source of performance information for the UK's pooled pension fund sector. We begin with all the 993 pension funds from 1980 to 2008. The requirement for each firm year observation in order to enter the sample is the availability of fund returns and fund size for at least the preceding twelve months of that fund. We remove 203 funds for non-availability of fund size data. Another 142 funds are removed for non-availability of fund returns. The resulting sample contains 11,664 fund year-end observations of 648 funds from 1990 to 2008. Monthly fund returns for each universe, namely equities and bonds, are collected for each fund. We use two robust estimations of pension funds returns; the returns are calculated both gross and net of expenses.

We sort our sample into size deciles as sorting stocks into portfolios reduces the measurement error and enhances the power of the tests as well as would make for a strong argument against data mining concerns (Lo and Mckinlay, 1990; Black 1993). Secondly, as size relates to economic fundamentals and present information in prices about risk and

expected returns (Fama-French 1992; Ammann and Moerth, 2005), we form monthly portfolios according to fund size. Asset pricing tests are known to focus on the magnitude of the abnormal returns (Fama-French, 1993; Carhart, 1997). Hence tests based on combinations of alphas for portfolios of securities can be more powerful (Dijk 2011).

The return on each portfolio is taken in excess of the risk-free rate and regressed against a number of factors. We run the regressions in equations 1 through 3 for the equity portfolios:

$$R_{it} = \alpha + \beta_1 ExRM + \varepsilon_{it} \quad (1)$$

$$R_{it} = \alpha + \beta_1 SMB + \beta_2 HML + \beta_3 ExRM + \varepsilon_{it} \quad (2)$$

$$R_{it} = \alpha + \beta_1 SMB + \beta_2 HML + \beta_3 ExRM + \beta_4 MOMENTS + \varepsilon_{it} \quad (3)$$

Next for the bond portfolios we run equations 4, 5 and 6 as shown below

$$R_{it} = \alpha + \beta_1 ExRM + \beta_2 TERMUK + \varepsilon_{it} \quad (4)$$

$$R_{it} = \alpha + \beta_1 SMB + \beta_2 HML + \beta_3 ExRM + \beta_4 TERMUK + \varepsilon_{it} \quad (5)$$

$$R_{it} = \alpha + \beta_1 SMB + \beta_2 HML + \beta_3 ExRM + \beta_4 MOMENTS + \beta_5 TERMUK + \varepsilon_{it} \quad (6)$$

Where:

R_{it} is the portfolio returns in excess of the risk free rate (measured as the yield on one month UK T-bills) for fund *i* at time *t*; α is the intercept;

SMB is the size mimicking portfolio;

HML is the market-to-book mimicking portfolio;

MOMENTS is the momentum mimicking portfolio;

ExRM[2] is the excess return of the market and ε is the error term;

TERMUK is the difference between the monthly 20-year government bond and the UK one-month gilt.

Table 1 here

Panel A of Table 1 presents the summary statistics on the CAPS-Mellon survey pension fund size used in this study. The table presents the average fund size for both equity and bond universes used in the data. The average fund size of the equity fund is £351.91 m and the corresponding figure for the bond universe is £207.28 m. The data also shows large variation in fund sizes in both the equity and bond universes. The median is higher for the equity fund universe at £123.2 and for the bond universe at £ 87.84 m. The smallest firms for the equity and bond universes are similar but the largest equity fund belongs to the equity universe at £818.5 m and £547.55 m.

Panel B of Table 1 presents the summary statistics of the returns across both the equity and bond universes. The mean net and gross returns for equity funds are 0.33% and 0.41% respectively. For the bond universe net and gross returns are 0.50% and 0.43%. The variation of the equity funds is much larger than that of the bond funds. The Jarque-Bera tests indicate non-normality.

We test for heteroskedasticity by using Glejser test. Results of the Glejser test indicate possible heteroskedasticity (F=94.78) and hence we use White [1980] heteroskedasticity consistent standard errors in all estimations. We also test for autocorrelation and do not find evidence of autocorrelation.[3]

[2] The UK Fama-French factors plus momentum factors are obtained from Xfi Centre for Finance and Investment

Table 2 presents the descriptive statistics and correlation matrix of the risk factors. Panel A presents the descriptive statistics for all the risk factors that this study uses namely, excess returns, size factor (SMB), market-to-book factor (HML), momentum factor (MOMENTS) excess return on the market (ExRM) and the spread between long term UK government bond and one year UK gilt (TERMUK). The mean and the median of the equity returns for the sample is 0.41 percent and 1.22 percent respectively with a range between -26.13 percent and 38.09 percent. The mean and the median of the bond returns for the sample is 0.43 percent and 0.53 percent respectively with a range between -11.61 percent and 8.25 percent. The size factor (SMB) has an average of 0.01 percent and the median ratio is 0.02 percent with a wide range between -0.11 percent and 0.08 percent. The average and median for the market-to-book factor (HML) is 0.05 percent and 0.04 percent respectively. The market risk factor (ExRM) has an average of -0.01 percent and the median of 0.01 percent. The momentum factor (MOMENTS) has an average return of 0.02 percent and median of 0.05 percent with a range between -0.19 percent and 0.13 percent. JB test statistics rejects normality in all cases.

Panel C presents the correlation matrix of the risk factors and excess returns. The correlations between factor portfolios are low between -0.34 and 0.19 indicating that multicollinearity does not affect the estimated factor loadings.

Table 2 here

4. Findings

This study analyses the performance of UK pension funds using three performance attribution models, namely CAPM, FF and FF plus Carhart. We test if the abnormal returns

generated by the pension funds can be explained by factors mimicking size, book-to-market value, market returns and momentum in the equity and bond universes of funds.

Table 3 here

Table 3 presents the results for the equity universe. Column 2 of Panel A presents the results on the gross returns for the equity universe when the CAPM is used. The coefficients on the market return portfolio are significant and fairly close in value as we progress through the deciles. We also find that the alpha is significant across all the deciles. This suggests that the returns of the equity fund universe are not fully explained by the market mimicking portfolio and that factors other than market returns may have an effect on fund performance. If we take the highest and lowest alpha values from CAPM in Panel A they are 0.72 and 0.29 respectively, which translates into annualised value of 8.64% and 3.48% respectively.

The results of the FF model on gross returns for the equity portfolio are presented in Column 4 of Panel A. The FF three factor model adds portfolios mimicking size and book-to-market factors to test if the variations of excess returns may be explained by all three-factors. The HML coefficients are negative for the majority of deciles indicating. The SML coefficients are all positive indicating that in a given month the small cap stocks have outperformed the large cap stocks. The size co-efficient values of all the deciles are similar except for deciles 5 where the coefficient is 2.99. Under the FF model, we find that the highest value for alpha is 0.67 and lowest value is 0.28. However, after adding factor-mimicking portfolios for size and book-to market, the alphas are still positive and significant; indicating that the excess returns cannot wholly be explained by the FF three factors. Next when we add the one-year momentum returns factor mimicking portfolio

(MOMENTS) using the FF plus Carhart model is in we can see from the results in Column 8 that the alphas remain significant and positive. The highest value for the alpha is 0.66 and the lowest value being 0.36.The coefficients for momentum are not significant for most of the deciles which indicate that momentum returns do not help explain the variation of the returns.

Panel B of Table 3 presents the findings for the net returns for the equity universe. Column 2 presents the results of the CAPM model. The coefficients on the market return portfolio are significant and close in value for all the deciles. The alphas are also significant across all the deciles, the highest value being 0.66 and the lowest value being 0.24. This indicates that the returns of the equity universe are not fully explained by the market mimicking portfolio and that there are other factors that affect fund performance. The table shows that the small funds in decile 1 have consistently higher excess returns compared to large funds in decile 10.

The results of the FF model are presented in Column 4 of Panel B. The HML coefficients are negative for most deciles, confirming that growth stocks outperformed values stocks for the period examined. The SML betas are all positive indicating that the small cap stocks have performed better than large cap stocks. The alphas are still positive and significant after we add the size and book to market factors, which confirms our previous finding that the excess returns cannot be fully explained by FF three factors. Here the ranges between the lowest and highest values are 0.22 and 0.57 respectively. We present the results when we add the one-year momentum factor mimicking portfolio using the Carhart model in Column 8. The results indicate that the alphas remain significant and positive, the largest value being 0.57 and the lowest value is 0.20. Relative to the gross returns, the momentum coefficients are significant across more deciles indicating that momentum helps to explain the variation in returns.

The study also examines the performance of the bond universe by adding a bond factor, TERMUK, which is more relevant when evaluating the performance of bonds. Table 4 presents the results for the bond universe. The findings for gross and net returns are presented in Panels A and Panel B respectively. The results of the CAPM can be found in Column 2 of Panel A. The alphas the gross returns are positive except for deciles 5, 6 and 7 with the highest value for alpha being 1.56. This suggests that the market portfolio is unable to explain the variation in gross returns for the bond universe.

Table 4 here

The results of the FF model are presented are in Column 4 of Panel A. The HML coefficients are mostly positive across the deciles, this result differs from the finding in the equity universe and indicates that value funds have outperformed growth funds over the timeframe considered. The coefficients for the SML factor are positive, suggesting that, like for the equity universe, small funds have outperformed the large funds. The coefficient values for the size factor are similar to each other for all deciles except for deciles 5 and 7. The positive and significant alphas here confirm our previous finding that the FF three factors do not fully explain excess returns with the largest value at 1.53. In Column 8 we present the results of the FF plus Carhart model. The addition of the momentum factor does not explain any of the variation in returns of the bond fund universe and is largely insignificant over the deciles for the gross returns. The market, size, book-to-market and momentum – factor mimicking portfolios are unable to explain the variation in returns of the bond fund universe. Therefore, return differences are driven by factors other than those set out in the performance attribution models. The smaller funds in the bond fund universe once again outperform the larger funds by a spread of 24 basis points on average.

Panel B of Table 4 presents the findings for the net returns for the bond universe. Column 2 presents the results when the CAPM is used. The coefficients on the market return portfolio are significant and positive, close in value across all deciles with the largest value being 0.79 and the lowest being 0.42. This suggests that returns of the bond universe are closely related to the market performance; however the sign of the alphas imply that other factors may have a significant effect on fund performance.

The results of the FF model are presented in Column 4 of Panel B. The coefficients for both the HML and SML factors remain positive and significant for all deciles, confirming our previous results. Further, the size beta values do not change significantly across deciles. Once more, the alphas remain positive and significant to show that the excess returns cannot be explained entirely by the FF three factors with the largest value being 0.80 and the lowest being 0.28. We present the results of the FF plus Carhart model in Column 8. The addition of the momentum factor does not explain any of the variation in returns of the bond fund universe with the largest value at 0.85 and the lowest at 0.27. The momentum coefficient is significant in deciles 1, 3, 5 and 7.

5. Conclusion

This paper examines the performance of UK pension funds between 1990 and 2008, a larger timeframe than comparable studies. We use three attribution models, the Capital Asset Pricing Model, the Fama-French as well as the Fama-French plus Carhart model. We calculate both gross and net returns for two fund universes (equity and bonds) and divide them into deciles according to their size.

The alphas for both the equity and bond fund universes are positive and significant across all three models. This means that the pension funds examined do earn abnormal returns over the years considered but also that returns cannot be fully explained by the three

pricing models used. Our findings support Clare et. al.'s (2010) who also find a positive significant mean alpha for their data. The alphas for the gross and net returns are comparable in magnitude and sign, however when we compare the alphas for the net returns in the equity and bond universes we find that although they are positive for both universes, they are larger for the bond universe over a majority of size deciles. This is consistent with Blake et al.'s findings (2002) that although the total returns for the UK equity funds are greater than for the bond funds, the risk-adjusted returns for the bond universe are higher than the equity universe.

We also find that expenses play an important role as the alphas for the net returns of the bond universe are positive across all the performance attribution models but not for the gross return results. When we analyse the net returns we observe that the alphas for the small funds are greater than for the larger funds, with a 19 basis point and 24 basis point difference between the smallest and largest deciles for the equity and bond fund universe respectively, suggesting that large equity funds underperform small funds and conclude that fund size effects do matter.

We use different performance attribution models to test for robustness and find that the addition of the momentum factor does not significantly add to the Fama-French model. Our evidence indicates that the best model in explaining the data is the Fama-French three-factor model, while the momentum factor does not add to the existing three-factor model. This is in agreement with Tonks' (2005) and Clare et. al.'s (2010) findings of little or no evidence of long-term persistence. Further, our findings show that superior returns, even after taking expenses into consideration, cannot be fully explained by factor-mimicking portfolios such as size, book to market, market returns and momentum.

Our study has several limitations that open useful potential future research avenues. First, its weakness is that the findings are confined to the UK pension funds. Future research

will thus benefit if it can expand the samples across time and test our results in other countries. Future research may also extend our work to incorporate economic, political and legal differences across the countries on the performance of pension funds. Secondly, due to data constraints, this study excludes the default probability of corporate bonds as an additional variable in their tests on bond returns. Future work may add the default probability as an additional variable whilst examining bond returns. Thirdly, this study ignores taxes which is an important factor that affect pension funds performance (Romaniuk, 2011).Work in the future may add the tax variable when examining the performance of pensions funds.

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Table 1: Pension Funds Summary Statistics

This table presents the summary statistics for our sample of pension funds for the period 1990-2008. There are a total 11664 observations for 648 funds. Portfolios are formed according to fund size. Portfolio returns in excess of the risk free rate (measured as the yield on one month UK T-bills) is calculated for each universe, namely equities and bonds. Gross

fund return is the fund return plus expenses and net fund returns is the fund return in excess of expenses.

Panel A: Pension Funds Size Summary Statistics				
	Equity (£millions)		**Bond(£millions)**	
Mean	351.91		207.28	
Median	123.2		87.84	
Std. Dev.	601.01		384.86	
Minimum	0.51		0.51	
Maximum	818.5		547.55	
Panel B: Summary Statistics of Fund Returns				
	Equity		**Bond**	
	Gross Return	**Net Return**	**Gross Return**	**Net Return**
Mean	0.41	0.33	0.50	0.43
Median	1.22	1.13	0.55	0.53
Std. Dev.	4.27	4.30	2.93	2.28
Minimum	-26.13	-26.18	-11.17	-11.61
Maximum	38.09	38.09	10.14	8.25
JB statistic	3658.89	3589.78	382.64	507.04

Table 2: Risk Factors Summary Statistics

This table presents the summary statistics for our sample of pension funds for the period 1990-2008. There are a total 11664 observations for 648 funds. Portfolios are formed according to fund size. Portfolio returns in excess of the risk free rate (measured as the yield on one month UK T-bills) is calculated for each universe, namely equities and bonds. SMB is the size mimicking portfolio; HML is the market-to-book mimicking portfolio; MOMENTS is the momentum mimicking portfolio; ExRM is the excess return of the market and ε is the error term and TERMUK is the difference between the monthly long term government bond and the UK one month gilt.

Panel A: Full Sample

	Equities Exrtns	Bond Exrtns	SMB	HML	ExRM	MOMENTS	TERMUK
Mean	0.41	0.43	0.01	0.05	-0.01	0.02	0.01
Median	1.22	0.53	0.02	0.04	0.01	0.05	-0.04
Min	26.13	-11.61	-0.11	-0.17	-0.14	-0.19	-0.11
Max	38.09	8.25	0.08	0.13	0.1	0.13	0.11
JB statistic	36.58	38.26	39.43	58.2	14.77	13.98	83.36

Panel B: Correlation Matrix

	SMB	HML	ExRM	MOMENTS	TERMUK
SMB	1				
HML	-0.18	1			
ExRM	0.13	0.02	1		
MOMENTS	0.01	-0.34	-0.21	1	
TERMUK	0.19	0.05	0.03	0.04	1

Table 3 Regression Results: Equity Universe

This table presents the regression results using the performance attribution models for our sample for the period 1990-2008. There are a total 5426 observations for 467 funds. Portfolios are formed according to fund size. Decile 1 represents the smallest pension funds and decile 10 represents the largest pension funds. Portfolio returns in excess of the risk free rate (measured as the yield on one month UK T-bills) is calculated for the equity universe. Gross fund return is the fund return plus expenses and net fund returns is the fund return in excess of expenses. * 1% significance level; ** 5% significance level; *** 10% significance level

Panel A
Gross Return – Equity Universe

	CAPM		FAMA-FRENCH THREE FACTOR				CARHART FOUR FACTOR with MOMENTUM				
Portfolio (Deciles)	**α**	**EXRM**	**α**	**ExRM**	**SMB**	**HML**	**α**	**EXRM**	**SMB**	**HML**	**MOMENTS**
1 (Small)	0.54*	0.94*	0.67*	0.95*	17.5*	-0.47	0.66*	0.94*	17.5*	-0.07	0.52
2	0.51*	1.02*	0.57*	0.94*	11.0*	-4.07*	0.49*	0.94*	11.5*	-0.25	3.8*
3	0.72*	0.96*	0.49*	0.97*	11.8*	-0.67*	0.50*	0.98*	11.8*	-1.25*	-0.68
4	0.63*	0.96*	0.47*	0.97*	13.2*	0.55	0.49*	0.97*	13.6*	0.09	-1.5
5	0.51*	0.98*	0.56*	0.97*	2.99***	-3.51*	0.56*	0.97*	3.98**	-3.59*	-1.5**
6	0.32*	0.94*	0.37*	0.94*	11.15*	2.3***	0.36*	0.94*	11.04*	2.81***	0.49
7	0.51*	1.04*	0.52*	1.02*	11.9*	-3.73**	0.43*	1.04*	12.9*	-2.94**	5.98*
8	0.29*	0.97*	0.28*	0.95*	7.63*	-1.39	0.27*	0.96*	7.56*	-1.26	1.61
9	0.55*	0.98*	0.47*	0.96*	13.42*	0.66	0.47*	0.96*	13.0*	0.32	0.82
10 (Big)	0.30*	0.99*	0.45*	0.98*	13.6*	2.15***	0.38*	0.98*	16.9*	3.59*	4.65*

Panel B

- **Net Return – Equity Universe**

	CAPM		FAMA-FRENCH THREE FACTOR				CARHART FOUR FACTOR with MOMENTUM				
Portfolio (Deciles)	**α**	**EXRM**	**α**	**EXRM**	**SMB**	**HML**	**α**	**EXRM**	**SMB**	**HML**	**MOMENTS**
1 (Small)	0.43*	0.93*	0.57*	0.93*	17.4*	-1.14	0.57*	0.93*	17.56*	-0.31*	1.06
2	0.44*	1.09*	0.50*	0.93*	13.2*	-1.62	0.41*	0.94*	13.08*	3.11***	4.67*
3	0.66*	0.96*	0.44*	0.98*	11.2*	-1.52	0.45*	0.98*	11.23*	-2.09	-0.67
4	0.62*	0.94*	0.46*	0.95*	14.7*	0.53	0.49*	0.95*	15.47*	-0.18	-1.65**
5	0.43*	0.98*	0.48*	0.97*	6.2*	-2.78**	0.49*	0.96*	7.31*	-2.96**	-1.74**
6	0.21*	0.94*	0.27*	0.94*	11.9*	1.74	0.27*	0.94*	11.92*	2.07	0.33
7	0.47*	1.04*	0.46*	1.01*	11.9*	-2.12**	0.37*	1.04*	12.87*	-1.19	5.82*
8	0.24*	0.98*	0.22*	0.95*	11.5*	-0.83	0.20*	0.96*	11.33*	-0.64	2.09**
9	0.48*	0.98*	0.38*	0.96*	14.3*	2.25***	0.38*	0.96*	14.32*	2.24	0.03
10 (Big)	0.24*	0.99*	0.41*	0.99*	15.7*	1.52	0.36*	0.98*	18.78*	2.87**	4.19*

Table 4 Regression Results: Bond Universe

This table presents the regression results using the performance attribution models for our sample for the period 1990-2008. There are a total 6238 observations for 181 funds. Portfolios are formed according to fund size. Decile 1 represents the smallest funds and decile 10 represents the largest funds. Portfolio returns in excess of the risk free rate (measured as the yield on one month UK T-bills) is calculated for the bond universe. Gross fund return is the fund return plus expenses and net fund returns is the fund return in excess of expenses.
* 1% significance level; ** 5% significance level; *** 10% significance level

Panel A
Gross Return – Bond Universe

Portfolio (Deciles)	CAPM			FAMA-FRENCH					FAMA-FRENCH PLUS CARHART					
	α	ExRM	TERMUK	α	SMB	HML	ExRM	TERMUK	α	SMB	HML	ExRM	MOMENTS	TERMUK
1 (Small)	1.30*	-7.57*	-13.16*	1.49*	32.80*	2.24*	-10.34*	-11.08*	1.91*	29.15*	-23.97*	-10.34*	-35.86*	-14.47*
2	1.21*	-5.02*	-3.23*	1.12*	4.89*	4.60*	-4.29*	-5.14*	1.62*	3.14*	-18.65*	-9.50*	-24.54*	-3.30*
3	0.03	11.82*	-11.58*	0.21*	-10.86*	5.18***	8.46*	-8.79*	0.24*	-10.79*	4.60	8.64*	-1.01	-8.68*
4	0.18*	5.30*	5.68*	0.19*	-5.36*	-13.93*	6.91*	4.55*	0.15**	0.45	-19.36*	6.03*	-7.12*	6.25*
5	-0.38*	-9.36*	7.64*	-0.28*	-7.96*	-10.77*	-11.95*	9.64*	-0.31*	14.89*	-22.10*	-27.13*	-21.46*	9.00*
6	0.01	-5.01**	0.07	0.06	31.83*	15.49*	-14.07*	-9.82*	0.05	32.19*	16.23*	-14.02*	1.56	-9.65*
7	-0.35*	-22.72*	-3.14	-0.29*	4.77	18.07*	-23.98*	-5.60*	-0.29*	4.77	18.24*	-23.85*	0.34	-5.59*
8	0.73*	-4.43*	-20.37*	0.58*	14.32*	25.89*	-10.83*	-29.63*	0.59*	14.93*	25.91*	-11.72*	-1.74	-29.78*
9	1.56*	-4.97*	4.87*	1.44*	12.01*	11.27*	-6.53*	1.81	1.39*	17.27*	18.21*	-12.64*	-13.27*	2.72**
10 (Big)	1.07*	20.55*	19.39*	1.18*	6.30*	-4.62**	20.46*	19.42*	0.96*	17.13*	1.30	19.13*	10.58*	14.62*

Panel B
Net Return – Bond Universe

	CAPM			FAMA-FRENCH					FAMA-FRENCH PLUS CARHART					
Portfolio (Deciles)	**α**	**ExRM**	**TERMUK**	**α**	**SMB**	**HML**	**ExRM**	**TERMUK**	**α**	**SMB**	**HML**	**ExRM**	**MOMENTS**	**TERMUK**
1 (Small)	0.62*	1.58	-3.61*	0.61*	-2.30	-0.17	2.49	-3.55*	0.63*	-2.98	-3.08	-1.59	-3.66*	-3.73*
2	0.79*	-7.68*	0.53	0.80*	-5.21	-1.49	-4.40	1.33	0.85***	-5.26*	-3.86*	-5.24*	-2.37*	1.46
3	0.43*	-3.22	0.86	0.56*	-6.28	0.40	-3.92	1.91	0.53*	-5.98*	1.43	-3.94*	1.25	1.61
4	0.53*	-0.44	2.27	0.28*	1.10	-0.44	-2.69	0.02	0.27*	1.13	-0.45	-2.72	-0.07	0.03
5	0.53*	-0.44	2.27	0.47*	-2.60	4.67	0.69	2.19	0.47*	0.01	4.41*	-1.40	-3.76*	2.36
6	0.61*	-3.55	-0.33	0.53*	-9.36*	3.24	-3.83	2.02	0.55*	-8.70*	1.70	-4.34*	-1.58	1.51
7	0.42*	0.99	2.46	0.41*	-8.42*	0.21	3.67	4.26***	0.29*	-8.22*	1.21*	7.88*	6.56*	5.81*
8	0.43*	2.43	-0.19	0.43*	-0.62	-0.28	2.64	-0.06	0.43*	-0.64	-0.20	2.89*	0.64	-0.06
9	0.57*	-6.35**	-0.08	0.62*	-7.54*	-1.04	-5.67***	0.78	0.62*	-7.53**	-1.03	-5.67***	-0.03	0.79
10 (Big)	0.44*	0.98	3.11***	0.41*	-3.48	0.97	1.34	3.78**	0.43*	-4.41*	0.57	1.42	-1.07	4.14**